Healthy Eating, Physical Activity, and Learning Behaviors

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Objectives: Associations between family nutrition and physical activity (FNPA) and elementary students' learning behaviors were examined. **Methods**: Parents (N = 85) of elementary-age students completed a survey about FNPA factors. Children's learning behavior scores, reported as Characteristics of Successful Learning (CSL), were transcribed from school performance reports. We used multiple linear regression to estimate associations between CSL and FNPA scores. Scores were calculated as FNPA-Nutrition, FNPA-Activity, and FNPA-Total. **Results**: CSL was positively and significantly associated with higher FNPA-Total (p = .02) and FNPA-Nutrition scores (p = .001). **Conclusions**: Children with more favorable family nutrition and activity factors displayed more positive learning behaviors. Schools and families can promote practices and policies that support behaviors associated with lower risk for overweight to enhance children's educational outcomes.

Approximately 17% of US youth aged 2-19 years are obese, a state defined as a body mass index (BMI) at or above the 95th percentile on the BMI-for-age growth charts.[1] Obese children are at increased risk for chronic physical, social, and psychological health problems,[2-4] and are more likely to become obese adults.[3] In addition to health consequences, childhood obesity has been associated with school performance.[5] Although the causal path remains unclear, several studies provide support for an inverse relationship between overweight status and academic achievement.[6-8] Other studies indicate that weight-related health behaviors, including physical activity and healthy eating habits, are positively associated with learning.[9-17] Together, these findings suggest that the establishment of healthy eating and activity practices at a young age may enhance child development related to both health and education. According to one published review,[18] the interrelationships among health behaviors, including nutrition and physical activity, and academic achievement may have long-term implications for youth, adults, and society.

An ecological perspective of human development considers the reciprocal determinants of human behavior.[19] Examination of the relationships among personal, organizational, and environmental levels is consistent with multiple theories of health behavior and learning.[20-22] For example, school and home environments are considered key behavioral settings that influence risk for childhood obesity.[23,24] Whereas emphasis has been placed on creating school environments that support student health and learning,[25,26] our review of the literature found no previous studies that have examined the relationship between the home nutrition and physical activity environment and school performance. Multiple studies[27-33] suggest that home contextual

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factors, such as food availability, family food rules, parental influences, and family meal patterns, are associated with children's eating behaviors. Likewise, support for and modeling of physical activity, adequate space for play, provision of physical activity equipment, and limiting access to screen time in home environments are associated with increased activity levels and decreased sedentary time among children.[34-36] A supportive home environment is central to the development of learning-related abilities that are important for success in school,[37,38] and for habitual healthy eating and physical activity.[12,35,39] Accordingly, the home environment can help or hinder the development of habits and skills that may influence the risk for obesity as well as academic achievement.

Healthy People 2020 specifies objectives for reducing obesity (Objective NWS-10) and increasing academic achievement (Objective AH-5) among youth populations.[40] Expanding the knowledge base on the connections among children's food, activity, and learning behaviors will inform efforts to promote environments that foster healthy, holistic child development. The aim of this study was to examine associations between elementary school students' learning-related behaviors and family nutrition and physical activity contextual factors previously associated with childhood risk for overweight.[33,41]

METHODS

Participants

Parents or caregivers of children attending kindergarten through 5th grade (K-5) in Corvallis, Oregon were eligible for participation in this cross-sectional study. In 2010, the population of Corvallis, a university town, was 54,462; 52% had a bachelor's degree or higher; 12% had a family income below the poverty level; and 84% were white.[42] In 2011-12, 85% of students in the Corvallis School District were white, 39% of students participated in the free and reduced-cost lunch program, and a total of 2,823 students were enrolled in one of 9 elementary schools in the district.[43] All elementary schools were invited to participate as recruitment sites for study participants. Three schools agreed to participate. In 2011-12, enrollment across the 3 participating schools totaled 941 students (413, 180, and 348, respectively).[43] School lunch participation rates were 18%, 23%, and 69%, respectively.

Instruments

Demographic characteristics. Sex, race/ethnicity, and socioeconomic status (SES) were selected as covariates because they have been identified as 3 primary socio-demographic factors associated with dietary intake during childhood and adolescence.[44] Multiple-choice items were used to measure student sex (male or female) and student race/ethnicity (Hispanic, Black/African American, Asian, Hawaiian or Pacific Islander, American Indian or Alaska Native, White, or Other). Proxy measures for student SES included highest education level of adult caregivers (never attended school or only attended kindergarten, grades 1-8, grades 9-11, grade 12 or GED, 1-3 years college, or 4 years or more college) and student eligibility for free or reduced-cost school meals (yes or no). Additional demographic covariates included student grade (K-5) and number of adult caregivers living in the home.

