

# Trajectories of Picky Eating in Low-Income US Children

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abstract

**BACKGROUND AND OBJECTIVES:** Picky eating is common, yet little is known about trajectories of picky eating in childhood. Our objectives were to examine trajectories of child picky eating in low-income US children from ages 4 to 9 years and associations of those trajectories with participant characteristics, including child BMI z score (BMIz) and maternal feeding-behavior trajectories.

**METHODS:** Mother-child dyads ( $N = 317$ ) provided anthropometry and reported on picky eating and maternal feeding behaviors via questionnaires at child ages 4, 5, 6, 8, and 9 years. At baseline, mothers reported on demographics and child emotional regulation. Trajectories of picky eating and maternal feeding behaviors were identified by using latent class analysis. Bivariate analyses examined associations of picky-eating trajectory membership with baseline characteristics and maternal feeding-behavior trajectory memberships. A linear mixed model was used to examine the association of BMIz with picky-eating trajectories.

**RESULTS:** Three trajectories of picky eating emerged: persistently low ( $n = 92$ ; 29%), persistently medium ( $n = 181$ ; 57%), and persistently high ( $n = 44$ ; 14%). Membership in the high picky-eating trajectory was associated with higher child emotional lability and lower child emotional regulation. Picky eating was associated with restriction ( $P = .01$ ) and demandingness ( $P < .001$ ) trajectory memberships, such that low picky eating was associated with low restriction and high picky eating was associated with high demandingness. Medium and high picky-eating trajectories were associated with lower BMIz.

**CONCLUSIONS:** Picky eating appears to be traitlike in childhood and may be protective against higher BMIz.



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**WHAT'S KNOWN ON THIS SUBJECT:** Picky eating is common during childhood. Certain child characteristics (eg, sex, birth order, and socioeconomic status) have been associated with persistence of picky eating. It remains unclear how picky eating is related to child weight and maternal feeding behaviors.

**WHAT THIS STUDY ADDS:** Picky eating is a stable trait that is established in children by age 4 and may be protective against overweight and obesity. Picky eating is also associated with maternal feeding behaviors, such as restriction and demandingness.

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Picky eating, defined as eating a limited amount of foods, rejection of novel foods, and strong food preferences, is common during childhood<sup>1,2</sup> and often concerning to parents.<sup>3</sup> Current estimates of picky eating prevalence vary widely.<sup>4</sup> Limited work has examined picky-eating trajectories in individual children, with some studies suggesting that children “grow out of it”<sup>5,6</sup> and others suggesting that it persists as a stable trait.<sup>7</sup> Determining if picky eating is a trait for some children and transient state for others, and identifying associated characteristics, could be helpful in providing anticipatory guidance and informing decisions regarding need for intervention.

The literature is mixed with regard to associations of picky eating with child weight status, with a recent systematic review<sup>8</sup> reporting inconsistent associations between child weight status and picky eating (using a variety of definitions) and calling for longitudinal studies examining BMI z score (BMIZ) and picky eating. Child and dyad characteristics previously associated with picky eating include male sex,<sup>5</sup> lower income,<sup>5</sup> and maternal feeding behaviors characterized by restriction, pressure, and demandingness.<sup>9</sup> Greater child emotionality and difficult temperament have been associated with development of later picky eating,<sup>10</sup> although picky eating was assessed by maternal response to 2 questions rather than a more nuanced definition. Longitudinal work, however, has found that being a firstborn is associated with a decline in picky eating<sup>5</sup> and that maternal feeding behaviors did not prospectively predict picky eating.<sup>11</sup>

Most previous studies have been cross-sectional,<sup>8,12</sup> and previous longitudinal studies have not focused on low-income children,<sup>1,5,7</sup> who are at elevated risk for being both overweight<sup>13</sup> and picky.<sup>14</sup> No previous

studies have investigated trajectories of picky eating in a low-income population or associations with BMIZ and maternal feeding behaviors over time. Therefore, our objectives in this study were to examine trajectories of child picky eating in a low-income population of US children from ages 4 to 9 years and associations of those trajectories with participant characteristics, including child BMIZ trajectories and maternal feeding-behavior trajectories.

