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Children's Executive Function and High Calorie, Low Nutrient Food Intake: Mediating Effects of Child-Perceived Adult Fast Food Intake

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Abstract

Objective—This study tested the relationships among child executive function (EF), child-perceived parent fast food intake, and child self-reported subsequent consumption of high-calorie, low nutrient (HCLN) food.

Design—One year and 6-month longitudinal observation from larger randomized control trial

Setting—Southern California elementary schools

Subjects—Fourth and fifth grade children (n = 1,005) participating in the Pathways to Health obesity prevention program

Results—Child EF problems were associated with higher concurrent HCLN intake (B = 0.29, SE = 0.10, $p < 0.001$) and had a significant indirect effect through higher perceived frequency of parent fast food intake (*indirect effect* = 0.17, 95% CI = 0.11/0.25, $p < 0.001$). Longitudinally, child EF problems did not significantly predict higher HCLN intake a year and a half later (B = 0.01, SE = 0.10, p = 0.92, n = 848) but did have a significant indirect effect through higher perceived parent fast food intake (*indirect effect* = 0.05, 95% CI = 0.02/0.10, $p < 0.001$).

Conclusions—Children's EF difficulties may increase their perception of parent concurrent fast food intake, contributing to their own unhealthy food intake. However, EF problems may not directly affect HCLN intake across time, except when problems are associated with child perception of more frequent parent consumption of convenience foods. Future research is needed to investigate the possibility that helping children perceive and understand role models' convenience food consumption may improve child dietary consumption patterns.

Keywords

executive function; child obesity; social learning theory; high-calorie low-nutrient; snack foods

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In 2009–2010, the prevalence of pediatric obesity in the United States was 16.9% (Ogden, Carroll, Kit, & Flegal, 2012). Obese children are at higher risk for metabolic syndrome, cardiovascular risk, insulin resistance syndrome, Type 2 diabetes, depression, and social stigma (Arslanian, 2002; Goran & Gower, 1998; Heuer, McClure, & Puhl, 2011; Keddie, 2011; Steinberger & Daniels, 2003; Weiss et al., 2004). Excessive intake of high-calorie foods such as sugar-sweetened beverages and fast food can contribute to energy imbalance, increasing obesity risk (Anderson & Butcher, 2006). Parents may affect child diet via food availability, modeling eating behaviors, and purchasing fast food meals, although study results are mixed (Boutelle, Fulkerson, Neumark-Sztainer, Story, & French, 2007; Campbell, Crawford, & Ball, 2006; Hendrie, Sohonpal, Lange, & Golley, 2013).

Social Learning Theory provides a framework to understand potential effects of parent behavior on child diet. According to Social Learning Theory, important persons such as parents and teachers influence children through modeling behavior (Bandura, 1977). Children observe others' actions and rewards – observational learning – and may engage in those behaviors themselves (Bandura, 1977). Modeling could affect child intake of calorically-dense foods, or "high-calorie, low-nutrition/low-nutrient" (HCLN) foods (Bandini et al., 1999; Story, Sallis, & Orleans, 2009; Pentz, Spruijt-Metz, Chou, & Riggs, 2011). Supporting this interpretation, parents who model fruit and vegetable intake and regular physical activity typically have children with these diet and exercise patterns (Gross, Pollock, & Braun, 2010; Strauss, Rodzilsky, Burack, & Colin, 2001). In contrast, adult modeling of fast food consumption and provision of fast food meals is associated with child sugar-sweetened beverage consumption and obesity (Anderson, Rafferty, Lyon-Callo, Fussman, & Imes, 2011; Schroder, Fito, Covas, & Investigators, 2007; Lopez et al., 2012).