Family nutrition and physical activity factors. The Family Nutrition and Physical Activity (FNPA) screening tool is a previously validated instrument designed to assess evidence-based family environmental and behavioral factors that predispose young children to becoming overweight.[33,41] Ihmels et al[41] demonstrated internal consistency of the FNPA instrument (Cronbach's α = .72) and found that the FNPA score was significantly associated with increased risk for being at risk of overweight or overweight (>85th BMI-for-age percentile). Children with a total FNPA score in the lowest tertile (high family environmental and behavioral risk) had an odds ratio (OR) of 1.7 for being at risk of overweight or overweight compared to children with a score in the highest tertile (more favorable family environment and behaviors). Findings from another study showed that the FNPA explained unique variance in child BMI during a one-year period, after adjustment for baseline child BMI, parent BMI, and demographic variables.[33]

Briefly, the 20-item version of the instrument used in this study included 10 items for each of the 2 component areas: nutrition and physical activity. These 2 component areas each contained 5 domains, which were each comprised of 2 items. The domains and items in the nutrition component included: *family meal patterns* (My child eats breakfast + Our family eats meals together); *family eating habits* (Our family eats while watching

TV + Our family eats fast food); *food choices* (Our family uses microwave or ready to eat foods + My child eats fruits and vegetables at meals or snacks); *beverage choices* (My child drinks soda pop or sugar drinks + My child drinks low fat milk at meals or snacks); and *restriction and reward* (Our family monitors eating of chips, cookies, and candy + Our family uses candy as a reward for good behavior).

The domains and items in the physical activity component included: *screen time behavior and monitoring* (My child spends less than 2 hours on TV/games/computer per day + Our family limits the amount of TV our child watches); *healthy environment* (Our family allows our child to watch TV in their bedroom + Our family provides opportunities for physical activity); *family activity involvement* (Our family encourages our child to be active every day + Our family finds ways to be physically active together); *child's activity involvement* (My child does physical activity during his/her free time + My child is enrolled in sports or activities with a coach or leader); and *family routine* (Our family has a daily routine for our child's bedtime + My child gets 9 hours of sleep a night).

Item response categories were coded on a 4-point scale as "Almost Never" (1), "Sometimes" (2), "Usually" (3), and "Almost Always" (4). All items were coded such that higher scores indicated more favorable behaviors and environments. For example, a high score in the *restriction and reward* domain reflects a family who "almost always" monitors eating of chips, cookies, and candy and "almost never" uses candy as a reward for good behavior. Previous research suggests that a higher total FNPA score reflects more favorable family policies and practices, inferring lower risk for child overweight.[33] In our study, scores were averaged for each domain, each component, and total FNPA score (minimum score, 1; maximum score, 4).

Student learning behaviors. Learning behaviors were measured by classroom teacher observation and reported as "Characteristics of a Successful Learner" (CSL) on students' academic performance reports[45] using a 4-point scale: "Emergent" (1), "Developing" (2), "Proficient" (3), and "Exceeds" (4). These data were transcribed from performance reports by parent responders and entered into a replicate of the performance report developed for the present study. The CSL category represents observable learning-related qualities, accepted in the education domain as behaviors indicative of self-regulated learning and learning confidence,[22] and important determinants of academic success.[37,38] Table 1 provides a list of the CSL items included on students' performance reports by grade. The CSL are developmentally defined, which is reflected by different items observed for students in grades K-2 and 3-5. To compensate for this, and normalize the CSL variable for analysis, we computed an average score for each student (minimum score, 1; maximum score, 4). A higher CSL score indicated better performance of learning behaviors.

Procedure

Study participants were recruited by electronic invitation delivered via each school's email listserv during February 2013. Recruitment materials included a brief description of the study and a link to the online informed consent and survey instruments previously described. The expected number of families reached via the email dissemination was 544. The number of respondents who submitted the online, self-administered survey was 117 (22% response rate).