## METHODS

### Participants

Low-income mother-child dyads ( $N = 317$ ) were recruited into a longitudinal cohort from Head Start programs in Southeastern Michigan between 2009 and 2011. All child participants attended Head Start and were 3 to 4 years old at recruitment. Exclusion criteria included gestational age  $\leq 35$  weeks, significant perinatal or neonatal complications, serious medical problems as determined on a case-by-case basis, food allergies, foster care, and mother not speaking English fluently or having an education  $\geq 4$ -year college degree. Participants were followed longitudinally, participating in data collection at 5 time points. Children's mean ages were 4.24 (SD 0.52), 4.90 (SD 0.70), 5.94 (SD 0.72), 7.91 (SD 0.72), and 8.55 (SD 0.94) years, respectively. Child BMIZ was collected at all 5 time points, Children's Eating Behaviour Questionnaire (CEBQ) score was collected at 4 time points, Child Feeding Questionnaire (CFQ) and Caregiver's Feeding Styles Questionnaire (CFSQ) scores were collected at 3 of the time points (Table 1).

The data set contained 397 dyads, but the analysis was restricted because of missing data. For each outcome, dyads with data from at least 2 of the time points were included in the trajectory analysis, resulting in slightly different subsamples used in each trajectory analysis because of

missing data (picky eating,  $n = 317$ ; restriction,  $n = 275$ ; pressure to eat,  $n = 276$ ; demandingness,  $n = 276$ ). Complete cases were used for subsequent analyses involving picky-eating trajectories and other variables and trajectories. Bivariate tests were done on variables used in this analysis between the included and excluded dyads. Dyads excluded from the picky-eating analysis (those with 1 or no picky-eating measurement,  $n = 80$ ) had younger maternal age (excluded = mean 27.55 [SD 4.90]; included = mean 29.47 [SD 7.33];  $P = .032$ ). Those excluded from the restriction, pressure-to-eat, and demandingness analyses had higher baseline behaviors (restriction: mean excluded = 2.82 [SD 0.65], mean included = 2.66 [SD 0.55];  $P = .04$ ; pressure to eat: mean excluded = 2.82 [SD 0.65], mean included = 2.65 [SD 0.55];  $P = .03$ ; demandingness: mean excluded = 2.83 [SD 0.66], mean included = 2.65 [SD 0.55];  $P = .03$ ). No other variables were significantly different between included and excluded dyads.

Mothers gave written informed consent and were compensated \$40 at each time point. The University of Michigan Institutional Review Board approved this study.

### Measures

#### Picky Eating

Maternal report of child picky eating was measured by using the Food Fussiness subscale of the CEBQ<sup>15</sup> (6 items,  $\alpha = .88, .83, .91, \text{ and } .87$ ). Questions were answered on a 1-to-5 point Likert scale and averaged to create a mean score with a possible range of 1 to 5, with higher scores indicating pickier eating. Previous work<sup>16</sup> has found scores of  $>3.0$  or 3.3 to be consistent with clinically moderate and severe picky eating, respectively. The Food Fussiness scale has been shown to be reliable and valid in low-income US populations.<sup>17</sup>

**TABLE 1** Participant Characteristics at Each Time Point of the Study

Participant Characteristics	Child Age 4 y (N = 306)	Child Age 5 y (N = 286)	Child Age 6 y (N = 295)	Child Age 8 y (N = 266)	Child Age 9 y (N = 192)
<b>Mother characteristics</b>					
Age, y, mean (SD)	29.47 (7.32)	—	31.19 (7.18)	33.52 (7.65)	34.29 (7.57)
Race and/or ethnicity, n (%)					
Non-Hispanic white	205 (67.0)	180 (67.7)	189 (67.7)	141 (67.1)	123 (68.0)
Hispanic or not white	147 (48.0)	86 (32.3)	90 (32.3)	69 (32.9)	58 (32.0)
Level of education, n (%)					
High school diploma or less	147 (48.0)	129 (48.5)	135 (48.4)	120 (47.2)	83 (45.9)
More than a high school diploma	159 (52.0)	137 (51.5)	144 (51.60)	134 (52.8)	98 (54.1)
BMI, mean (SD)	32.50 (8.89)	—	33.04 (9.32)	32.87 (9.50)	33.88 (9.90)
Feeding behaviors, mean (SD)					
Restriction	—	3.36 (0.93)	3.33 (0.92)	—	3.15 (1.00)
Pressure to eat	—	2.81 (1.15)	2.75 (1.08)	—	2.49 (1.10)
Demandingness	—	2.67 (0.56)	2.55 (0.56)	—	2.28 (0.56)
<b>Child characteristics</b>					
Age, y, mean (SD)	4.24 (0.52)	4.90 (0.70)	5.94 (0.69)	7.91 (0.72)	8.55 (0.94)
Male sex, n (%)	158 (51.60)	136 (51.1)	144 (51.60)	130 (51.2)	98 (54.10)
BMIz, mean (SD)	0.79 (1.10)	0.83 (1.10)	0.84 (1.03)	0.96 (0.99)	0.91 (1.02)
Picky eating (CEBQ FF), mean (SD)	2.73 (0.84)	—	2.72 (0.77)	2.86 (0.82)	2.68 (0.82)