Child perception of modeled behavior is a crucial component of observational learning. Thus, cognitive factors that compromise accurate perception may alter what is learned. Executive Function (EF) is a set of psychological processes that could potentially influence the observational learning process. EF is the set of psychological processes that guide self-regulation, goal-oriented problem-solving, planning, and emotion regulation (Alvarez & Emory, 2006; Hongwanishkul, Happaney, Lee, & Zelazo, 2005; Zelazo, Carter, Reznick, & Frye, 1997). Key EF components include attention, working memory, and inhibitory processes (Alvarez & Emory, 2006). EF skills include "cool" skills, or cognitive, evaluative processes, and "hot" skills, or those relating to emotional regulation (Hongwanishkul, Happaney, Lee, & Zelazo, 2005).

However, EF difficulties could compromise observational learning and affect what children learn from modeled eating behavior. Children with EF difficulties may misperceive or misunderstand parents' *un*healthy behavior. EF difficulties could hinder children's ability to understand infrequently modeled behavior (such as an occasional fast food meal) as an "exception to the rule" rather than a new model to follow. While children across the EF range may find it difficult to understand parent fast food intake as undesirable, EF difficulties could intensify misunderstandings. If EF difficulties impair child perception and encoding of modeled behavior, their own eating behavior may become unhealthier.

In fact, one study shows that temporary, experimental impairment of EF leads to person perception that relies more on routinized processing than cognitive flexibility with real-time information (Macrae, Bodenhausen, Schloerscheidt, & Milne, 1999). Thus, children with EF difficulties could potentially process a parent's occasional fast food meal as a routine action and new rule to follow. Consequently, the perceived rule of acceptable fast food consumption would be expected to change children's own dietary behavior.

Indeed, recent research suggests that child EF is associated with patterns of food intake, physical activity, and other health behaviors. EF difficulties have been associated with obesity in both male and female adolescents, and high-calorie or fatty snack intake in children and adults (Cserjesi, Moinar, Luminet, & Lenardo, 2007; Hall, 2012; Lokken, Boeka, Austin, Gunstad, & Harmon, 2009; Mond, Stich, Hay, Kraemer, & Baune, 2007; Riggs et al., 2010a; Smith, Hay, Campbell, & Trollor, 2011; Verdejo-Garcia et al., 2010). In contrast, EF proficiency has been associated with greater fruit and vegetable consumption and physical activity in adolescents (*ex.*, Riggs, Mesirov, Shin, & Pentz, 2009).

Current Study

However, to our knowledge, no studies have examined the effect of EF on perceived parent dietary behavior and child consumption. This study tested whether child-perceived parent fast food intake mediated the relationship between child EF and child HCLN intake. We hypothesized that child-perceived parent fast food intake would mediate the relationship between child EF and HCLN, and we tested this hypothesis with (a) cross-sectional data and (b) data collected 1.5 years after the original assessment.

Method

Participants

Data came from students participating in the Pathways to Health (Pathways) school-based obesity prevention program, which is delivered by teachers and designed to improve executive function skills, healthy eating, and physical activity, by teaching affect regulation, impulse control, and decision-making skills (Riggs, Sakuma, & Pentz, 2007). Participants were students from 4th grade in 82 classrooms across 28 Southern California elementary schools (Riggs, Sakuma, & Pentz, 2007). Of the 1,587 participants at baseline, 1,005 had full active consent and were tracked over time. Schools were randomized to intervention and control conditions. The sample was 30% Caucasian, 29% Latino, 8% Asian, 3% African American, 15% Bi-racial, and 16% Other. About half (51%) were female, and 25% received free or reduced-price lunch at school. Data were collected at: (a) baseline, at the beginning of spring semester of 4th grade (Time 1; $M = 9.27$ years; $n = 1{,}005$), (b) the end of the 4th grade year, about 6 months later (Time 2; $M = 9.65$ years; $n = 998$), and (c) the end of 5th grade, about 1 year and 6 months after baseline (Time 3; $M = 10.70$ years; $n = 859$). Details of recruitment and retention are described in Riggs et al. (2012).

Measures

At each of the three time points, participants completed a 45-minute paper-and-pencil assessment in their classrooms, with trained administrators available to answer questions.

