



Picky Eating in Childhood: Associations With Obsessive-Compulsive Symptoms

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Abstract

Objective To test whether childhood picky eating (PE)—a behavior previously linked to many forms of psychopathology—is specifically associated with symptoms of obsessive-compulsive disorder (OCD). **Methods** We investigated the relationship between PE and symptoms of several forms of psychopathology in two separate observational samples: a sample of 110 children (5 and 6 years old) and a sample of 210 children (8 and 9 years old) drawn from a longitudinal study. In each sample, regression models based on psychiatric symptoms or diagnoses were used to assess the specificity of PE associations while accounting for cooccurring symptoms or comorbidities. **Results** Although bivariate associations emerged between PE and multiple forms of psychopathology, multivariate analyses revealed these associations were driven by a strong and specific association between PE and symptoms of OCD in both samples. Moreover, PE among 8- and 9-year-olds in the longitudinal study predicted emergence of additional later psychopathology, specifically attention-deficit/hyperactivity disorder (ADHD). **Conclusions** Findings suggest that PE, an easily identifiable clinical presentation, is also a specific marker for obsessive-compulsive symptomatology in school-age children and may impart risk for ADHD later in childhood.

Key words: ADHD; contamination; obsessive-compulsive disorder; picky eating; selective eating.

Introduction

Picky eating (PE), also known as selective eating or food fussiness, is a behavioral pattern characterized by strong food preferences, refusal to eat unfamiliar foods, and reduced variety or quantity of food intake. Child picky eaters are more likely than nonpicky eaters to experience family conflicts about eating and to suffer from developmental delays, behavioral disorders, anxiety disorders, and depression (Dubois et al., 2007; Mascola et al., 2010; Micali et al., 2011). PE is most common in the toddler and preschool years, with prevalence around 30%; however, prevalence declines to ~3–13% among 5- and 6-year-old children and

remains low through middle childhood (Cardona Cano et al., 2015; Mascola et al., 2010; Micali et al., 2011; Taylor et al., 2015). Longitudinal studies indicate PE that has not resolved by age 5 or 6 years tends to be long-lasting (Fernandez et al., 2020; Mascola et al., 2010). These results suggest that when PE persists into middle childhood, it is nonnormative and may be indicative of psychopathology or other maladaptive behaviors (Zucker & Hughes, 2020). Moreover, extreme PE that causes children to be underweight, malnourished, or to experience significant impairments in daily functioning constitutes a psychopathology in its own right: avoidant/restrictive food

intake disorder (ARFID; Zimmerman & Fisher, 2017).

Prior work has highlighted transdiagnostic associations between PE in preschool and school-age children and behavioral, emotional, and developmental problems (Dubois et al., 2007; Micali et al., 2011; Zucker et al., 2015). Reported rates of PE among children with autism spectrum disorders (ASD) are high, ranging from 53% to 83% (Cermak et al., 2010). PE in childhood is associated with elevated emotional lability, cognitive rigidity, and concurrent symptoms of anxiety and depression (Fernandez et al., 2020; Maiz & Balluerka, 2018; Micali et al., 2011; Zickgraf & Elkins, 2018; Zickgraf et al., 2020; Zucker et al., 2015). Moreover, PE in early childhood predicts increases in anxiety symptoms over a 2-year period (Zucker et al., 2015). Taken together, these results suggest that childhood PE is broadly associated with concurrent psychopathology and may forecast the emergence of subsequent psychopathology.

Although these findings highlight transdiagnostic symptom associations with PE, these broad associations might arise from a specific underlying association: one between PE and obsessive-compulsive symptoms (OCS). Adults with PE are more than twice as likely to have clinically significant symptoms of obsessive-compulsive disorder (OCD) than adults without PE (Kauer et al., 2015; Wildes et al., 2012). Obsessional thoughts and compulsive behaviors unrelated to food are common among children with severe PE (Timimi et al., 1997). OCS are common in childhood, with an estimated prevalence of 15–38%, and exist on a continuum in both child and adult populations (Alvarenga et al., 2015; Apter et al., 1996; Barzilay et al., 2019; Geller et al., 2012). A specific association between PE and OCS would be compatible with existing evidence for broad associations between PE and psychopathology because children with OCD typically suffer from comorbid psychiatric conditions, including separation anxiety disorder, attention-deficit/hyperactivity disorder (ADHD), and oppositional defiant disorder (ODD) each at rates surpassing 50% (Geller, 2006). Rates of comorbid major depressive disorder (MDD) are also high in childhood OCD (39%) and further increase by adolescence (62%; Geller, 2006). Subclinical pediatric OCS is also associated with elevated symptoms of anxiety and mood disorders, psychosis, and disruptive behaviors (Alvarenga et al., 2015). In a community sample of children 6–12 years old, diagnoses of separation anxiety, social phobia, generalized anxiety disorder (GAD), and MDD were more than twice as prevalent among children with subthreshold OCS compared with symptom-free children (Alvarenga et al., 2016). In sum, nonspecific bivariate associations between PE and many forms of psychopathology could result from a specific underlying