Sample size (N) indicates the largest sample used from that time point in any analyses; total sample size represented for each variable varies because of missing data. FF, Food Fussiness; —, not measured at this time point.

### Mother and Child Characteristics at Child Age 4 Years

At average child age 4 years, mothers completed questionnaires reporting their children's sex, date of birth, maternal parity, date of birth, and race and/or ethnicity and their highest level of educational attainment.

Mothers completed the Emotion Regulation Checklist,<sup>18</sup> a 24-item measure consisting of 2 subscales: emotional regulation, which assesses the frequency of a child's displays of empathy and emotional awareness (8 items,  $\alpha = .84$ ), and emotional lability, which assesses a child's affective lability and negative reactivity (16 items,  $\alpha = .85$ ). Items are rated on a 5-point Likert scale. The means of contributing items are calculated to create subscale scores.

### Anthropometrics

At each time point, heights and weights of mothers and children were measured<sup>19</sup> and BMI was calculated. BMIz was calculated for children on the basis of the US Centers for Disease Control and Prevention growth charts.

### Maternal Feeding Behaviors

At 3 time points (average child age 5, 6, and 9 years), mothers self-reported feeding behaviors on the CFQ,<sup>20</sup> a valid and reliable<sup>20,21</sup> 31-item measure of feeding behaviors. We examined 2 subscales: restriction (8 items,  $\alpha = .70$ ,  $.75$ , and  $.82$ ), which measures limiting the child's intake of palatable and high-fat foods, and pressure to eat, which assesses pressuring the child to eat more food (4 items,  $\alpha = .66$ ,  $.62$ , and  $.71$ ). Mothers responded on a 1-to-5 point Likert scale, and contributing items were averaged to generate a mean score, with higher scores for each subscale reflecting more of the behavior. These subscales were chosen because they are discrete and potentially modifiable behaviors and the most extensively studied in previous literature.<sup>22,23</sup>

Mothers also completed the CFSQ at 3 time points (average child age 5, 6, and 9 years), which is a valid and reliable 19-item measure of feeding practices.<sup>24</sup> We examined the summary scale of CFSQ demandingness ( $\alpha = .85$ ,  $.84$ , and  $.78$ ), which assesses the degree to which mothers encourage or discourage children's eating. Mothers

responded on a 1-to-5 point Likert scale, and items were averaged to generate a mean score.

### Statistical Analysis

Data analysis was performed by using R version 3.6.1 statistical software. To assess trajectories of picky eating, maternal restriction, pressure to eat, and demandingness over the study period, latent class growth modeling was performed by using the package "lcm" version 1.8.1.<sup>25</sup> Latent class growth models of each outcome variable were estimated by using a class-specific slope parameter for child age. Higher-order slopes (quadratic and cubic) were included in models if they were found to be significant. Trajectories were assigned to each subject by using the highest posterior class membership probability. The number of trajectories was chosen by running models with increasing numbers of trajectories in a forward-selection fashion and selecting the model with the best fit, judging by the Bayesian information criterion. If a model resulted in class membership  $<5\%$  in any of the trajectories, the model was considered suboptimal<sup>26</sup> and rejected. By using this model

selection method, each chosen model included 3 latent trajectories. The average posterior class membership probability was >80% for all trajectories in all models, and the percentage of subjects with posterior probabilities >70% in their assigned trajectory was >75% for all trajectories in all models.