Data Analysis

A number of surveys (N = 32) lacked a critical amount of data and were not included in the analysis. Specifically, 31 participants did not report CSL scores and one did not indicate sex. A few surveys (N = 8) lacked an answer to one FNPA item; one survey had missing data on 2 FNPA items and one survey had 4 items missing. Because those 10 surveys contained a small amount of missing data, average FNPA scores were calculated for those individuals based on the number of items completed, which is equivalent to imputing the missing data by the mean of the reported FNPA items. A preliminary analysis indicated no significant differences in student sex, grade level, race/ethnicity, eligibility for free/reduced-cost school meals, parent education, or FNPA scores between participants with complete and incomplete surveys. Missing data were considered missing at random,[46] and as a result, we conducted a full information maximum likelihood analysis. The final sample size was 85. A *post hoc* power analysis, based on a sample size of N = 85, α = .05, and 80% power, revealed that

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Table 1
Characteristics of a Successful Learner (CSL),[a] as Indicated on the Elementary School Student Performance Report

Grades K-2

SAFE: Keeps hands and feet to self

SAFE: Carefully uses materials

SAFE: Makes appropriate choices

RESPECTFUL: Shows respect for classmates, adults and property

RESPECTFUL: Works and interacts well with others

RESPECTFUL: Respects the personal space of others

RESPONSIBLE: Focuses and listens attentively

RESPONSIBLE: Follows directions

RESPONSIBLE: Completes work in a reasonable amount of time

RESPONSIBLE: Takes responsibility for picking up after him/herself

RESPONSIBLE: Functions independently

SOCIAL EMOTIONAL GROWTH: Establishes friendship

SOCIAL EMOTIONAL GROWTH: Accepts correction or redirection

SOCIAL EMOTIONAL GROWTH: Verbalizes feelings appropriately

Grades 3-5

SAFE: Makes appropriate choices in structured/unstructured situations

RESPECTFUL: Demonstrates respect for self, others, rules, authority, and property

RESPONSIBLE: Accepts responsibility for own actions and behaviors

ATTENTIVE: Listens well and follows directions

COOPERATIVE: Sensitive to the feelings of others; gets along well with and supports others

ORGANIZATION: Manages self and belongings; has necessary supplies; prepared to work

PARTICIPATION: Voluntarily contributes to class and small group discussions

PERSISTENT: Stays with a task, continuing despite problems

QUESTIONING: Asks thoughtful questions and responds to questions appropriately

RESOURCEFUL: Uses and applies available technology

RESOURCEFUL: Recognizes and resolves problems, seeks help appropriately

REFLECTIVE: Thinks problems through, gives reasons for opinions, self-evaluates

WORK ETHIC: (daily work) Demonstrates independent work habits to complete duties and quality assignments in a timely manner

WORK ETHIC: (homework) Demonstrates independent work habits to complete duties and quality assignments in a timely manner

Note.

a   **The 14 CSL items were reported on a 4-pt scale by classroom teachers (1, emergent; 2, developing; 3, proficient; 4, exceeds).**

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this study was able to detect an increase in R^2 of 0.07 or higher when a single primary predictor variable (eg, FNPA) was added to the reduced model. For multiple linear regression with CSL as the dependent variable, the reduced model in Table 3 (independent variables: school, grade, sex, race/ethnicity, eligibility for free or reduced school meals, and parent education) had $R^2 = 0.19$. Five of the 6 models reported in Table 3 contain a primary predictor variable that, when added to the reduced model, yields an increase in R^2 ranging from 0.07 to 0.12. The other model (restriction and reward as the primary predictor variable; model 4) had a slightly smaller increase in R^2 of 0.06. Therefore,

Table 2
Spearman Correlations among Student CSL[a] and FNPA[b] Scores (N = 85)

	FNPA[b]	FNPA-Nutrition[c]	FNPA-Activity[d]	FamMeal[e]	EatHab[f]	FoodChoice[g]	BevChoice[h]	RestRew[i]
CSL	.279*	.292**	.182	.003	.247*	.064	.233*	.228*
FNPA-Total	–	.811***	.893***	.219*	.323**	.575***	.459***	.504***
FNPA-Nutrition	–	–	.500***	.366***	.420***	.643***	.639***	.496***
FNPA-Activity	–	–	–	.080	.179	.385***	.225*	.379***
FamMeal	–	–	–	–	-.0403	.258*	.008	-.075
EatHab	–	–	–	–	–	.083	.136	.001
FoodChoice	–	–	–	–	–	–	.182	.218*
BevChoice	–	–	–	–	–	–	–	.198