The survey contained the same measures across waves and was administered aloud. As with other school-based studies, (*e.g.*, Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999), the authors were constrained to one class period for administering the survey. Due to this constraint on survey length, the authors used abbreviated versions of scales, as described in Riggs, Chou, Spruijt-Metz, & Pentz, (2010) and Riggs, Spruijt-Metz, Sakuma, Chou, & Pentz (2010). Construction of abbreviated scales proceeded through extensive pilot testing where full scales of EF and food intake were reduced to index items representing the highest loading items for each scale (Riggs et al., 2010b). Prior research with these measures indicated acceptable reliability with this population that was comparable to full scales (Riggs et al., 2010a, 2010b). All procedures involving human subjects/patients were approved by [removed]. Parental written consent and child assent were obtained for all participants.

Executive Function—Items from four of eight clinical sub-scales of the Behavioral Rating Inventory of EF, Self-Report (Guy, Isquith, & Gioia, 2004) were included to assess EF. *Emotional control* is the ability to modulate behavior in the face of an emotional response (*e.g.*, "I yell, scream, or cry for no reason"). *Inhibitory control* refers to refraining from non-desirable behavior (*e.g.*, "I do things without thinking first"). *Working memory* is a mental "work bench", holding and manipulating components of a task while a solution is found (*e.g.*, "I forget what I'm doing in the middle of things"). *Organization of materials* is keeping spaces orderly and important materials accessible (*e.g.*, "My desk is a mess"). Item response choices were: *1 = Never, 2 = Sometimes, 3 = Often*. Previous pilot analysis using the four full BRIEF-SR scales on 4th grade students demonstrated acceptable internal consistency coefficients (emotional control (10 items) = .63, inhibitory control (13 items) = .78, working memory (12 items) = .78, organization of materials (7 items) = .66,) (Riggs, Sakuma, & Pentz, 2007). Research on the BRIEF-SR suggests convergent and discriminant validity with measures of inattention and general child behavior, and demonstrates ecological validity (*e.g.*, Child Behavior Checklist) (Gioia & Isquith, 2004; Gioia, Isquith, & Guy, 1998; Jarratt, Riccio, & Siekierski, 2005). Parent and teacher ratings on the BRIEF correspond to performance-based measures of EF (Toplak, Bucciarelli, Jain, & Tannock, 2009). Previous studies show that these abbreviated BRIEF scales demonstrate predictive validity when compared to full BRIEF-SR scales (Riggs et al., 2009). Internal consistencies were comparable to full scales: emotional control (6 items) $\alpha = .68$, inhibitory control (6 items) $\alpha = .74$, working memory (5 items) $\alpha = .71$, organization of materials (5 items) $\alpha = .63$,,. Subscales were significantly correlated with one another (ranging from $r = .45$ to $r = .49$, $ps < .0001$). Items were averaged to create subscales and, as with the full BRIEF-SR, scores from subscales were combined to create an overall EF score (Guy et al., 2004). The total EF score was the mean of the 4 subscales, and internal reliabilities were acceptable at each wave (T1 $\alpha = .81$, T2 $\alpha = .79$, T3 $\alpha = .77$).

Child HCLN intake—To assess child HCLN food intake, 5 items were taken from a validated open-source food frequency questionnaire (Willett, Sampson, Stampfer, Rosner, Bain, Witschi et al., 1985) that has been used successfully in previous studies (Nguyen-Michel, Unger, & Spruijt-Metz, 2007; Riggs et al. 2007, Riggs et al. 2009, Riggs et al. 2010a, Riggs et al., 2010b, Riggs et al., 2011). The items assessed consumption of French fries, chips, doughnuts, candy, and non-diet soda (*e.g.*, "How often do you eat corn chips, potato chips, popcorn, crackers?"). Response choices for snack food intake items were: *1 = Less than once a week; 2 = Once a week; 3 = 2–3 times a week, 4 = 4–6 times a week, 5 = Once a day, 6 = 2 or more of these a day.* Abbreviated food frequency questionnaires have been validated for 4th grade youth (Field et al., 1999). Internal reliability for snack food items was acceptable (T1 α = .80, T2 α = .79, T3 α = .81).