Latent class growth modeling was applied to BMIz, but the model Bayesian information criteria continued to improve with as many as 11 trajectories, suggesting the BMIz trajectories were not clustering in a meaningful way. Therefore, we analyzed the association of BMIz with picky-eating trajectories, fitting a linear mixed model using the R package “nlme” version 3.1 to 140. The model included fixed effects for the 3 picky-eating trajectories and child age along with their interaction, a random intercept, and a random slope for child age at the subject level.

Associations of picky-eating trajectories with maternal restriction, pressure-to-eat, and demandingness trajectories, and with participant characteristics at average child age 4 years, were examined by using  $\chi^2$  and Fisher’s exact tests for categorical variables and analysis of variance or the Kruskal-Wallis rank sum test for continuous variables. The variables were maternal age, maternal race and/or ethnicity (non-Hispanic white versus Hispanic or not white), maternal BMI, maternal highest level of education obtained (less than or equal to a high school diploma versus more than a high school diploma), child baseline BMIz, child sex (male versus female), parity, emotional regulation, and emotional lability. When a statistically significant association with picky-eating trajectories was observed, Tukey’s post hoc analysis or Fisher’s exact tests with Bonferroni corrections were used to determine which categories were associated.

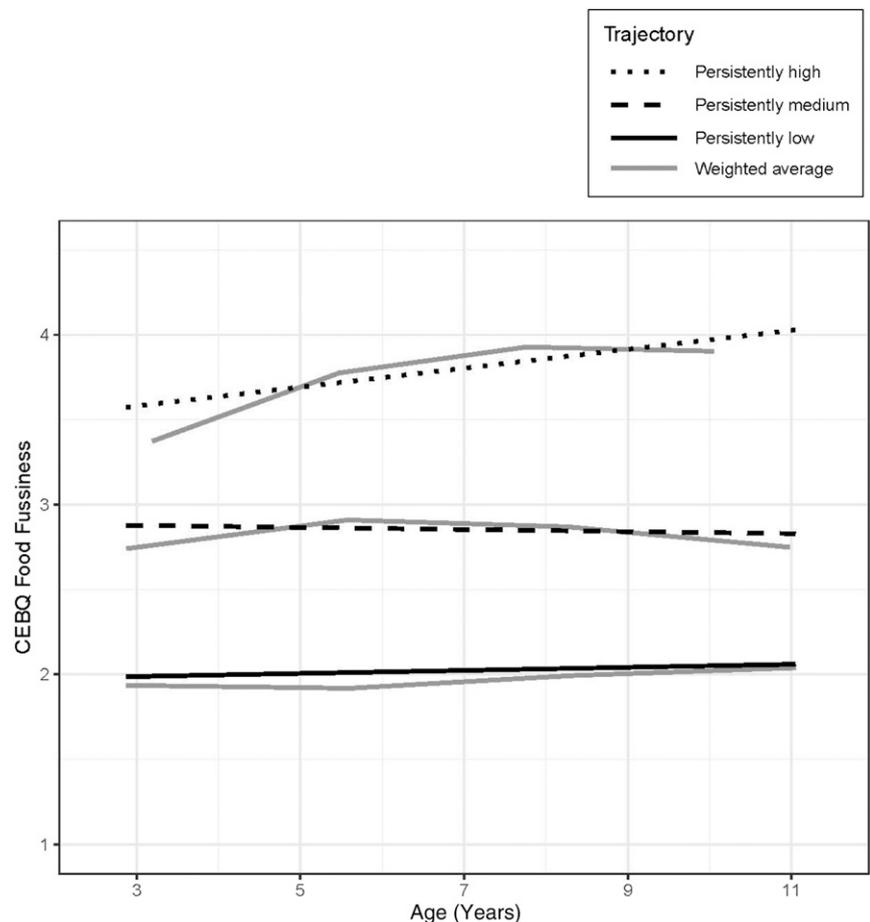
## RESULTS

Characteristics of the sample at each time point are shown in Table 1. For mothers, the majority were non-Hispanic white (67%–68% at each time point), and just more than half had more than a high school education (51%–54%). For children, just more than half were boys (50%–54% at each time point), and mean BMIz ranged from 0.79 to 0.96 across time points.

Three trajectories of picky eating were identified and are shown in Fig 1. The trajectories were persistently low picky eating ( $n = 92$ ; 29%; mean across time points = 1.97 [SD 0.53]), persistently medium picky eating ( $n = 181$ ; 57%; mean across time points = 2.87 [SD 0.55]), and persistently high

picky eating ( $n = 44$ ; 14%; mean across time points = 3.86 [SD 0.59]). A 1-point difference corresponds to the following: “never” = 1; “rarely” = 1 to 2; “sometimes” = 2 to 3; “often” = 3 to 4; and “always” = 4 to 5.