*p < .05; **p < .01; ***p < .001

Note.
a   CSL=Characteristics of a Successful Learner; average of 14 items coded on 4-pt scale (1, emergent; 2, developing; 3, proficient; 4, exceeds)
b   FNPA-Total=Family Nutrition and Physical Activity; average of 20 items coded on 4-pt scale (1, almost never; 2, sometimes; 3, usually; 4, almost always)
c   FNPA-Nutrition=Nutrition component; average of 10 FNPA nutrition items
d   FNPA-Activity=Physical Activity component; average of 10 FNPA physical activity items
e   FamMeal=Family meals; average of 2 items: My child eats breakfast + Our family eats meals together
f   EatHab=Family eating habits; average of 2 items: Our family eats while watching TV + Our family eats fast food (both items reverse coded)
g   FoodChoice=Food choices; average of 2 items: Our family uses microwave or ready to eat foods (reverse coded) + My child eats fruits and vegetables at meals or snacks
h   BevChoice=Beverage choices; average of 2 items: My child drinks soda pop or sugar drinks (reverse coded) + My child drinks low fat milk at meals or snacks
i   RestRew=Restriction and reward; average of 2 items: Our family monitors eating of chips, cookies, and candy + Our family uses candy as a reward for good behavior (reverse coded)

there was sufficient power to detect a moderate to strong bivariate correlation between the primary study variables (CSL and FNPA). Power analysis was performed using Stata (version 12.1, 2011, StataCorp) and PASS 2005.

Descriptive statistics were used to summarize differences in demographics, mean FNPA scores, and mean CSL scores. Fisher's exact test was used to examine demographic differences between respondents from different schools. Independent t-tests were used to examine differences in FNPA and CSL by sex and school meals eligibility. Analysis of variance was used to test for differences in FNPA and CSL scores by school, grade level, race/ethnicity, and parent education. The Tukey-Kramer method was used for pairwise comparisons. Spearman's rank-order correlations were used to measure the strength of the unadjusted correlations between CSL and FNPA scores. For all significant correlations, separate multiple linear regression models were used to examine CSL-FNPA associations adjusted for demographic covariates. Student race/ethnicity and parent education were analyzed as dichotomous variables (ie, white or non-white and greater or less than 4 years of college, respectively). All 2-way interactions between FNPA scores and covariates were also examined. Likelihood ratio tests were used to compare models. Residual plots and normality tests for the residuals assessed model assumptions and goodness of fit. Statistical significance was set at α = .05. Data analyses were performed using Stata (version 12.1., 2011, StataCorp).

RESULTS

The final sample (N = 85) included parents of students from all 3 participating schools (N = 47, 13, and 25, respectively). The students were 49% female, predominantly white (85%), with a mean (SD) grade in school of 2.28 (1.66). About 14% of students were eligible for free or reduced-cost

Table 3
Multiple Linear Regression Analyses Examining Associations between Components of the FNPA[a] and CSL[b] in a Sample of Elementary School Students (N = 85)

Predictor Variable	β Coef	SE	p	95% CI	R²
FNPA-Total[a]	.54	.22	.02	(.10, .97)	.26
FNPA-Nutrition[c]	.74	.21	.001	(.31, 1.16)	.31
Family Eating Habits[d]	.32	.12	.01	(.08, .56)	.27
Restriction and Reward[e]	.27	.11	.02	(.05, .49)	.25
Fast Food[f]	.26	.10	.01	(.06, .46)	.26
Sweetened Beverages[g]	.37	.11	.002	(.14, .59)	.30

Note.
Each row presents the primary predictor results from separate multiple linear regression analyses where CSL is the outcome variable, adjusted for school, grade, sex, race/ethnicity, eligibility for free or reduced-cost school meals, and parent education.
The coefficients reflect the estimated increase in average CSL score for each 1-point increase in average primary predictor score.
a   FNPA-Total=Family Nutrition and Physical Activity; average of 20 items coded on 4-pt scale (1, almost never; 2, sometimes; 3, usually; 4, almost always)
b   CSL=Characteristics of a Successful Learner; average of 14 items coded on 4-pt scale (1, emergent; 2, developing; 3, proficient; 4, exceeds)
c   FNPA-Nutrition=Nutrition component; average of 10 FNPA nutrition items
d   Family Eating Habits=average of 2 items: Our family eats while watching TV + Our family eats fast food (both items reverse coded)
e   Restriction and Reward=average of 2 items: Our family monitors eating of chips, cookies, and candy + Our family uses candy as a reward for good behavior (reverse coded)
f   Fast Food=single FNPA item: Our family eats fast food (reverse coded)
g   Sweetened Beverages=single FNPA item: My child drinks soda pop or sugar drinks (reverse coded)

school meals. A high percentage of parents (86%) reported 4 or more years of college education. Mean FNPA-Total score was 3.45 (0.28) and mean CSL score was 2.87 (0.54). Analyses of demographic variables revealed that mean FNPA-Total score was negatively correlated with student eligibility for free or reduced-cost school meals (r_s = -.240; p = .027).