association between PE and OCS. To our knowledge, no prior studies have investigated whether PE is specifically associated with OCS relative to other symptoms of psychopathology in childhood.

Empirical evidence is needed to determine whether PE in childhood is a transdiagnostic marker of internalizing psychopathology or bears a more specific association with concurrent OCS. In this study, we investigated this question in a community sample of 5- and 6-year-olds enriched for overcontrol, a phenotype that consists of a constellation of tendencies related to perfectionism, social comparison, and inflexibility (Study 1). To follow best practices for scientific reproducibility (Open Science Collaboration, 2015), we tested whether the results from Study 1 replicated in an independent dataset (Study 2). In particular, associations found between PE and concurrent OCS in Study 1 might not replicate in samples that are not enriched for overcontrol. Therefore, we tested whether the specific association between PE and concurrent OCS found in Study 1 replicated in a second sample with a different demographic makeup, different ages, and enriched for depressive tendencies. Because the Study 2 dataset included a longitudinal component, we additionally performed exploratory analyses on subsequent measures of psychopathology to investigate whether PE in 8- and 9-year-olds predicted later OCD or other psychiatric illness.

Study 1 Methods

Participants

Community children aged 5.0–6.99 years were recruited from the St. Louis region for a larger study of overcontrolled tendencies in childhood. Recruitment materials sought healthy and overcontrolled children through posted flyers, online posting boards, and informational talks about child anxiety at schools and anxiety clinics with the goal of oversampling children with overcontrolled tendencies (Gilbert et al., 2020). Although recruitment materials targeted children with overcontrol (to oversample for this phenotype), all community children were invited to participate. See [Supplementary Table 1](#) for additional recruitment and inclusion details. The study sample size was determined based on power analyses and slightly truncated due to the COVID-19 pandemic. Exclusion criteria included ASD, chronic medical or neurological disorders, speech, language or cognitive delays or learning disabilities, and current psychotropic medication use. The exclusion of ASD is noteworthy because PE and sensory sensitivity are common among children with ASD (Emond et al., 2010; Täljemark et al., 2017). Exclusion of children using psychotropic medication ensured that symptoms and behaviors observed in this community sample were not due to medication use.

Written consent from caregivers and child assent was obtained from all participants. A primary caregiver completed questionnaires and clinical interviews. Children completed cognitive assessments, an electroencephalogram, and parent-child interactions as part of the larger study. Of the 134 caregiver-child participants enrolled in the larger study, 110 caregivers completed the PE measure and were included in the present analyses. Caregivers were primarily biological mothers (92%), followed by biological fathers (7%), and other relations (1%). See Table I for sociodemographic information about participants. The Institutional Review Board at Washington University School of Medicine approved all study procedures. Data are available on request.

Study 1 Materials

Spence Preschool Anxiety Scale

The Preschool Anxiety Scale (PAS) is a parent-report questionnaire that assesses anxiety symptoms in 3- to 6-year-old children (Spence et al., 2001). Caregivers completed 28 items using a 5-point scale. The measure yields a total of five subscale scores: generalized anxiety, social anxiety, OCD, physical injury fears, and separation anxiety (Cronbach's α total = .89, and subscales, respectively α = .84, .86, .36, .58, and .75). Higher scores indicate elevated anxiety.

Child Yale-Brown Obsessive Compulsive Scale

The Child Yale-Brown Obsessive Compulsive Scale (CY-BOCS) is a clinician-rated, semistructured interview assessing OCS in children and adolescents that consists of a symptom checklist and severity scale (Scahill et al., 1997). The severity items were only administered if at least one past or current symptom was reported. Having both PAS OCD and CY-BOCS scores allowed us to test whether PE was associated with multiple (parent-report versus interview-based) independent measures of OCS. We used two CY-BOCS summary measures: (a) total number of past and present obsessions and compulsions ("sum score") and (b) sum severity ratings ("severity score") for the subset of children who exhibited symptoms. Staff were trained in administering this interview by a clinical psychologist (K.E.G.), 20% of tapes were coded for reliability, which was good for both the sum (intraclass correlation = .85) and severity (intraclass correlation = .88) scores, and Cronbach's α = .83 was also high for the CY-BOCS sum score.