Associations of baseline child and mother characteristics with picky-eating trajectory membership are presented in Table 2. With respect to these characteristics, the low picky-eating trajectory was associated with female sex, higher emotional regulation, and lower emotional lability compared with the medium and high trajectories. Child sex ( $P = .003$ ), emotional regulation ( $P \leq .001$ ), and emotional lability ( $P < .002$ ) were associated with picky-eating trajectory membership overall. In post hoc



**FIGURE 1** Trajectories of child picky eating over time as measured by the CEBQ Food Fussiness subscale. Three persistent trajectories emerged that consistently differed from each other by 1 to 2 points across ages 3 to 11 years.

**TABLE 2** Baseline Associations With Picky-Eating Trajectory Membership

	Picky-Eating Trajectory Membership			<i>P</i>
	Low	Medium	High	
<b>Maternal characteristics</b>				
Age, y, mean (SD) <sup>a</sup>	28.5 (6.13)	29.6 (7.28)	31.1 (9.45)	.52
Race and/or ethnicity, <i>n</i> (%)				
Non-Hispanic white	54 (60.0)	119 (68.79)	31 (73.81)	.21
Hispanic or not white	36 (40.0)	54 (31.21)	11 (26.19)	
Level of education is high school diploma or more, <i>n</i> (%)	39 (43.33)	89 (51.44)	19 (45.24)	.42
Parity, mean (SD)	2.02 (0.90)	1.98 (1.23)	1.61 (0.95)	.12
BMI, mean (SD)	33.4 (9.80)	32.1 (8.70)	31.8 (7.51)	.48
<b>Child characteristics</b>				
BMIz at baseline, mean (SD)	0.99 (1.08) <sup>b</sup>	0.75 (1.11) <sup>b,c</sup>	0.49 (1.04) <sup>c</sup>	.046
Male sex, <i>n</i> (%)	34 (37.8) <sup>b</sup>	103 (60.6) <sup>c</sup>	20 (47.6) <sup>b,c</sup>	.003
Emotional regulation, mean (SD)	3.32 (0.33) <sup>b</sup>	3.13 (0.39) <sup>c</sup>	3.05 (0.37) <sup>c</sup>	<.001
Emotional lability, mean (SD)	1.82 (0.43) <sup>b</sup>	2.01 (0.49) <sup>c</sup>	2.09 (0.48) <sup>c</sup>	.002

Analysis of variance or the Kruskal-Wallis test was used for continuous variables, and the  $\chi^2$  test was used for categorical variables. Superscripts b and c that differ from one another denote significant differences between low, medium, and high picky-eating trajectories in the row variable.

<sup>a</sup> Kruskal-Wallis test.

analyses, female child sex was more prevalent in the low picky-eating than in the medium picky-eating trajectory ( $P = .003$ ), but there was no significant sex difference between low and high or between medium and high trajectories ( $P > .99$  and  $.67$ , respectively). Child emotional regulation and emotional lability were both associated with picky-eating trajectory membership overall ( $P < .001$  and  $.002$ , respectively). In post hoc analyses, emotional regulation was higher in the low picky-eating trajectory compared with the medium and high trajectories ( $P < .001$ ) and was not different between medium and high trajectories ( $P = .42$ ). In post hoc analyses, emotional lability was lower in the low compared with the medium and high trajectories ( $P = .007$  and  $.005$ , respectively) and was not significantly different between medium and high trajectories ( $P = .52$ ). There was no association of maternal age, race and/or ethnicity, parity, or BMI with picky-eating trajectories.

The 3 picky-eating trajectories were significantly associated with BMIz. The linear mixed model of BMIz obtained statistically significant estimates for the fixed effects of picky-eating trajectory membership and child age but not their

interaction. Child age in years was positively associated with BMIz, having the same slope for each eating trajectory group ( $\beta = .03$ ;  $P = .002$ ). Persistently medium ( $\beta = -.25$ ;  $P = .046$ ) and persistently high ( $\beta = -.41$ ;  $P = .03$ ) picky-eating trajectories were associated with lower BMIz over time relative to the persistently low trajectory, adjusting for child age.

