What Facets of Picky Eating Relate To Eating Concerns in Undergraduate Students?: The Moderating Effects of Inflexible Eating and Mental Health Concerns

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Abstract

Purpose: Picky eating (PE) can occur in adulthood and is associated with mental health concerns. PE is often conceptualized as distinct from disordered eating, but recent research maps positive relationships between these maladaptive eating phenotypes. Relatedly, recent research suggests PE is more strongly related to eating concerns, a facet of disordered eating, via inflexible eating and mental health concerns, but precisely what PE facets explain these relations remain unknown.

Methods: A large, undergraduate sample ($N=509$) completed an online survey assessing PE facets (Adult Picky Eating Questionnaire; meal presentation, food variety, meal disengagement, and taste aversion), disordered eating (Eating Disorder Examination Questionnaire), specifically eating concerns, mental health concerns (Depression, Anxiety and Stress Scale - 21 Items), and inflexible eating (Inflexible Eating Questionnaire).

Results: Positive relationships emerged between PE facets, eating concerns, inflexible eating, and mental health concerns. Meal disengagement was more strongly associated with eating concerns when inflexible eating was higher, whereas food variety and meal presentation were more strongly associated with eating concerns when mental health concerns was higher. Inflexible eating and mental health concerns did not significantly interact with taste aversion to explain variance in eating concerns.

Conclusions: Considering PE multidimensionally may yield important insights beyond the broader construct. Mental health concerns and inflexible eating may be treatment and research targets in addressing the overlap between PE facets such as meal presentation, meal disengagement, and food variety and eating concerns.

Level of Evidence: Level V, cross-sectional descriptive study.

What Is Already Known On This Subject?

Adult picky eating (PE) is positively associated with significant psychological impairment and disordered eating. Mental health concerns and inflexible eating may strengthen the relationship between PE and disordered eating, specifically eating concerns, but which facets of PE describe these relationships is unknown.

What does this study add?

Maps relationships between PE facets, eating concerns, inflexible eating, and mental health concerns. Identified mental health concerns and inflexible eating strengthen relations between specific PE facets (e.g., meal presentation, meal disengagement, food variety) and eating concerns in adult participants.

Introduction

Picky eating (PE) is often a vexing behavior present across the lifespan. Indeed, while some research suggests that PE is confined by age (i.e., only present in younger populations) [1], other research suggests that PE persists over time [2-5] and that approximately 35% of adults engage in PE [6]. Adult PE is associated with poor dietary quality [7-8] and significant psychological impairment including a range of mental health concerns and disordered eating [9-11] (e.g., dietary restraint, eating concerns, binge eating, and overall eating pathology) [9]. Recent research suggests that relationships between adult PE and disordered eating, specifically eating concerns, are strengthened by mental health concerns and inflexible eating in undergraduate students [9]. A critical piece missing from this research is precisely which facets of PE explain these relationships.

Picky Eating: Definitions, Multidimensional Structure, and Correlates

PE includes difficulty trying new foods, eating a limited range of foods, and marked rigidity and sensory sensitivity around food presentation and preparation [12]. PE also includes the rejection of familiar foods - when an individual refuses to eat or rejects a food they have consumed before - which distinguishes it from related constructs like food neophobia, or the avoidance of only novel foods that have never been consumed [13]. Because PE in adults is less understood than PE in children, a multidimensional tool was created to assess four distinct facets of adult PE [14]: (1) meal presentation, or strong preferences regarding food preparation and presentation; (2) food variety, or restricted dietary intake across food groups; (3) meal disengagement, or avoidant behavior around mealtimes; and (4) taste aversion, or rejection of bitter or sour foods [14-15]. This multidimensional approach to assessing PE has been identified as a key area of future research to define and elaborate on the nuances of adult PE [16], including the overlap between PE, disordered eating, and relevant correlates across these two eating phenotypes such as inflexible eating and mental health concerns.