Kiddie Schedule for Affective Disorders, Early Childhood Version

The Kiddie Schedule for Affective Disorders, Early Childhood Version is a semistructured diagnostic interview (Gaffrey & Luby, 2012) administered to the

caregiver that assessed the presence of childhood anxiety, mood, and externalizing disorders. Staff interviewers underwent extensive training from a clinical psychologist (K.E.G) and ~20% of tapes were coded for reliability, which was good across diagnoses (97.5% agreement).

Child Behavior Checklist

The Child Behavior Checklist (CBCL) is a parent-report instrument that assesses common childhood psychiatric symptoms (Achenbach & Rescorla, 2001). The preschool version (ages 1.5–5 years) was administered to 5-year-olds and the school-age version (ages 6–18 years) to 6-year-olds. We used the Depression T-score, an age-adjusted standardized score, as a nondiagnostic measure of depressive symptoms.

Picky Eating

PE was measured based on parent responses to the following three questions: "Is your child a picky eater?" "Does your child eat a wide variety of foods?" and "Does your child enjoy eating new foods?" Responses ranged from 1 (*not at all*) to 10 (*very much so*) with the latter two questions reverse coded and the three items summed to generate a summary score of PE, with higher scores indicating greater severity. The three questions are identical or similar to items from the three-item PE section of the Nine Item ARFID screen (questions 1 and 2) and the three-item portion of the Stanford Feeding Questionnaire used to identify persistent picky eaters (questions 1 and 3; Toyama & Agras, 2016; Zickgraf & Ellis, 2018) and internal consistency was high for the three-item PE measure (Cronbach's α = .87). Prior research has validated PE measures based on parent responses to question 1 against direct measures of children's food intake (Jacobi et al., 2003).

Study 1 Data Analytic Plan

To determine if sex, race, or age should be included in our models as covariates, we tested whether PE differed by child sex, race (White vs. non-White), or age using independent-samples *t*-tests and Pearson's correlation analysis, respectively. We computed correlations to examine whether PE was associated with internalizing symptoms, as measured using the PAS total anxiety score and the CBCL depression score, using bivariate analyses. To investigate whether OCS were specifically and uniquely associated with PE among internalizing disorder symptoms, we conducted a simultaneous multiple regression on PE with each of the five PAS subscales (GAD, social anxiety, OCD, physical injury fears, and separation anxiety) and the CBCL depression score as independent variables. To determine whether the observed association between PE

Table 1. Sociodemographic Information, Picky Eating (PE) Scores, and Diagnosis Rates in Study 1 and Study 2

	Sample	
	Study 1 (<i>n</i> = 110)	Study 2 (<i>n</i> = 210)
Sample characteristics		
Age in years, mean (SD)	5.90 (0.63)	9.01 (0.53)
Range	5.00–6.99	8.00–9.95
Sex, <i>n</i> (%)		
Girls	53 (48%)	101 (48%)
Boys	57 (52%)	109 (52%)
Race, <i>n</i> (%)		
American Indian or Alaska Native	5 (5%)	
Asian	5 (5%)	
Black or African American	16 (15%)	69 (33%) ^a
Native Hawaiian or Pacific Islander	0 (0%)	
White	97 (88%)	116 (55%) ^a
Ethnicity, <i>n</i> (%)		
Hispanic/Latinx	7 (6%)	2 (1%)
Not Hispanic/Latinx	103 (94%)	208 (99%)
Parental educational attainment ^b , <i>n</i> (%)		
Without high school diploma	1 (1%)	12 (6%)
High school graduate without college	4 (4%)	10 (5%)
Some college education	23 (21%)	82 (39%)
Degree from 4-year college or more	82 (75%)	105 (50%)
Picky eating measures		
Dimensional picky eating measure, mean (SD)	14.9 (6.7)	
Range	3–30	
CAPA picky eating measure, <i>n</i> (%)		
Absent		188 (90%)
Eats only within the range of his/her fads		18 (9%)
Eating with others difficult because of extreme fads		4 (2%)
Rates of internalizing diagnoses		
MDD, <i>n</i> (%)	4 (4%)	34 (16%)
GAD, <i>n</i> (%)	20 (18%)	12 (6%)
Social phobia, <i>n</i> (%)	9 (8%)	23 (12%)
Separation anxiety, <i>n</i> (%)	6 (6%)	16 (8%)
Specific phobia, <i>n</i> (%)	2 (2%)	14 (7%)
OCD, <i>n</i> (%)	2 (2%)	15 (8%)