Child-perceived parent fast food intake—To assess child-perceived parent fast food consumption, one item was used from the Midwestern Prevention Project (MPP) (Pentz, Johnson, Dwyer, Mackinnon, Hansen, & Flay, 1989): "In a usual week, how many times a day do you see either of your parents (or other important adult) eating fast food or packaged snacks like cookies or chips?" Response choices for this item ranged from: *1 = 0 times a day, 2 = 1 time a day; 3 =2 or more times/day.* To our knowledge, this single item measure has not been validated against actual fast food consumption by adults. However, single-item measures have been found to be valid for other health indicators, such as overall health, in population studies and small pilots (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Rohrer, Herman, Merry, Naessens, & Houston, 2009).

Data analytic strategy

First, overall mean scores for child EF and self-reported HCLN intake were calculated. Second, attrition analysis was conducted to test differences between participants lost versus retained at follow-up. Third, intra-class correlation assessed the degree of clustering (children nested within classrooms) (Murray, Varnell, & Blitstein, 2004). Fourth, the direct effect of EF on HCLN and the indirect effect through perceived parent fast food intake were tested cross-sectionally and longitudinally. The SAS macro INDIRECT was used to estimate effects, which uses a bootstrapping method to calculate indirect effects and the underlying sampling distribution of the *ab* paths, rather than relying on assumed multivariate normality (Hayes, 2009; Preacher & Hayes, 2008). The INDIRECT macro provides a more accurate assessment of statistical significance of the indirect effect compared to traditional methods but does not account for clustering within schools. Therefore, results from the bootstrapping procedure were compared to those adjusted for clustered data using data mixed models (PROC MIXED) and the three-step mediation procedure outlined by Baron and Kenny (1986). The pattern of significance for the parameter estimates and *ab* paths was unchanged. Resampling was repeated 5,000 times, and unstandardized coefficients and standard errors are reported (Preacher & Hayes, 2008). Cross-sectional and longitudinal models were adjusted for gender, ethnicity, intervention group, and free/reduced lunch status. The longitudinal model also adjusted for baseline child HCLN. At Time 3, due to school closings and transitioning from elementary to middle school, 48 students changed group assignment and 146 were missing data on group. Therefore, intent-to-treat analysis was conducted: the group to which a student was originally assigned was used. Analysis was conducted using Statistical Analysis Software version 9.2 (SAS Institute, Cary, NC, USA).

Results

Table 1 shows descriptive statistics. Mean scores (see Table 1) and internal reliabilities (see Methods) were acceptable. At baseline, mean scores for child EF indicated overall proficiency, with children experiencing problems between “never” and “sometimes”, child self-reported HCLN food intake was between 1 and 3 times per week, and 51% of children reported perceiving that parents ate fast food or prepackaged foods about 1 time per day. As shown in Table 2, participants who did not complete measures at all time points were significantly more likely to receive free/reduced lunch and were less likely to be Caucasian than those who completed all waves. The intraclass correlation for the dependent variable, child HCLN intake at Time 3, was moderate (*ICC* = 0.07) and slightly larger than is typically observed in school-based studies (0.001 to 0.05; Stevens, Taber, Murray, & Ward, 2007).

Child EF Proficiency, Perceived Parent Fast Food Intake, and Child HCLN Intake

Table 3 shows cross-sectional results for each time point. The pattern across waves was relatively consistent. Child EF difficulties were associated with higher child HCLN consumption (*B*s range: 0.46 – 0.61, *p*s < 0.001), and there were significant indirect effects through higher perceived parent fast food intake (*AB*s range = 0.16 – 0.18; 95% CIs = 0.10–0.11/0.24–0.25). Thus, cross-sectionally, EF difficulties were associated with higher self-reported HCLN intake, mediated by perceiving more frequent parent fast food consumption.