Some research has examined PE in relation to disordered eating, with mixed results. Importantly, PE and disordered eating have been considered distinct eating phenotypes such that PE attitudes, cognitions, and behaviors are thought to persist in the absence of shape and weight concerns [17]. Unlike PE, disordered eating includes shape and weight concerns (i.e., body dissatisfaction), with some research suggesting such concerns drive the development and maintenance of eating pathology (e.g., tripartite influence model) [18]. That said, some research suggests that PE and disordered eating relate and co-occur [9-11]. For example, one study found that a comorbid class (high PE and disordered eating symptoms) was the largest class via latent class analysis, and was associated with psychosocial impairment and poor mental health outcomes [10]. Other research found that all PE

facets were related to social anxiety around eating as well as anxiety sensitivity when controlling for disordered eating symptoms [14]. In another study [16] using latent profile analysis, picky eaters emerged as a profile of participants that endorsed less disordered eating (including shape and weight concern behaviors) compared to a profile of participants called “approaching” eaters, or participants who self-reported higher food approach (e.g., high responsiveness and enjoyment of food) and lower traits of food avoidance. However, picky eaters also endorsed more eating-related impairment and depressive symptoms than “moderate” eaters, or eaters with a moderate food approach and avoidance [16]. Related to this is research suggesting that childhood PE did not predict disordered eating in adulthood [19]. These mixed findings and others [9, 20-23] suggest unclear relationships between PE and disordered eating, warranting further research mapping these relationships.

Relationships between PE and mental health concerns are clearer. For example, adult picky eaters endorse more obsessive-compulsive disorder and depressive symptoms than non-PE adults [10, 21]. Relatedly, positive relationships have been identified between PE and anxiety symptoms [14, 24], and preliminary evidence suggests that adult PE is positively associated with stress symptoms [9]. Another relevant correlate of PE is inflexible eating. For example, picky eaters with Avoidant Restrictive Food Intake Disorder (ARFID) reported elevated eating inflexibility (rigidity around eating rules) [23]. Using a multidimensional approach to PE, one study found that meal presentation and meal disengagement predicted psychological inflexibility and psychosocial impairment [14]. Furthermore, meal disengagement predicted depressive symptoms [14], suggesting that meal disengagement may be a more proximal predictor of poor mental health than other facets of PE. Taken together, while PE is consistently associated with psychological impairment, there is mixed evidence regarding relationships with disordered eating, and little is known about which specific facets of PE are associated with inflexible eating, mental health concerns, and disordered eating.

Inflexible Eating and Mental Health Concerns as Moderators of Relationships Between Picky Eating and Disordered Eating

Recently, Barnhart and colleagues [9] explored a range of psychological correlates as moderators of relationships between broad PE behavior and binge eating, dietary restraint, eating concerns, and overall eating pathology in undergraduate students. Mental health concerns (e.g., anxiety, depression, and stress symptoms) and inflexible eating moderated relationships between broad PE and eating concerns such that PE was more strongly associated with eating concerns when mental health concerns and inflexible eating were higher [9]. As it is measured on the Eating Disorder Examination-Questionnaire, eating concerns captures a range of disordered eating attitudes and cognitions including the fear of loss of control during eating, social aspects of eating such as eating in secrecy and guilt about eating, and a preoccupation with eating, food, calories [25]. The PE literature suggests some overlap with eating concerns, especially in terms of the social aspects of eating [10, 14, 26]. However, it remains unclear precisely what it is about PE that may relate to inflexible eating and mental health concerns in relation to variance in eating concerns. It may be the case that more control- and anxiety-based picky eating facets (e.g., meal presentation and meal disengagement) may be more closely related to eating concerns than food exposure-based picky eating facets (e.g., eating from a limited range of food groups; food variety). To this end, Barnhart and colleagues [9] outlined the need to examine these research questions with a focus on specific PE facets.