Note. Dimensional picky eating (PE) measure used in Study 1 was derived from parent responses (1–10 scale) to the following questions: “Is your child a picky eater?” “Does your child eat a wide variety of foods?” and “Does your child enjoy eating new foods?” The PE measure in Study 2 was derived from parent reports on the following item from the Child and Adolescent Psychiatric Assessment (CAPA): “Is s/he choosy about the foods s/he will eat?” Study 1 diagnoses for OCD were derived from the Children’s Yale-Brown Obsessive Compulsive Scale (CY-BOCS). Diagnoses for generalized anxiety disorder (GAD), social phobia, separation anxiety disorder, specific phobia, and major depressive disorder (MDD) were derived from the Kiddie-Schedule for Affective Disorders and Schizophrenia—early childhood version (K-SADS-EC (Gaffrey & Luby, 2012)). Study 2 diagnoses were derived from the parent-report and child-report Child and Adolescent Psychiatric Assessment (CAPA).

^aRace information in Study 2 was limited to the following categories: Black or African American, White, or Other.

^bParental educational attainment reflects responses for the caregiver who participated with the child. Parental education information was unavailable for one participant in Study 2.

and OCS was robust across measurements, we computed correlations of PE with the CY-BOCS sum of past and present obsessions and compulsions and, separately, the CY-BOCS severity score. All correlation, *t*-test, and regression analyses were carried out in SPSS; *p*-values reflect two-tailed tests. Participants missing data for any variables of interest in a given analysis were excluded from that analysis.

Study 1 Results

No significant differences in PE were found by child sex (*t* [108] = 0.14, *p* = .89), race (*t* [108] = −0.49,

p = .63), or age (*r* = .14, *p* = .15); therefore, these variables were not included in subsequent models. In keeping with prior work, PE was positively associated with elevated symptoms of anxiety and depression; bivariate analyses revealed significant associations between PE and the PAS OCD subscale (*r* = .37, *p* < .001), the PAS social anxiety (*r* = .23, *p* = 0.02), and physical injury fears (*r* = .31, *p* < .01) subscales, and the CBCL depression T-score (*r* = .23, *p* = .02), and marginal associations between PE and the PAS generalized anxiety (*r* = .18, *p* = .06) and separation anxiety (*r* = .19, *p* = .05) subscales. However, multivariate analysis revealed that PE was only significantly

associated with concurrent OCS, but no other concurrent symptoms (see Table II). PE was also significantly associated with both CY-BOCS sum ($r = .22$, $p = .02$) and severity ($r = .36$, $p = .02$).

Study 1 Discussion

The results of Study 1 replicate prior work demonstrating positive bivariate associations between PE and symptoms of diverse internalizing psychopathologies. In contrast, multivariate analysis demonstrates a specific association between PE and concurrent OCS. However, the Study 1 sample is enriched in children with overcontrolled tendencies, which may impact these results and limit their generalizability. Both PE and overcontrolled tendencies are associated with elevated cognitive rigidity (Gilbert et al., 2020; Zickgraf et al., 2020). Additionally, Cronbach's α indicated low internal consistency of the PAS OCD measure. Thus, to assess reproducibility and generalizability, we tested whether the relationship observed between PE and concurrent psychopathology in Study 1 replicated in an independent, existing sample with different sociodemographic characteristics and enriched for different traits (Study 2). Because the Study 2 dataset included a longitudinal component, we performed additional exploratory analyses to clarify the relationship between PE and subsequent psychopathology.

Study 2 Methods

Participants

The Preschool Depression Study is an existing longitudinal data set that we analyzed to test the reproducibility of findings from Study 1. Children in this study were recruited between the ages of 3.0 and 5.11 years from primary care, preschool, and daycare sites in St Louis. Children were screened with the Preschool Feelings Checklist (PFC; Luby et al., 2004) and oversampled for elevated symptoms of depression (defined as PFC scores ≥ 3) in preschool. Children with ASD and neurological disorders were excluded and those with other psychiatric disorders and healthy children with PFC scores of 0 were included for comparison (see Luby et al., 2009, for additional details). The primary data used in this analysis come from children ages 8.0–9.95 ($M [SD] = 9.01[0.53]$) drawn from two testing waves; PE was not assessed before age 8. There were 210 children who had parent-reported PE measures in the 8- and 9-year-old age range; see Table I for rates of internalizing diagnoses and sociodemographic information and Supplementary Table 1 for additional inclusion and recruitment details. The Institutional Review Board at Washington University School of Medicine approved all study procedures. Data are available on request.