Longitudinally, child EF difficulties did not have a direct effect on higher HCLN intake a year and a half later (B = 0.01, SE = 0.10, $t = 0.10$, p = 0.92, n = 848) (see Figure 1). However, greater EF difficulties did have a significant indirect effect through higher perceived parent fast food intake at Time 2 (AB path = 0.05; SE = 0.02, 95% CI = (0.02/0.10), $R^2 = 0.23$, $F(7, 840) = 36.23$, $p < 0.001$) suggesting that EF difficulties may increase children’s perception that parents consume fast foods more frequently over time (6 months), leading children to consume greater amounts of HCLN foods. Significant covariates were baseline child HCLN intake (B = 0.35, SE = 0.03, p < 0.001), free/reduced lunch status (B = 0.33, SE = 0.07, p < 0.001), and program group (Intervention vs. Control) (B = 0.15, SE = 0.06 p < 0.05). To explore differences by program group, the model was re-run for each group separately. There were no differences in significance values or coefficient magnitudes. The c and c′ paths were slightly larger in the Program group than the Control, but none significantly differed from zero (Program: *c* path = 0.09, *SE* = 0.13, $p = 0.52$; *c′* path = 0.04, *SE* = 0.13, $p = 0.78$; Control: *c* path = 0.04, *SE* = 0.13, $p = 0.76$; *c′* path = −0.01, *SE* = 0.13, $p = 0.94$). Indirect effects were similar for Program and Control: Program = 0.05, 95% CI = (0.01, 0.11), Control = 0.05, 95% CI = (0.01, 0.13).

Discussion

This study found that adolescents who have executive function difficulties report perceiving that parents consume convenience or snack foods more frequently, which was, in turn, positively associated with child consumption of high-calorie, low-nutrient foods. Similar to prior research, EF problems were associated with higher concurrent intake of high-calorie snack foods (Riggs et al., 2010a). The current study extends prior work by examining perceived parent behavior, according to a Social Learning Theory approach. Findings suggest that observational learning may affect child consumption of high-calorie snack foods, beyond the effects of gender, ethnicity, and SES. EF difficulties may compromise children's' ability to understand parents' occasional fast food consumption as an isolated event rather than a new model to follow. Several factors may shed light on these findings. First, EF proficiency may increase awareness of parents' expectations for healthy behavior and attempts to behave according to expectations. EF may raise awareness of parent rules (Vereecken, Legiest, De Bourdeaudhuij, & Maes, 2009). Second, EF proficiency could encourage children to attend to positive experiences when processing their surroundings, discounting potentially negative influences. During adolescence, prefrontal cortical development, associated with executive function, develops slower than the subcortex, which regulates appetitive behavior, partially explaining increases in risky behavior even when adolescents are aware of consequences (Somerville, Jones, & Casey, 2010). Similarly, adolescents with EF, prefrontal cortex, difficulties may experience heightened salience of highly palatable foods being consumed by role models, or may be more vulnerable to environmental stimuli such as food advertising (Moses & Baldwin, 2005). Third, EF could aid children in making personal decisions that align with long-term benefits, such as controlling impulsive eating. Finally, children with EF challenges may be difficult to manage during mealtimes, making fast food a quick, appealing option compared to quiet restaurants. Although the current results suggest that EF difficulties compromise perception of modeled behavior and potentially heighten obesity risk, further research is needed to untangle potential bi-directional relationships (Smith, Hay, Campbell, & Trollor, 2011).

Contrary to hypotheses, the current study did not find a direct, longitudinal effect of EF on HCLN consumption one and a half years later, although the mediated effect through perceived parent intake was significant. Potentially, the time between measures was too long. During this time, developmental changes in EF (Anderson, 2002), dietary intake patterns, or both could have occurred. Peers and media may also play a larger role in consumption patterns as children age, mitigating effects of parent behavior (Cullen, Baranowski, Rittenberry, & Olvera, 2000; Fitzgerald, Heary, Kelly, Nixon, & Shevlin, 2013).