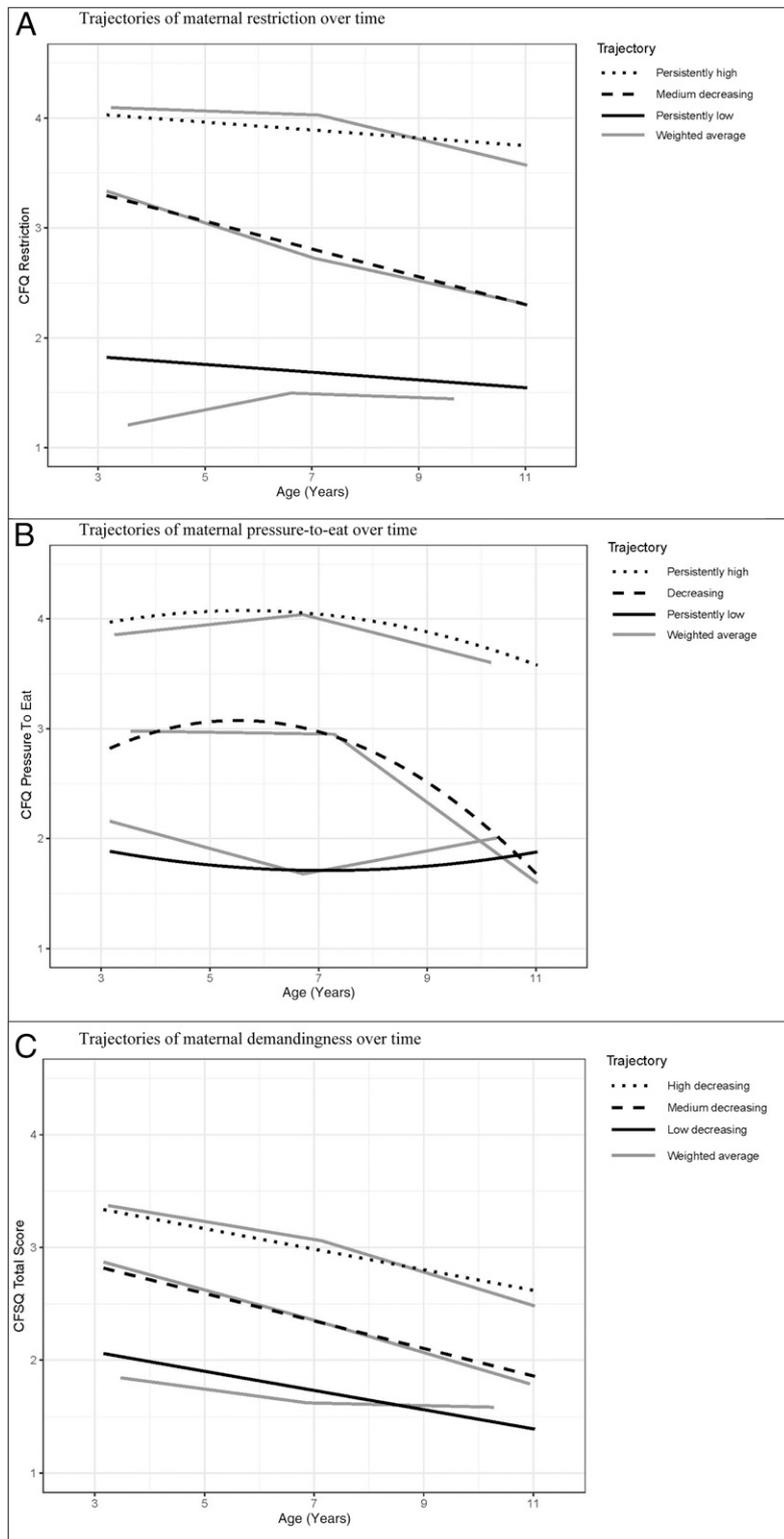
Three trajectories of restriction emerged: persistently low ( $n = 17$ ; 6%; mean across all 3 time points = 1.59 [SD 0.61]), medium decreasing ( $n = 126$ ; 46%; mean across all 3 time points = 2.85 [SD 0.73]), and persistently high ( $n = 132$ ; 48%; mean across all 3 time points = 3.95 [SD 0.57]). There was a significant association of trajectories of picky eating with trajectories of restriction ( $P = .01$ ; Fisher's exact test; Fig 2). The post hoc tests showed that the low restriction trajectory has greater representation in the low picky-eating compared with the medium picky-eating trajectory, the low picky-eating trajectory has greater representation in the low compared with medium and high restriction trajectories, and the medium picky-eating trajectory has less representation in the low compared with high restriction trajectory (Table 3).