The Present Study

The present study builds on previous research demonstrating positive relationships between PE and disordered eating [10-11], specifically eating concerns [9], by examining relationships between PE facets and eating concerns. Given recent research pointing to overlap between broad PE, disordered eating, mental health concerns, and inflexible eating [9], this study had two exploratory hypotheses. First, we hypothesized that positive, bivariate relationships will emerge between PE facets, eating concerns, inflexible eating, and mental health concerns. Second, we explored inflexible eating and mental health concerns as moderators of relationships between PE facets and eating concerns. Based on previous research [9], we hypothesized that, overall, inflexible eating and mental health concerns will *strengthen* relations between picky eating facets and eating concerns.

Methods

Participants

This secondary analysis [9] utilized undergraduate participants from a large, Midwestern university who completed an online survey on eating behaviors. Initially, 579 participants were recruited; of those, 70 participants were excluded due to completing 75% or less of the survey ($n=42$), completing the survey multiple times ($n=17$), or failing to meet quality standards (e.g., incorrect responses to attention checks; $n=11$). The final sample ($N=509$) ranged in age from 18 to 25 years ($M=19.96$, $SD=2.93$) and, on average, participants were overweight (BMI; $M=25.20$, $SD=5.67$). Participants were women ($n=390$) and men ($n=116$; 22.7%); White ($n=438$; 85.7%), Black/African American ($n=55$; 10.8%), Latinx/Hispanic ($n=19$; 3.7%), Arab/Middle Eastern ($n=3$; 0.6%), Native American ($n=5$; 2.5%), or Other race/ethnicity (e.g., Asian; $n=13$; 2.5%); and heterosexual ($n=436$; 85.3%), Gay ($n=11$; 2.2%), Lesbian ($n=9$; 1.8%), Bisexual ($n=37$; 7.2%), or Not Listed sexual orientation (e.g., asexual; $n=16$; 3.1%). Furthermore, participants' socioeconomic status breakdown was middle class ($n=270$; 52.8%), upper middle class ($n=127$; 24.9%), lower middle class ($n=75$; 14.7%), lower class ($n=26$; 5.1%), and upper class ($n=9$; 1.8%). Finally, 6.3% ($n=32$) and 2% ($n=10$) of participants reported past and current eating disorder diagnosis, respectively. See Barnhart and colleagues [9] for additional participant information.

Measures

Height and Weight

Body mass index (BMI; kg/m^2) was calculated using self-reported height in feet and inches and weight in pounds.

Demographics

Participants self-reported demographic characteristics including age, gender, socioeconomic status, year in school, race, and sexual orientation. Data were also collected on current and past eating disorder diagnosis, current and past PE, and adherence to a particular eating style (e.g., vegetarian, vegan, etc.).

Adult Picky Eating Questionnaire (APEQ)

Adult PE was examined using the APEQ [14]. The questionnaire yields four subscales that are typically averaged to create a total score: meal presentation, food variety, meal disengagement, and taste aversion. This study focused on the subscales, not the total score. Example items are “I have a strong preference toward specific food presentation (meal presentation),” “I eat a limited number of items from each food group (food variety),” “I usually feel that I have something better to do than eating (meal disengagement),” and “I reject bitter foods, even if they are only slightly bitter (taste aversion).” Participants completed 16 items, on a five-point Likert scale (1=*Never*, 5=*Always*). The APEQ has shown strong psychometric properties, including internal consistency and convergent validity [14]. Higher scores indicated greater PE.

Eating Disorder Examination Questionnaire (EDE-Q)

Disordered eating was self-reported using the EDE-Q [25]. The 28-item scale assesses attitudes, cognitions, and behaviors relating to restraint, weight, shape, and eating concerns on a seven-point Likert scale (1=*No days*, 7=*Everyday*). This study focused on the eating concerns subscale. Each of the 28 items is preceded with “on how many of the past 28 days” and followed by the statements such as “Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?” The mean is calculated across all items in each scale, and higher scores indicate greater disordered eating.