To examine associations between childhood PE and later clinical outcomes, we compiled diagnosis variables from subsequent waves when available; at least one subsequent timepoint was available for 206 children (98%). The first subsequent assessment occurred 0.7–9.4 years ($M [SD] = 1.14 [0.68]$) after the initial timepoint; for 99% of these children, it occurred < 2.4 years after the initial timepoint and before 12 years of age. Age at last assessment ranged from 9.3 to 20.7 years ($M [SD] = 15.6 [3.72]$).

Study 2 Materials

Diagnostic Assessments

The Child and Adolescent Psychiatric Assessment (CAPA; Angold & Costello, 1995) was used to assess both PE and psychiatric symptoms in Study 2. The CAPA consists of developmentally appropriate questions assessing the Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV) criteria for childhood disorders over the past 6 months. The CAPA was administered to parents when children were 8.0–8.95 years, and to both parents and children when children were 9 years and older. CAPA interviews were audiotaped, reviewed for reliability, and calibrated for accuracy. CAPA raters were blind to the child's previous diagnostic status, and ongoing calibration of interviews for 20% of cases was implemented in consultation with an experienced clinician (J.L.L.). The PE measure was derived from the parent-report CAPA item “Is s/he choosy about the foods s/he will eat?,” capturing food restrictions beyond what is typical for the child's stage. A similar single-item measure from the Preschool Age Psychiatric Assessment (PAPA) has previously been used to assess PE in younger children (Steinsbekk et al., 2017; Zucker et al., 2015). Possible responses included: “absent” (1), “the subject eats only within the range of his/her fads” (2), and “eating with others difficult because of extreme fads” (3). Because only four children obtained a score of (3), responses were dichotomized to indicate absence (0) or presence (1) of PE. Concurrent psychiatric diagnosis and symptom severity scores were computed by taking the most severe rating across parent and child report (e.g., Bird et al., 1992).

Separate dimensional scores of internalizing disorder severity and externalizing disorder severity were calculated as the total number of core symptoms of internalizing disorders (anxiety disorders and MDD) and externalizing disorders (ADHD, ODD, and conduct disorder [CD]) endorsed at each timepoint with CAPA. These were computed separately for the same timepoint as the PE measure (“concurrent”) and for later timepoints (“subsequent”). Subsequent dimensional internalizing and externalizing scores were computed by taking the mean of all internalizing or

Table II. Multiple Linear Regression of Internalizing Disorder Symptoms Predicting Picky Eating in Study 1

Picky eating score	<i>B</i>	95% CI for <i>B</i>		SE <i>B</i>	β	ΔR^2
		LL	UL			
Model						.13**
Constant	8.06	−5.89	22.01	7.03		
OCD	1.26**	0.40	2.12	0.44	.31**	
Depression	0.08	−0.20	0.35	0.14	.06	
Generalized anxiety	−0.21	−0.75	0.32	0.27	−.11	
Social anxiety	0.07	−0.22	0.37	0.15	.06	
Physical injury fears	0.34	−0.04	0.72	0.19	.21	
Separation anxiety	−0.06	−0.55	0.42	0.24	−.03	

Note. Model = “Enter” method in SPSS Statistics; *B* = unstandardized regression coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; SE *B* = standard error of the coefficient; β = standardized coefficient, ΔR^2 = adjusted R^2 . Internalizing symptoms for obsessive-compulsive disorder (OCD), generalized anxiety, social anxiety, physical injury fears, and separation anxiety were derived from the Spence Preschool Anxiety Scale (PAS). Depression symptoms were derived from the Child Behavior Checklist (CBCL). * $p < .05$, ** $p < .01$, *** $p < .001$.