For pressure to eat, 3 trajectories emerged: persistently low ( $n = 96$ ; 35%; mean across all 3 time points = 1.69 [SD 0.61]), decreasing ( $n = 131$ ; 47%; mean across all 3 time points = 2.92 [SD 0.77]), and persistently high ( $n = 49$ ; 18%; mean across all 3 time points = 4.15 [SD 0.67]) (Fig 2). The pressure-to-eat trajectories were not significantly associated with picky-eating trajectories ( $P = .21$ ; Fisher's exact test).

For demandingness, 3 trajectories emerged: low decreasing ( $n = 41$ ; 15%; mean across all 3 time points = 1.79 [SD 0.35]), medium decreasing ( $n = 160$ ; 58%; mean across all 3 time points = 2.48 [SD 0.38]), and high decreasing ( $n = 75$ ; 27%; mean across all 3 time points = 3.11 [SD 0.41]) (Fig 2). There was a significant association of trajectories of picky eating with trajectories of demandingness ( $P < .001$ ; Fisher's exact test). The post hoc tests showed that the low decreasing demandingness trajectory has greater representation in low and medium picky-eating than high picky-eating trajectories, high demandingness has greater representation in high and medium picky-eating trajectories than the low picky-eating trajectory, the low picky-eating trajectory has greater representation in the low and medium demandingness trajectories than the high demandingness trajectory, and the high picky-eating trajectory has greater representation in the low demandingness than high demandingness trajectory (Table 3).

## DISCUSSION

This study found 3 stable trajectories of picky eating. Lower picky eating was associated with female sex, greater emotional regulation, and lower emotional lability, whereas persistently high or medium picky eating was associated with lower BMIz. Maternal feeding behaviors characterized by restriction and demandingness were associated with picky eating.



**FIGURE 2** Trajectories of maternal feeding behaviors as measured by the CFQ and CFSQ. CFQ restriction and pressure-to-eat subscales are scaled from 1 to 5, and the CFSQ demandingness subscale is scaled from 1 to 5. A, Trajectories of maternal restriction over time. B, Trajectories of maternal pressure to eat over time. C, Trajectories of maternal demandingness over time.

The stable trajectories of picky eating we identified may differ from previous studies because of differences in demographics of study samples<sup>1</sup> or definitions of picky eating (ie, our definition of picky eating did not include aberrant eating behaviors).<sup>5</sup> Our finding that picky eating was stable from preschool to school age suggests that interventions for picky eating may need to begin before preschool age.

Similar to previous work that used different measures and therefore slightly divergent definitions of picky eating, our study found that persistently high picky eating was more common in girls<sup>5</sup> and in children with more emotional difficulties.<sup>10,27</sup> High and medium picky eating was associated with lower average BMIz, in the healthy BMIz range, suggesting that picky eating could be protective against overweight and obesity, as others have proposed.<sup>2,8,28</sup> We did not find evidence that picky eating was associated with being underweight, which is consistent with previous studies.<sup>2,29</sup> However, only a small number of children in this study were underweight (BMIz < -2 [1.3%, 0.6%, 0.6%, 0%, and 0% at each time point, respectively]). Of note, all of the underweight children were in low and medium picky-eating trajectories. Little is known, however, about the long-term weight gain trajectories of picky eaters into adulthood, and this is an important area for future research.