As Table 2 shows, family nutrition and physical activity factors were positively correlated with CSL scores. Specifically, the following elements of the FNPA score were significantly correlated with higher CSL scores: average FNPA-Total score, average FNPA-Nutrition score, and average family eating habits, beverage choices, and restriction and reward domain scores. Additionally, 2 individual FNPA items were significantly correlated with higher CSL scores: families who eat fast food less often (r_s = .257; p = .017) and children who drink soda or sugar drinks less often (r_s = .218; p = .045) (data not shown). No significant correlations between CSL and FNPA-Activity component, do-

main, or item scores were observed.

Multiple linear regression analyses showed that 6 elements of the FNPA score were independently associated with higher CSL scores (Table 3). For example, a higher, more favorable average FNPA-Total score was associated with a higher average CSL score, after adjusting for demographic covariates. Similarly, the results revealed that higher scores on the following elements of the FNPA were significantly associated with higher CSL scores: (1) the FNPA-Nutrition component (all FNPA nutrition items, combined); (2) the family eating habits domain (less eating while watching TV and less fast food consumption); and (3) the restriction and reward domain (family monitors junk food consumption and limits use of candy as a reward). Furthermore, children whose families eat fast food less often had higher CSL scores, as did children who drink sugar-sweetened beverages less often.

DISCUSSION
This study offers a unique contribution to the

literature through novel use of the FNPA instrument[41] to examine associations between a collection of family-level obesity risk factors and academic development in elementary school students. The findings indicate that students whose parents reported more favorable family nutrition and physical activity factors displayed greater development of learning-related behaviors. This is consistent with social cognitive conceptions of self-regulated learning that acknowledge the reciprocal causality among personal, behavioral, and environmental triadic influences.[22] Previous studies on the associations between obesity, nutrition, and academic achievement have centered on individual dietary behaviors (eg, soda consumption) and school-level environmental factors (eg, participation in school breakfast programs).[9,10,13,25,47-49] Although much attention has been directed toward improving school environments to better support the health and learning connection,[25,26] this study provides support for additional focus on the importance of the home environment.

Consistent with previous findings,[9-15,47-49] we found specific dietary behaviors that were associated with school performance. Edwards et al[13] found that drinking fewer sugar-sweetened beverages was positively associated with math and reading scores. Findings from other studies have indicated that increased frequency of eating fast food is negatively associated with math and reading achievement.[48,49] Likewise, the present study identified that those children who consumed sugar-sweetened beverages less often, as well as those children with families who ate fast food less often, had more favorable learning behavior scores. Additionally, 4 other FNPA variables were associated with more favorable learning behaviors: FNPA-Total and FNPA-Nutrition component scores, and family eating habits and restriction and reward domain scores. These findings support the premise that the connection between the personal, behavioral, and environmental influences on health and learning may be complex, involving a host of family practices and policies rather than 1 or 2 targeted behaviors.

We found no associations among family physical activity-related factors and learner behaviors despite the positive, longitudinal relationships between physical activity and academic performance emerging in the literature.[16,50] Some data suggest that among young children and adolescents, more moderate-to-vigorous physical activity (MVPA) shows the strongest association with self-regulated behaviors and/or academic performance.[17,50] Most of the family physical activity policies and practices measured by the FNPA-Activity items reflect external regulation of activity (ie, parent promoted, coached) and sedentary (ie, screen time, bedtime) behavior. It would be useful to identify aspects of the home and school settings that promote self-regulated MVPA and evaluate the association of these factors with learning behaviors.

This study demonstrates an association between the family nutrition environment and successful learning behaviors though other factors are likely involved in this relationship. Previous research has identified several family-level factors associated with healthy weight behaviors and academic achievement in children, including parenting style,[51,52] self-esteem,[11,53] and food security.[54,55] In the present study, a significant, negative correlation was found between eligibility for free or reduced-cost school meals and FNPA score. School meals eligibility was also negatively correlated with CSL, although the relationship was not statistically significant. It is important to note, however, that the study participants represented high SES families, as evidenced by low eligibility for free or reduced-cost school meals and high parent education levels, limiting the ability to analyze the influence of SES. Future investigations of the nutrition and learning connection should consider examination of the interplay between school-level conditions, such as participation in school meal programs, and family-level factors such as parenting style and food security status.