Depression, Anxiety and Stress Scale - 21 Items (DASS-21)

Mental health concerns were assessed using the DASS-21, a short version of the 42-item instrument [27]. The DASS-21 measures depression, anxiety, and stress symptoms on a four-point Likert scale (0=*Did not apply to me at all*; 3=*Applied to me very much, or most of the time*). This study averaged scores from the three subscales for a total score, titled mental health concerns. Example items are “I experienced trembling (anxiety),” “I felt that I had nothing to look forward to (depression),” and “I found it hard to wind down (stress).” The DASS-21 has shown strong psychometric properties, including internal consistency [27] and convergent validity [28]. Higher scores indicate greater mental health concerns.

Inflexible Eating Questionnaire (IEQ)

Inflexible eating was assessed using the IEQ [29]. The 11-item scale assesses engagement in inflexible and rigid eating rules on a five-point Likert scale (1=*Fully disagree*, 5=*Fully agree*). This study used the scale's total score with items such as, “To manage my eating through rules gives me a sense of control” and “not following my eating rules makes me feel inferior.” The IEQ has high internal consistency, construct and temporal stability [29], and higher scores indicate greater inflexible eating.

Procedure

Procedures were approved by the Institutional Review Board prior to data collection (IRB protocol #1530232). University instructors shared a recruitment script about the survey with their students. Interested students then provided informed consent and accessed the survey on Qualtrics. Participants provided demographic information followed by previously described self-report measures; median survey completion time was approximately 27 minutes. Participants received course credit or extra credit following survey conclusion and were asked to recruit their parents to complete a similar survey. However, only student responses were used in the present study.

Analytic Plan

Descriptive statistics, including mean, standard deviation, range, skew, and kurtosis were calculated. Next, internal consistency was examined across study variables, and missing data were examined. Missingness was low (APEQ (3.6%), EDE-Q (0.9%), DASS-21 (4.5%), and IEQ (0.8%)) and Little's Missing Completely at Random (MCAR) results revealed data were MCAR ($p=1.000$); thus, missingness was assumed to be MCAR, and analyses utilized listwise deletion. Next, bivariate correlations were examined across study variables. Finally, homoscedasticity, normality, and linearity were examined to determine if residual variability met assumptions of multiple regression.

Two multiple regressions were calculated in SPSS 27. Across both regression analyses, predictor variables were mean centered. In step 1 across both models, BMI (mean centered) and gender (0=men, 1=women) covariates were entered given they are related to primary study variables [30-31]. In step 2, nine predictor variables were entered: picky eating facets (meal presentation, meal disengagement, taste aversion, and food variety), inflexible eating total score or mental health concerns score, and four interaction terms created between inflexible eating or mental health concerns and each picky eating facet. Across both regression models, eating concerns was the outcome variable. See Table 2 for more information.

Results

Preliminary Results

See Table 1 for descriptive statistics and bivariate correlations. There were significant positive bivariate correlations between each facet of PE, eating concerns, inflexible eating, and mental health concerns (Table 1). Assumptions of multiple regression were confirmed via visual inspection of histograms, Q-Q plots, and scatterplots. Diagnostics confirmed there were no issues of multicollinearity (e.g., tolerance and variance inflation factors within acceptable ranges; [32]).

Multiple Regressions

Picky Eating Facets and Inflexible Eating as Correlates of Eating Concerns

The overall model assessing picky eating facets and inflexible eating contributed significant variance in eating concerns ($F(11, 492) = 35.15, p < .001, R^2 = .44$; see Table 2). When examining main effects (i.e., relations between picky eating facets/inflexible eating and eating concerns), higher inflexible eating ($\beta = .43, t = 11.68, p < .001$) and meal disengagement ($\beta = .29, t = 6.56, p < .001$) were associated with higher eating concerns (see Table 2).

When examining interaction terms, which examined the interaction of inflexible eating and each picky eating facet, the interaction between meal disengagement and inflexible eating was associated with significant variance in eating concerns ($\beta = .10, t = 2.25, p = .03$; see Table 2). More specifically, meal disengagement was more strongly associated with eating concerns when inflexible eating was higher. No other interaction terms were significantly related to variance in eating concerns (see Table 2).