externalizing scores, respectively, across all later CAPA assessments. Given prior work linking PE to concurrent anxiety and depression in children, the presence (1) or absence (0) of anxiety disorders (Separation Anxiety Disorder, Social Phobia, OCD) and MDD concurrent to the PE measure (child age: 8.0–9.95 years) were obtained from the CAPA based on DSM-IV criteria. An exploratory approach to analyzing the longitudinal data resulted in the analysis of diagnostic data from subsequent timepoints for three externalizing disorders: ODD, CD, and ADHD. Subsequent diagnoses were defined as the presence (1) or absence (0) of the diagnosis at any later time point. These measures were obtained from the CAPA for all except the last two assessments, which were derived from the Kiddie–Schedule for Affective Disorders and Schizophrenia—present and lifetime version (K-SADS-PL (Kaufman et al., 1997)). For the K-SADS-PL, coder reliability on diagnoses ranged from 85% to 100% ($M = 96\%$). Simple agreement was calculated instead of Cohen’s kappa due to the relative low frequency of these codes. Subsequent diagnosis measures were dichotomous, indicating the presence of the diagnosis at any subsequent assessments (1) or its absence at all subsequent assessments (0).

Study 2 Data Analytic Plan

We tested for associations between PE and child sex or race (White vs. non-White) using chi-square tests and for age differences using *t*-tests. To test whether the specific association between PE and concurrent internalizing symptoms observed in Study 1 replicated in Study 2, we ran a binomial logistic regression on our PE measure with concurrent dimensional internalizing and externalizing scores as independent variables. Next, we tested whether bivariate and multivariate analysis of PE and concurrent internalizing diagnoses in Study 2 replicated results from Study 1. To ensure sufficient events per variable for the logistic

regression, only internalizing diagnoses with 15 or more cases at the initial timepoint (i.e., MDD, OCD, social phobia, and separation anxiety disorder) were analyzed as independent variables. To test whether bivariate associations between PE and concurrent internalizing psychopathology found in Study 1 replicate in Study 2, we ran Fisher’s exact tests for each diagnosis (i.e., OCD, MDD, social phobia, and separation anxiety). To test whether the specific association between PE and concurrent OCD psychopathology in multivariate analyses replicates in Study 2, we ran a logistic regression on PE scores with concurrent internalizing diagnoses as independent variables.

Given the longitudinal assessments in Study 2, we could additionally examine how PE at ages 8 and 9 related to later psychopathology. We carried out these analyses in an exploratory fashion, with the goal of identifying potential links between PE and psychopathology to inform future research. We first performed two *t*-tests to determine whether children with PE had higher mean subsequent dimensional internalizing or externalizing scores than their nonpicky peers. Based on results, we specifically evaluated associations between PE and subsequent externalizing diagnoses by running three Fisher’s exact tests between PE and subsequent diagnosis for ADHD, ODD, and CD using a significance threshold of $p < .016$ to correct for multiple comparisons. Fisher’s exact test was used instead of a chi-square test because of crosstabulation expected counts < 5 . Finally, we ran two logistic regressions to test whether PE predicted (a) subsequent OCD, controlling for concurrent OCD and (b) subsequent ADHD, controlling for concurrent ADHD.

Study 2 Results

No significant associations were found between PE and child sex ($\chi^2 [1] = 0.51, p = .48$), race ($\chi^2 [1] = 0.01, p = .95$), or age ($t [208] = 1.51, p = .13$); therefore,

these variables were not included in subsequent models. Replicating results from Study 1, a binomial logistic regression analysis demonstrated a specific association between PE and concurrent internalizing symptoms (Wald = 10.32, $p = 0.001$), but not concurrent externalizing symptoms (see [Supplementary Table 3](#)). Fisher's exact tests on PE and internalizing diagnoses with 15 or more cases revealed that picky eaters were more likely to have an OCD diagnosis ($p < .01$; odds ratio = 5.6; 95% CI [1.7–18.5]; relative risk = 4.5) and marginally more likely to have diagnoses of MDD ($p = .05$; odds ratio = 3.0; 95% CI [1.1–8.1]) or separation anxiety ($p = .06$, odds ratio = 3.5; 95% CI [1.0–12.0]) but not social phobia ($p = 1.00$, odds ratio = .8; 95% CI [0.2–3.8]). A multivariate logistic regression analysis including concurrent diagnoses of MDD, social phobia, and separation anxiety as predictors showed that PE was significantly associated only with concurrent OCD diagnosis (Wald = 3.97; $p < .05$; odds ratio = 3.8; 95% CI [1.0–13.9]), but not with other diagnoses (see [Table III](#)), replicating results from Study 1.