Limitations

A limitation of this study was the cross-sectional design that did not allow for examination of temporal relationships or causal inference. The small, homogenous sample limits generalizability of the findings; however, homogeneity promotes reduced variability for more precise statistical inference. The schools that participated as recruitment sites for our study included 2 schools with school lunch participation rates below the district average and one school with the second highest participation rate in the district. The electronic survey format, which required email and Internet access, may have

limited the number of schools and families willing to participate in this study. The parent respondents represented a higher percentage of adults with more than 4 years of college education compared to the Corvallis population, and the number of participants who reported eligibility for free and reduced-cost school meals was lower than the Corvallis School District average; however, participant race/ethnicity was representative of the district and the larger population of families residing in Corvallis, Oregon.[42,43] Therefore, the study findings may be limited to white, relatively high SES families; families that may have greater resources to support their children with healthy eating and physical activity opportunities as well as learning outcomes. Approximately 30% of participants completed the FNPA section of the survey but did not complete the CSL section, which required parents to report information from the student's academic performance report. Some parents may have found the latter section of the survey inconvenient or inaccessible. Although our survey link was emailed to participants during the same month that the academic performance reports were postal mailed by the school district, it is possible that some parents may not have had access to the performance report when they received our survey. If the performance report was not accessible at the time when a parent attempted to respond to the survey, the parent would have been unable to complete the CSL component of the survey. However, the missing at random data analysis employed herein revealed that survey completers were not significantly different from non-completers based on the other study variables. Another limitation is the parent-reported data, which may reflect social desirability bias. Despite these limitations, this is the first study to examine the relationship between the family environment and school performance in the context of obesity prevention, providing direction for future research in this area.

Conclusions

Our findings provide evidence of positive associations between family nutrition and physical activity factors and successful learning behaviors in elementary-age students. Home environments, practices, and policies that promote healthy eating and activity behaviors may improve children's

learning outcomes, in addition to decreasing obesity and chronic disease risk.

IMPLICATIONS FOR HEALTH BEHAVIOR OR POLICY

School health interventions targeting elementary-age children would be well served to consider linking home-based interventions together with school-based policies and programs that promote healthy eating, physical activity, and learning behaviors. The Healthy, Hunger-Free Kids Act of 2010 expands upon the 2004 Child Nutrition and Special Supplemental Nutrition Program for Women, Infants and Children (WIC) Reauthorization Act that required all local educational agencies participating in the National School Lunch Program to create local school wellness policies by 2006.[56] Initially, school wellness policies were required to include goals for nutrition education, physical activity, and other school-based activities to promote student wellness, as well as nutrition guidelines for all foods available on school grounds. Additionally, school wellness committees were required to include broad representation from school stakeholders, including parents, students, school food authority representatives, the school board, school administrators, and the public in the development of the wellness policy. The 2010 Act expands upon the 2004 Act by requiring schools to include goals for nutrition promotion and to include physical education teachers and school health professionals in wellness policy development. Furthermore, schools are required to inform and update parents, students, and community members about the content of the wellness policy and to measure and communicate to the public an assessment of wellness policy implementation. As schools implement the federal wellness policy requirements, wellness committees may capitalize on the opportunity to communicate school nutrition and physical activity policies, programs, and practices with students and families. School leaders can encourage parent involvement in the development, assessment, and communication of school wellness efforts. School health professionals and teachers can use the findings from this study together with other evidence[57] to communicate with families about the connection between health and learning. Moreover, schools can serve as role model

environments to support parents and students in making improvements in their home nutrition and physical activity environments to further promote health and academic success. Providing consistent support across school and home environments will assist efforts to make the healthy choice the default choice for children and families.

Our findings also demonstrate the potential utility of the FNPA screening tool as an instrument that may be useful for both researchers and practitioners to assess and promote family-level health behaviors for benefits beyond obesity prevention. Further exploration of the association between the FNPA and school performance with larger and more diverse samples is warranted. Additionally, more research is necessary to examine causal relationships between nutrition, physical activity, and academic achievement. Advancing the evidence base around the concept that healthy kids learn better will strengthen support for efforts to improve both home and school environments in order to promote health and education jointly.

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Human Subjects Approval Statement

The Oregon State University Institutional Review Board approved all protocol and procedures prior to initiation of this study.

Conflict of Interest Declaration

The authors of this paper report no conflicts of interest

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