



# Picky Eaters Improved Diet Quality in a Randomized Behavioral Intervention Trial in Youth with Type 1 Diabetes



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## ARTICLE INFORMATION

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## ABSTRACT

**Background** Children who are picky eaters typically demonstrate persistent food refusal and poor diet quality and may be resistant to intervention.

**Objective** This study tested whether pickiness moderated the effect of a nutrition intervention on diet quality in youth with type 1 diabetes, hypothesizing that the intervention effect would be smaller among picky relative to nonpicky eaters.

**Design** The study was an 18-month randomized clinical trial.

**Participants** Youth age 8.0 to 16.9 years (n=136) with type 1 diabetes duration  $\geq 1$  year, receiving care at an outpatient diabetes center in Boston, MA, and a parent, participated from 2010 to 2013.

**Intervention** The intervention integrated motivational interviewing, active learning, and applied problem solving to increase whole plant food intake.

**Main outcome measures** Whole plant food density (WPF, cup/oz equivalents per 1,000 kcal target food groups), Healthy Eating Index–2005 (HEI2005, measures conformance to US dietary guidelines), and dietary variety were calculated from 3-day food records completed at six different times. Parents completed the pickiness subscale of the Child Feeding Questionnaire.

**Statistical analyses performed** Mean WPF and HEI2005 were estimated using the population ratio method; standard errors were computed using jackknife variance-covariance estimation. Overall *P* value comparing groups across visits was derived using the  $\chi^2$  test.

**Results** Baseline diet quality was lower in picky than in nonpicky eaters. No intervention effect on pickiness or dietary variety was seen. In stratified analyses, the intervention effect on diet quality was significant for picky eaters only (WPF *P*=0.0003; HEI2005 *P*=0.04). Among picky eaters, diet quality in the treatment group improved, whereas diet quality in the control group remained low. Diet quality of nonpicky eaters in the intervention group changed to a lesser degree.

**Conclusions** The intervention resulted in increased diet quality in picky eaters, whereas no intervention effect was seen in nonpicky eaters. Findings suggest that diet quality of picky eaters can be improved without changing their underlying pickiness.

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**D**IET QUALITY AMONG YOUTH WITH TYPE 1 DIABETES is inconsistent with dietary guidelines, with inadequate intake of fruits, vegetables, and whole grains,<sup>1,2</sup> and excessive intake of total and saturated

fat and discretionary foods.<sup>2-4</sup> These diet patterns increase risk for numerous chronic diseases.<sup>5</sup> As part of standard care, youth with type 1 diabetes typically receive nutrition education addressing carbohydrate counting and guidelines for healthful eating.<sup>6,7</sup> Despite this, diet quality in type 1 diabetes patients appears to be no better than that of the general population of US youth,<sup>8</sup> suggesting the importance of understanding potential barriers to dietary change in this population.

Families of youth with type 1 diabetes report child pickiness, generally defined as eating a limited variety of foods while rejecting many foods (whether familiar or unfamiliar),<sup>9,10</sup> as a barrier to improving child diet quality.<sup>11</sup> Picky eaters may reject foods because of dislike of their taste or their texture.<sup>9</sup> They also tend to demonstrate less food

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enjoyment, more slowness in eating, and higher satiety responsiveness.<sup>9,12</sup> Pickiness is more common in preschool than school-age children<sup>9,13</sup>; hence, most research has been conducted in young children.<sup>9,10</sup> Children who are picky eaters typically demonstrate lower vegetable intake<sup>12,14-16</sup> and lower dietary diversity.<sup>17</sup> Research examining pickiness in older children and adolescents is scarce; one study reported an inverse association of pickiness with diet variety in youth aged 8 to 18 years with type 1 diabetes,<sup>18</sup> with mean pickiness scores similar to those reported in younger samples. One longitudinal study reported that food variety-seeking in preschoolers was predictive of such behaviors into adulthood.<sup>19</sup> Further research investigating the influence of pickiness on diet quality in older children and adolescents, and examining whether pickiness is an important barrier to dietary behavior change in this age group, is warranted.