Limitations

One limitation of this study is that EF and food intake were measured via self-report. Clinical differences may exist between the issues measured by the BRIEF versus performance measures (McAuley, Chen, Goos, Schachar, & Crosbie, 2010). In one study, task-based impulsivity but not self-reported impulsivity, was related to obesity (Verdejo-Garcia et al., 2010). Also, this study used a single-item measure of perceived parent fast food intake from previous research (Pentz et al., 1997). The measure has not been validated against multiple-item measures, such as multiple-item 24-hour dietary recalls (*ex.*, Paeratakul, Ferdinand, Champagne, Ryan, & Bray, 2003). However, other studies have used single-item measures of adolescent self-reported fast food intake (*ex.*, French, Story, Neumark-Sztainer, Fulkerson, & Hannan, 2001), and single-item measures have been found to be valid for other health indicators, such as overall health (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Rohrer, Herman, Merry, Naessens, & Houston, 2009). While this single-item measure has not been validated against actual parent diet to our knowledge, the study aimed to examine child perception – not actual parent intake – but effects of actual parent consumption remain unknown. However, future research could include measures of actual parent intake to investigate correspondence with child perceptions. Second, effects might have been stronger with a more comprehensive measure of dietary intake, although these abbreviated screeners have been used successfully in other studies (*ex.*, Riggs et al. 2009). Potentially, self-reported intake of these foods is related to EF differently than intake assessed by 24-hour, 3 day dietary recalls. Third, the follow-up sample was less likely to receive free/reduced lunch and more likely to be Caucasian, possibly limiting generalizability. Fourth, effects of child EF could have been caused by differences in child perception, encoding, or memory retrieval, and specific cognitive functions remain unknown.

Implications for Theory, Policy, and Practice

This study found that child EF was indirectly related to subsequent child HCLN intake through child-perceived parent fast food intake. Results suggest that EF could affect observational learning of dietary behaviors. Although additional intervention research is needed examining actual parent food intake, one potential implication is that child diet could be improved by helping children understand occasional role model unhealthy food consumption. Programs focused solely on changing parents' actual role modeling behavior may not address the issue of child perception and interpretation of modeled behavior. EF could operate less directly on children's health behaviors than previously thought. Rather, EF may affect cognitive processing of observed modeled behaviors, suggesting that research assuming a direct modeling effect might consider investigating interpreted modeling instead. Programs could also educate parents about potential effects of their behavior on child consumption patterns and on the importance of explaining occasional exceptions. Additionally, EF may affect children's interpretation of other observed modeled behaviors, such as those of peers or teachers, suggesting other avenues for future research and program design. Parent behavior plays an important role in child health. Parents provide healthy foods, engage in positive feeding practices, and can have supportive parenting styles. However, EF proficiency may allow children to benefit fully from role models' healthy behaviors and minimize effects of less healthy behaviors.

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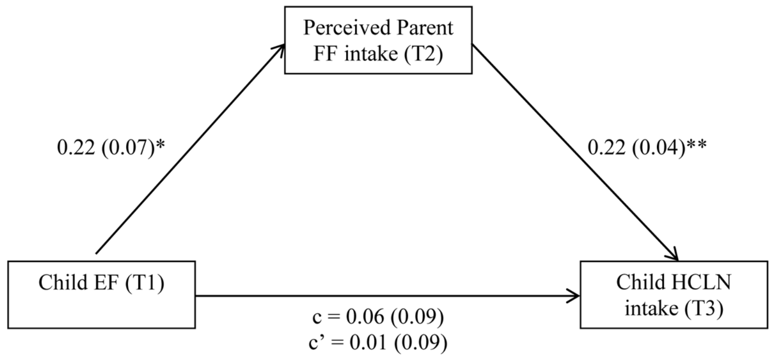

Figure 1. Longitudinal Direct and Indirect Effects of Child EF on Perceived Parent Fast Food Intake and HCLN intake

Indirect effect = 0.05, SE = 0.02, 95% CI = (0.02/0.10)

$R^2 = 0.23$; $F(7, 840) = 36.23$, $p < 0.001$

N = 848

* p < 0.01

** p < 0.001

Note: Covariates include child gender (male = 1, female = 0, B = 0.01, SE = 0.06, p = 0.90), Hispanic ethnicity (B = 0.06, SE = 0.07, p = 0.34), free/reduced lunch status (B = 0.33, SE = 0.07, p < 0.001), program group (B = 0.15, SE = 0.06 p < 0.05) and baseline child HCLN intake (B = 0.35, SE = 0.03, p < 0.001); unstandardized parameter estimates are reported with standard errors in parentheses; higher EF scores indicate more EF difficulties.