Associations of picky-eating trajectories with maternal restriction and demandingness were identified. Our study is the first, to our knowledge, to examine maternal feeding trajectories in association with picky-eating trajectories. With regard to restriction, we found that children who were pickier had mothers who reported more restriction. This may be explained by certain questions on the CFQ restriction subscale that conceptually map onto the restriction of unhealthy foods and sweets. These mothers of

**TABLE 3** Associations of Picky-Eating Trajectories With Maternal Feeding-Behavior Trajectories

	Picky-Eating Trajectory Membership, <i>n</i> (%)			<i>P</i>
	Low ( <i>N</i> = 92)	Medium ( <i>N</i> = 181)	High ( <i>N</i> = 44)	
CFQ restriction trajectory				.01
Low	11 (13.8) <sup>a,c</sup>	4 (2.6) <sup>b,c</sup>	2 (5.3) <sup>a,b,c</sup>	
Decreasing	39 (48.8) <sup>a,d</sup>	73 (47.0) <sup>a,c,d</sup>	14 (36.8) <sup>a,c</sup>	
High	30 (37.5) <sup>a,d</sup>	78 (50.3) <sup>a,d</sup>	22 (57.9) <sup>a,c</sup>	
CFQ pressure-to-eat trajectory				.21
Low	36 (44.4)	49 (31.6)	10 (26.3)	
Decreasing	34 (42.0)	75 (48.4)	22 (57.9)	
High	11 (13.6)	31 (20.0)	6 (15.8)	
CFSQ demandingness trajectory, decreasing				<.001
Low	20 (24.4) <sup>a,c</sup>	19 (11.6) <sup>a,b,c</sup>	2 (5.3) <sup>b,c</sup>	
Medium	53 (64.6) <sup>a,c</sup>	89 (54.3) <sup>a,c</sup>	18 (47.4) <sup>a,c</sup>	
High	9 (11.0) <sup>a,d</sup>	46 (28.0) <sup>b,c</sup>	18 (47.4) <sup>b,d</sup>	

Fisher's exact test was used for all comparisons. Superscripts a and b that differ from one another denote significant differences between low, medium, and high picky-eating trajectories proportionally represented by the row and/or column trajectory. Superscripts c and d that differ from one another denote significant differences between trajectories of each type in proportion represented by the column trajectory of picky eating.

picky eaters may be trying to shape their children's preferences for more palatable and calorie-dense foods and selective diets to be more healthful. Regarding pressure to eat, this study did not find any association with picky-eating trajectories. Previous longitudinal studies that used the picky-eating subscale of the CFQ have found greater pressure to eat to be associated with more picky eating among girls,<sup>28</sup> whereas others have found no association between maternal feeding behaviors and picky eating.<sup>11</sup> With regard to demandingness, overall pickier eaters had mothers with more demandingness, which decreased over time. Of note, the CFSQ demandingness scale includes items that map onto the general concept of pressure feeding. It may be that mothers of pickier eaters do engage in more pressuring behavior, yet this may not have been captured by the construct definition used by the CFQ. Despite overall decreasing of

maternal feeding behaviors, child picky eating was stable, which may indicate that maternal feeding behaviors may not have a strong influence on child picky eating. Trajectories of each of these maternal feeding behaviors and how they relate to picky eating trajectories is illustrated in Supplemental Fig 3. Given evidence that picky eating is not associated with micronutrient deficiencies,<sup>30</sup> coupled with our findings that child BMI<sub>z</sub> trajectories are stable in the healthy range, parents may be reassured that they can take a less controlling approach to child feeding. Alternatively, trajectories of both feeding behaviors and picky eating may be interpreted as bidirectional. It is unknown if children who are picky eaters would have become even more selective if they did not receive higher levels of controlling feeding behaviors. Future studies investigating interventions around maternal feeding and child picky eating will be important.

Although strengths of this study include the large longitudinal cohort of low-income participants with measured anthropometrics, results may not be applicable to other populations. Participants excluded from the sample because of missing data differed from those included in terms of baseline feeding behaviors, limiting generalizability. Child picky eating was measured by maternal questionnaire, which may be biased. Future work should examine the trajectories of observationally measured picky eating over time.

## CONCLUSIONS

Picky eating in early childhood was found to be stable over an ~4-year period and was established by age 4 years. Interventions to prevent or modify picky eating may need to start before the preschool years. High picky eating was associated with lower BMI<sub>z</sub>, and low picky eating was associated with higher BMI<sub>z</sub>. High picky eating was associated with higher restriction and demandingness. Future work examining effects of picky-eating interventions on children's weight gain and maternal feeding-behavior trajectories are needed.

## ABBREVIATIONS

BMI<sub>z</sub>: body mass index z score  
 CEBQ: Children's Eating Behaviour Questionnaire  
 CFQ: Child Feeding Questionnaire  
 CFSQ: Caregiver's Feeding Styles Questionnaire

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