Although exploratory analysis of subsequent internalizing symptom scores did not demonstrate differences between children who did or did not exhibit PE at 8 or 9 years ($t [193] = 0.92$, $p = .36$), there was a trend toward higher rates of subsequent externalizing symptoms among children with PE at 8 or 9 ($t [193] = 1.72$, $p = .09$). Among specific externalizing diagnoses, PE in 8- and 9-year-olds was significantly associated with subsequent ADHD ($p < .001$) but not ODD or CD (p 's $> .25$). PE at 8 or 9 years did not significantly predict later OCD above and beyond OCD diagnosis at 8 or 9 years (see [Supplementary Table 4](#)). However, PE at 8 or 9 years did significantly predict later ADHD (Wald = 11.78; $p < .001$; odds ratio = 6.8; 95% CI [2.3–20.1]) above and beyond ADHD diagnosis at 8 or 9 years (see [Table IV](#)).

Study 2 Discussion

Study 2 tested whether the results from Study 1 were reproducible and generalizable to an independent sample with lower socioeconomic status, greater representation of racial minorities, older child age, and enriched for symptoms of depression. We note that Study 1 and Study 2 differed in the specific measures used to assess PE and psychopathology, increasing the likelihood that results would not generalize due to method variance. Thus, the demonstration of specific associations between PE and OCS in both studies provides particularly strong evidence that the result is robust and reproducible. The longitudinal design of Study 2 additionally permitted exploratory analyses into the subsequent emergence of psychopathology in children with PE at 8 or 9 years of age. Whereas PE at

8–9 years is associated with concurrent OCD, it specifically predicts the emergence of later ADHD.

General Discussion

Findings from this study replicate and extend existing evidence that PE in childhood is a transdiagnostic marker of psychopathology. Bivariate analyses indicate that PE is associated with symptoms of multiple psychiatric disorders. However, a multivariate approach demonstrates that concurrent OCS underpin these associations. Specifically, across two independent samples, multivariate analyses incorporating symptoms for many internalizing psychopathologies reveal a strong and specific association between PE and OCS, even though the prevalence of OCD diagnoses is low compared with that of other internalizing diagnoses in both samples (see [Table I](#)). The consistency of these findings across different measures and across samples differing in age, parental educational attainment, socioeconomic status, racial makeup, and trait enrichment suggests that the observed effects are robust and generalizable to multiple samples of children.

The current findings linking PE and OCS may prove clinically useful in improving screening and detection of pediatric OCD. Evidence suggests that OCD in childhood is underdiagnosed, with an estimated 90% of children who meet clinical criteria going undetected and untreated ([Heyman et al., 2003](#)). Even among children who are identified and treated, the average delay between illness onset and psychiatric assessment is 2.5 years ([Geller, 2006](#)). Children with subthreshold OCS might also benefit from identification, given their increased risk for psychiatric illness and functional impairment compared with their symptom-free peers ([Alvarenga et al., 2016](#)). This study found that children identified by their parents as picky eaters are 4.5 times more likely to have OCD than their nonpicky peers. These results may help clinicians and pediatricians identify children suffering from OCD or subclinical OCS. Whereas obsessions and compulsions may be hidden, a child's persistent problems with PE tend to be disruptive and obvious to parents. Moreover, pediatricians routinely ask how children are eating at wellness visits. Thus, probing this important, if routine, domain has the potential to serve as a useful identifier for children experiencing OCS and at risk for developing additional psychopathology.

Although PE was specifically associated with concurrent OCS/OCD in both samples, longitudinal analyses in Study 2 showed that PE at 8 or 9 years of age did not predict later OCD after controlling for concurrent OCD. Rather, among children who did not have ADHD at age 8 or 9, picky 8- and 9-year-olds are 6.8 times more likely than their nonpicky peers to

Table III. Results of Binomial Logistic Regression Analysis on Picky Eating Based on Internalizing Diagnoses in Study 2

Picky eating	<i>B</i>	SE <i>B</i>	Wald	Odds ratio	95% CI for odds ratio	
					LL	UL
OCD	1.33	0.67	3.97*	3.77	1.02	13.88
MDD	0.77	0.56	1.93	2.17	0.73	6.45
Social phobia	−0.54	0.84	0.41	0.58	0.11	3.04
Separation anxiety	0.96	0.72	1.80	2.62	0.64	10.66
Constant	−2.58	0.32	65.27***			

Note. Model = “Enter” method in SPSS Statistics; *B* = regression coefficient; SE *B* = standard error of the coefficient; Wald = result of Wald test; CI = confidence interval; LL = lower limit; UL = upper limit. Odds ratios are for diagnosis present compared with absent. Diagnoses for obsessive-compulsive disorder (OCD), major depressive disorder (MDD), social phobia, and separation anxiety disorder were determined from Child & Adolescent Psychiatric Assessment (CAPA). Model performance: Nagelkerke $R^2 = .11$, $\chi^2(4) = 10.64$, and $p = .03$. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table IV. Results of Binomial Logistic Regression Analysis on Later Attention-Deficit/Hyperactivity Disorder (ADHD) Diagnosis in Study 2 Based on Picky Eating (PE) and ADHD Diagnosis at Ages 8 or 9