Picky Eating Facets and Mental Health Concerns as Correlates of Eating Concerns

The overall model assessing picky eating facets and mental health concerns contributed significant variance in eating concerns ($F(11, 469) = 25.52, p < .001, R^2 = .38$; see Table 2). When examining main effects (i.e., relations between picky eating facets/mental health concerns and eating concerns), higher mental health concerns ($\beta = .31, t = 6.80, p < .001$) and meal disengagement ($\beta = .24, t = 4.73, p < .001$) were associated with higher eating concerns (see Table 2).

When examining interaction terms, which examined the interaction of mental health concerns and each picky eating facet, the interaction between meal presentation and mental health concerns was associated with significant variance in eating concerns ($\beta = .13, t = 2.38, p = .02$; see Table 2). More specifically, meal presentation was more strongly associated with eating concerns when mental health concerns were higher. Also, the interaction between food variety and mental health concerns was associated with significant variance in eating concerns ($\beta = .10, t = 2.25, p = .03$; see Table 2). More specifically, food variety was more strongly associated with eating concerns when mental health concerns were higher. Neither the interaction between meal disengagement and mental health concerns, nor taste aversion and mental health concerns were significantly related to variance in eating concerns (see Table 2).

Discussion

In the present study, we explored relationships between PE facets, eating concerns, inflexible eating, and mental health concerns. Eating concerns and PE facets such as meal presentation and meal disengagement were positively related with medium strength, whereas eating concerns and food variety and taste aversion had small positive relations. Thus, some PE facets were more strongly related to eating concerns than others, a finding that is complemented by bivariate results that suggest that meal presentation and meal disengagement were also more strongly related to mental health concerns and inflexible eating. These findings map onto previous research suggesting that PE, specifically meal presentation and meal disengagement, is positively associated with significant psychological impairment [9–10, 14, 21, 23–24].

Building on this, moderation analyses examined inflexible eating and mental health concerns as moderators of relationships between PE facets and eating concerns. Overall, findings suggested that PE attitudes and behaviors such as strong preferences for specific food presentation, negative affect when food is not prepared/cooked the “right” way (meal presentation), avoiding mealtime and disengagement while sitting down for mealtime (meal disengagement), and eating from a limited number of food groups (food variety) were more strongly associated with eating concerns in undergraduates who self-reported higher mental health concerns and inflexible eating. These findings expand on previous research [9] by demonstrating that specific facets of PE such as meal presentation, meal disengagement, and food variety may be especially relevant in these relationships. Importantly, meal presentation should be distinguished from food variety in terms of how it may influence eating concerns via mental health concerns. Meal presentation appears to hinge on control of eating behaviors, including affective responses to eating when food rules are not met [14], whereas food variety emphasizes the food itself, including eating from a limited range of food groups [14]. Despite these unique features, findings suggest mental health concerns act as a mutual positive correlate that strengthens relations between these PE facets and eating concerns. Importantly, food variety often sits at the center of PE conceptualizations [e.g., 12, 13], both in popular and academic thought, which might explain a bias toward a unidimensional conceptualization of PE. The present findings caution against this approach, emphasizing the role of more internal, control-based PE facets, including affective responses and rigidity around food, that may relate to eating concerns via mental health concerns and inflexible eating. Importantly, conclusions drawn from this research may benefit both researchers and clinicians through a more nuanced understanding of the complex links between PE facets, disordered eating, inflexible eating, and mental health concerns.

Limitations And Future Directions

Of course, this study is not without limitations and future directions. First, cross-sectional data do not allow us to make causal attributions across study variables. While the statistical analyses, specifically moderation analyses, allow us to discern the role of both moderators on the relationship between PE facets and eating concerns, it is important for future research to confirm these exploratory findings with both experimental and experience sampling (e.g., ecological momentary assessment) methods to better map the temporal order and mechanistic links between PE, inflexible eating, mental health concerns, and eating concerns. Second, though large and well-powered, the sample is convenient and primarily WEIRD (i.e., Western, Educated, Industrialized, Rich, and Democratic [33]); thus, findings are bound to undergraduate participants. Still, these effects suggest several important research avenues to build on constraints on generality [34], including how these effects unfold in more severe presentations of PE, disordered eating, and mental health concerns, as well as how these effects unfold across development (e.g., from childhood to adulthood). Third, the present study focused on eating concerns to build on the parent study; still, some recent research has called into question the psychometric strength of this subscale [see 35]. To this end, findings from this study should be interpreted in light of these data. Finally, data collected in the present study were self-reported; thus, concerns common to descriptive, survey-based research such as social desirability and recall biases may compromise the validity of these findings. Future research using diverse methods to probe these constructs (e.g., behavioral) may build and substantiate observed effects.