Table 1

Descriptive Statistics for Child EF, Perceived Parent Fast Food Intake, and Child HCLN across Three Waves of Data Collection

Variable	N or Freq.	M or %	SD	Min.	Max.
Executive Function					
T1	1005	1.67	0.33	1.00	2.82
T2	1005	1.69	0.33	1.00	2.86
T3	859	1.66	0.33	1.00	2.63
Child self-reported HCLN					
T1	1003	2.39	1.05	1.00	6.00
T2	993	2.31	0.96	1.00	6.00
T3	855	2.32	0.98	1.00	6.00
Child-perceived Parent Fast Food Intake					
T1					
0 times/day	268	26.75			
1 time/day	508	50.70			
2 or more times/day	226	22.55			
Missing	3				
T2					
0 times/day	254	25.48			
1 time/day	527	52.86			
2 or more times/day	216	21.66			
Missing	8				
T3					
0 times/day	233	27.25			
1 time/day	463	54.15			
2 or more times/day	159	18.60			
Missing	150				

Note: HCLN = High-calorie, Low-nutrition: *1 = Less than once a week; 2 = Once a week; 3 = 2–3 times a week, 4 = 4–6 times a week, 5 = Once a day, 6 = 2 or more of these a day;* Higher scores indicate EF proficiency

Table 2

Attrition Analysis for Baseline Values of Study Variables and Demographics

	Completed all waves (*n* = 848)	Did not complete all waves (*n* = 157)	Chi-Square or F test	p-value
Executive Function	1.66	1.71	2.79	0.10
HCLN	2.37	2.51	2.55	0.11
Perceived Parent FF				
0 times/day	27.12%	24.20%	1.60	0.66
1 time/day	50.59%	50.32%		
2 or more/day	22.05%	24.84%		
Missing	0.24%	0.64%		
Age	9.27 yrs	9.27 yrs.	0.04	0.84
Gender (male)	47.76%	49.04%	0.09	0.77
Free/reduced lunch	23.35%	33.76%	7.66	0.01 *
Caucasian	31.37%	20.38%	7.66	0.01 *

Note: HCLN = high-calorie, low-nutrition; FF = fast food

* $p < 0.05$

Table 3

Cross-sectional results for mediated relationship between EF and HCLN intake via perceived parent fast food intake at three time points

	n	C	SE C	C′	SE C′	A	SE A	B	SE B	AB	95% CI Lo.^	95% CI Up.^	R^2	*F*	*p*
Time 1	1000	0.46**	0.10	0.29**	0.10	0.36**	0.07	0.48**	0.04	0.17	0.11	0.25	0.17	33.57	< 0.001
Time 2	986	0.61**	0.09	0.44**	0.09	0.37**	0.07	0.47**	0.04	0.18	0.11	0.25	0.19	37.58	< 0.001
Time 3	851	0.55**	0.10	0.39**	0.09	0.36**	0.07	0.45**	0.05	0.16	0.10	0.24	0.18	30.09	< 0.001

* $p < 0.01$

** $p < 0.001$

^ bias corrected

Note: Covariates include child Hispanic ethnicity, gender, free/reduced lunch, and program group; C = the direct effect of the predictor variable on the outcome; C′ = the direct effect of the predictor on the outcome, adjusting for the mediator; A = the direct effect of the predictor on the mediator; B = the effect of the mediator on the outcome, adjusting for the predictor; AB = the indirect effect of the predictor on the outcome via the mediator; SE = standard error