Later ADHD diagnosis	<i>B</i>	SE <i>B</i>	Wald	Odds ratio	95% CI for odds ratio	
					LL	UL
Early picky eating	1.91	0.56	11.78***	6.76	2.27	20.11
Early ADHD diagnosis	2.42	0.46	27.25***	11.24	4.53	27.87
Constant	−2.20	0.27	65.03***			

Note. Model = “Enter” method in SPSS Statistics; *B* = regression coefficient; SE *B* = standard error of the coefficient; Wald = result of Wald test; CI = confidence interval; LL = lower limit; UL = upper limit. Odds ratios are for symptom present compared with absent. Dichotomous early picky eating measure and the dichotomous early attention-deficit/hyperactivity disorder (ADHD) diagnosis measure were both derived from the Child and Adolescent Psychiatric Assessment (CAPA) when children were 8 or 9 years old. Later ADHD diagnosis was derived from diagnostic assessments collected using the CAPA at all timepoints prior to the last two study assessments and the Kiddie-Schedule for Affective Disorders and Schizophrenia—present and lifetime version (K-SADS-PL) for the last two study assessments. Subsequent diagnosis was defined as the presence of the diagnosis at any timepoint after the PE measure. Model performance: Nagelkerke $R^2 = .29$, $\chi^2(2) = 39.61$, and $p < .001$. * $p < .05$, ** $p < .01$, *** $p < .001$.

subsequently develop ADHD. Prior findings may aid in interpreting these results. First, pediatric OCD and ADHD exhibit familial cosegregation and clinical or subclinical ADHD symptoms are associated with both pediatric OCD and OCS (Abramovitch et al., 2015; Geller et al., 2007). Moreover, OCD in adolescence has been shown to predict ADHD in adulthood with an odds ratio of 13.3 (Peterson et al., 2001). If PE is associated with concurrent OCS and OCD, then it too might signal risk for ADHD. Because participant age is an essential variable for considering risk and the emergence of psychopathology in childhood, the longitudinal findings from Study 2 might be specific for analyses anchored at 8–9 years. Although our results provide initial evidence that school-age PE is associated with concurrent OCS and predicts subsequent psychopathology, we cannot draw firm conclusions about the utility of PE for predicting specific psychopathology. Longitudinal studies that incorporate PE

measures, OCS measures, and broader psychiatric batteries are needed to establish the utility of PE for predicting specific psychopathology at different ages and in diverse samples.

Additional outstanding questions arise from the limitations of this study. It is important to note that both samples were enriched for specific, albeit different, tendencies (overcontrolled tendencies in Study 1 and symptoms of depression in Study 2) and excluded children with ASD. Further work is needed to determine whether the observed association between PE and OCS generalizes to children with ASD and to unenriched community samples. Moreover, neither Study 1 nor Study 2 contained assessments for ARFID and Study 2 used diagnostic measures based on the DSM-IV, therefore Study 2 diagnostic criteria may differ from the DSM-V and we cannot determine the extent to which our measures of PE may have identified children who meet diagnostic criteria for ARFID.

Additional studies collecting matched measures would help clarify which sample characteristics, such as age, might influence the generalizability of these results. Finally, in both studies, PE was derived from parent-report measures obtained from a single parent. Opportunities for screening, such as a pediatrician asking about a child's eating habits at their annual checkup, will tend to rely upon reports from a single parent. How parents' view their children's eating behaviors is clearly an important metric; however, single-informant measures may be susceptible to reporter biases or not representative of children's eating behavior outside of the home. Future work will be needed to confirm the present results using observational or objective measures of PE (e.g., using ecological momentary assessment) and/or collection of multiple informant reports.

Taken together, the results of this study build upon and advance the existing literature on childhood PE. They replicate prior findings that PE is broadly associated with concurrent symptoms of anxiety and depression yet also extend these findings to demonstrate a specific role of OCS in PE. The findings offer insight into the clinical significance of childhood PE and may afford new opportunities for early screening and detection of OCD and other debilitating psychiatric illnesses.

Supplementary Data

Supplementary data can be found at: <https://academic.oup.com/jpepsy>.

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