Conclusions

Understanding precisely which PE facets interact with inflexible eating and mental health concerns in relation to eating concerns provides useful information to researchers interested in targeting mutual mechanisms of PE and disordered eating, specifically eating concerns. The present study suggests that PE facets such as meal presentation, meal disengagement, and food variety were more strongly associated with eating concerns when mental health concerns and inflexible eating were higher. These data inform clinical practice through knowledge of mental health concerns and inflexible eating as correlates that may worsen relationships between PE facets and disordered eating, specifically eating concerns, which in turn may provide information about potential therapeutic targets in concurrent PE and disordered eating presentations.

Declarations

Conflicts of Interest: None of the authors have potential conflicts of interest to disclose.

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Data Availability: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Code Availability: N/a.

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Ethics Approval: This study was performed in line with the principles of the Declaration of Helsinki. The present study received approved IRB review prior to data collection by Bowling Green State University's Institutional Review Board prior to data collection (#1530232)

Consent to Participate: All participants gave online informed consent prior to participating in the present study.

Consent for Publication: All participants have consented to having de-identified, group data published in a journal article.

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Multiple Regression Model 1: Mental Health Concerns (MHC)	<i>Unstandardized B</i>	<i>SE</i>	<i>Standardized Beta</i>	<i>t-value</i>	<i>p-value</i>
<i>Main Effects</i>					
Meal Presentation	.10	.08	.06	1.18	.08
Food Variety	.01	.07	.01	.13	.04*
Meal Disengagement	.36	.08	.24	4.73	.19
Taste Aversion	-.03	.06	-.02	-.43	.10
Mental Health Concerns	.58	.09	.31	6.80	.89
<i>Interaction Effects</i>					
Meal Presentation x MHC	.29	.12	.13	2.38	.02*
Food Variety x MHC	-.23	.10	-.10	-2.25	.03*
Meal Disengagement x MHC	.06	.10	.03	0.58	.57
Taste Aversion x MHC	.14	.09	.08	1.68	.09
<i>Covariates</i>					
Covariate: BMI	.04	.01	.18	4.72	<.001***
Covariate: Gender	.35	.11	.12	3.20	.001**
Multiple Regression Model 2: Inflexible Eating (IE)	<i>Unstandardized B</i>	<i>SE</i>	<i>Standardized Beta</i>	<i>t-value</i>	<i>p-value</i>
<i>Main Effects</i>					
Meal Presentation	.11	.08	.07	1.52	.13
Food Variety	-.01	.06	-.01	-.12	.91
Meal Disengagement	.41	.06	.29	6.56	<.001***
Taste Aversion	-.06	.05	-.05	-1.17	.24
Inflexible Eating	.56	.05	.43	11.68	<.001***
<i>Interaction Effects</i>					
Meal Presentation x IE	.14	.07	.09	1.82	.07
Food Variety x IE	-.08	.07	-.06	-1.25	.21
Meal Disengagement x IE	.13	.06	.10	2.25	.03*
Taste Aversion x IE	.03	.05	.02	0.56	.58
<i>Covariates</i>					
Covariate: BMI	.04	.01	.16	4.64	<.001***
Covariate: Gender	.29	.10	.10	2.94	.003**

Notes. SE = standard error. * $p < .05$. ** $p < .01$. *** $p < .001$. Model 1: $N = 480$. Model 1 $R^2 = .38$. Model 2: $N = 503$. Model 2 $R^2 = .44$.