The characteristics of picky eating—limited variety and food rejection—may represent an important barrier to efforts to improve diet quality. As such, picky eaters may be less likely to benefit from behavioral nutrition interventions designed for the general population. Although family-based educational programs designed specifically for parents of children with nonclinical feeding problems have been shown to reduce these feeding problems,<sup>20</sup> the impact of pickiness on the efficacy of general behavioral nutrition interventions has not been examined. The authors previously reported an improvement in diet quality among youth with type 1 diabetes participating in a behavioral nutrition intervention relative to controls.<sup>21</sup> The family-based intervention incorporated a motivational interviewing interaction style and an applied problem-solving process in which youth selected which healthful foods they wanted to consume. Such an approach may be useful for picky eaters by allowing choice and adapting to their preferences. The purpose of this secondary analysis was to test whether the intervention impacted pickiness, and whether pickiness modified the intervention effect on diet quality.

## MATERIALS AND METHODS

### Design

An 18-month randomized clinical trial of a behavioral nutrition intervention was conducted from August 2010 through May 2013 at an outpatient, freestanding, multidisciplinary tertiary diabetes center in Boston, MA.

### Participants

Participants were 136 youth–parent dyads meeting the following eligibility criteria: youth age 8.0 to 16.9 years, diagnosis of type 1 diabetes for 1 year or longer, daily insulin dose of at least 0.5 units per kilogram, most recent hemoglobin A1c (HbA1c) of at least 6.5% and 10.0% or less, intensive insulin therapy with either an insulin regimen of three or more injections daily or insulin pump, at least one clinic visit in the past year, and ability to communicate in English. Exclusion criteria included daily use of premixed insulin, transition to insulin pump therapy in the last 3 months, real-time continuous glucose monitoring use in the last 3 months, participation in another intervention study in the last 6 months, and presence of gastrointestinal disease such as celiac disease, multiple food allergies, use of medications that interfere significantly with glucose metabolism, or significant

## RESEARCH SNAPSHOT

**Research Question:** Does the effect of a behavioral nutrition intervention differ between picky and nonpicky eaters?

**Key Findings:** In this randomized clinical trial of 136 youth with type 1 diabetes, the intervention effect on diet quality was significant for picky eaters only in analyses stratified by baseline pickiness. Among picky eaters, diet quality in the treatment group improved, whereas diet quality in the control group remained low. Diet quality of nonpicky eaters in the intervention group changed to a lesser degree.

mental illness or neurodevelopmental condition. Sample size was based on detecting meaningful differences in dietary intake and glycemic control between intervention and control conditions, and has been reported in detail previously.<sup>21</sup>

### Procedures

Research staff recruited participants during regular clinic visits. Parents and youth turning 18 years of age during the trial provided written informed consent; all youth provided assent. Study procedures were approved by the institutional review board of the Eunice Kennedy Shriver National Institute of Child Health and Human Development. Randomization was conducted by the data coordinating center, using a permuted block randomization scheme, stratified by age (<13 years and ≥13 years), HbA1c (<8.5% and ≥8.5%), and insulin regimen (injection and insulin pump). Study visits and survey measures were completed in the clinic; diet records were completed after study visits.

### Intervention

Youth and parents in the intervention condition (described in greater detail elsewhere<sup>21</sup> and available on request from the lead author) participated in six core and three booster individual sessions targeting increased intake of whole plant foods, defined as whole fruits, vegetables, whole grains, legumes, nuts, and seeds. Sessions integrated a motivational interviewing style of interaction with youth and parents to increase internal motivation for healthful eating, active learning to facilitate skill-building and engagement with the educational information, and applied problem-solving (selecting goals, considering barriers, choosing strategies, and developing a specific action plan) to facilitate goal-directed behavior and self-regulation skills. An initial overview session addressed key principles of healthy eating, focusing on whole plant foods (whole fruit, vegetables, whole grains, legumes, nuts, and seeds). The next five sessions applied these principles to specific eating contexts—breakfast, lunch, dinner, snacks, and eating away from home. Three booster sessions addressed overcoming challenges associated with social eating, meal planning, and the food environment. Families in the control condition received equal frequency of research contacts, but no additional dietary advice beyond that provided as part of standard care.

### Measures

**Pickiness.** Parents reported youth pickiness at baseline and 6, 12, and 18 months, using the Pickiness subscale of the Child

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