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Research Article

Associations of Household Food Insecurity With Academic Outcomes in Early Adolescents

Catheryn A. Orihuela, PhD[a] Callista Cox, BA[b] Retta Evans, PhD, MCHCS[c] Sylvie Mrug, PhD[d]

ABSTRACT

BACKGROUND: Food insecurity is characterized by limited access to adequate food due to a lack of money or resources (eg, lack of transportation to obtain food). School aged children who are experiencing food insecurity are at greater risk for poor academic outcomes, but previous studies have not examined the effects of food insecurity on specific academic outcomes over time.

METHOD: This study examined food insecurity as a risk factor for subsequent academic skills, enablers, and achievement. As part of a larger longitudinal study, middle school students (N = 112; $mean_{age}$ = 12.14, SD = 0.41; 50% female; 68% black/African American, 14% white, 13% Hispanic or Latino, 5% other) reported on food insecurity at baseline, while teachers reported on students' academic skills and enablers at both baseline and 12 months later at 1 year follow up. Math and English/Language Arts grades were obtained from the schools at each wave.

FINDINGS: Food insecurity predicted lower academic skills over time but was unrelated to academic enablers and grades.

IMPLICATIONS: Considering a whole school, whole community, whole child (WSCC) framework, this study will also discuss the important role schools and communities have in reducing food insecurity in middle school students.

CONCLUSIONS: These results support negative long-term effects of food insecurity on academic skills in early adolescents.

Keywords: Food insecurity; academic performance; adolescents; middle/junior high school.

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Adolescence is a period marked by dynamic changes in cognitive development, physical and hormonal changes related to puberty, and emotional fluctuations, which in combination can be difficult for children.[1] Along with these challenges, approximately 6 million teens in the United States live with food insecurity.[2] The US Department of Agriculture describes food insecurity as limited access to adequate food due to a lack of money or resources.[3] In 2020, 10.5% of households in the United States reported food insecurity at some point during the year, some of those likely due to economic hardship on account of the COVID-19 pandemic. Among households with children, the prevalence of food insecurity increased from 13.6% in 2019 to 14.8% in 2020. Households at greater risk for experiencing food insecurity include those in metropolitan areas, single parent households, racial/ethnic minorities and those that live in the Southern United States.[4] Although food insecurity is a component of poverty, it is not defined by household income alone and can be categorized by insecurity in the variety, quality, or social acceptability of available

[a]Scientist, (catheryn@uab.edu), University of Alabama at Birmingham, 1720 University Blvd, Birmingham, AL, 35294.
[b]Research Associate, (coxcal@uab.edu, callistacox@sandiegoed.edu), University of Alabama at Birmingham, 1720 University Blvd, Birmingham, AL, 35294.
[c]Professor, (rrevans@uab.edu), University of Alabama at Birmingham, 1150 10th Avenue South, Birmingham, AL, 35294.
[d]University Professor, (sylva@uab.edu), University of Alabama at Birmingham, 1720 University Blvd, Birmingham, AL, 35294.

Address correspondence to: Catheryn A. Orihuela, Scientist, (catheryn@uab.edu), University of Alabama at Birmingham, 1720 University Blvd, Birmingham, AL 35294.

Present address: Callista Cox, University of San Diego, 5998 Alcala Park, San Diego, CA 92110.

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food.[5,6] For example, individuals experiencing food insecurity may be limited in what foods they can afford. Thus, their options may be limited to foods that they can buy in small quantities, such as having a snack food (eg, candy, potato chips, cookies) for an entire meal. Although families in poverty are more likely to be food insecure, youth in higher income households can also experience food insecurity if there is inconsistent income or a change in the composition of the household.[7] In sum, food insecurity has a negative impact on many children across the United States. This study focuses on the prospective association of food insecurity with academic skills, enablers, and performance in middle school students.

Adolescents living in households with food insecurity may suffer from negative outcomes including poorer mental health,[8,9] nutrient deficiencies,[10] behavioral problems,[8] lack of preventive care,[11-13] and higher rates of chronic conditions such as diabetes and asthma.[14] Food insecurity is also associated with higher intake of processed sugar, which is a key contributor to the development of dental caries.[11,15] A consistent diet of nutrient dense foods is essential to the developing brain for adequate learning to occur, however, children in food insecure homes may have difficulty accessing nutritious, balanced meals.[16] Indeed, evidence suggests that diets high in trans fats impair learning and memory,[17] whereas nutritional deficiencies can decrease brain function and energy levels.[18]

Although substantial literature documents the negative impact of food insecurity on physical and psychological health in adolescents, relationships between food insecurity and academic outcomes is less clear. Research in elementary-aged children suggests food insecurity can have a deleterious effect on academic achievement. For example, children who are experiencing food insecurity are at risk for not meeting expectations on standardized exams and having lower cognitive function.[19,20] One study found that children experiencing food insufficiency had decreased scores in math and reading and were more likely to repeat a grade.[21] Among older adolescents and college students, greater food insecurity was also linked to lower grades.[22,23] A recent study of over 13,000 college students found that almost half experienced food insecurity; food insecurity doubled the odds of having GPA in the lowest 10% GPA and tripled the odds of not having GPA in the top 10%.[24] Although research clearly documents associations between food insecurity and poorer academic outcomes, most studies used cross-sectional designs that cannot support directional interpretations of the results. Furthermore, few studies examine middle school students who experience the co-occurrence of fundamental physical, cognitive, emotional, and social changes that renders them more vulnerable to negative influences.

Prior research on food insecurity and academic outcomes has focused exclusively on academic achievement, typically assessed with grades and test scores. However, these measures do not encompass key precursors to learning and academic success, such as academic skills and academic enablers.[25,26] Academic skills, including problem solving, critical thinking and vocabulary competence, are strongly related to performance in language-based subjects such as math, reading, and science.[27,28] Further, nonacademic skills, such as engagement, motivation, and interpersonal skills, also help to support academic success, and are collectively referred to as academic enablers because they facilitate students' participation and enable learning in academic settings.[27] For example, effective study skills make learning more successful[29] whereas motivation is important for students' regulation and determination.[30] Similarly, active participation and positive interactions with school staff and peers in the classroom are facilitated by high levels of engagement and interpersonal skills.[31] Due to the negative impact of food insecurity on cognitive, emotional, and behavioral functioning,[7,8] it is plausible that food insecurity also decreases academic skills and enablers,[32] with downstream effects on students' academic performance.

Current study

This study extends prior research on food insecurity and academic outcomes by examining the prospective relationships between food insecurity and subsequent academic outcomes among middle school students. To provide a more comprehensive examination of the role of food insecurity (independent variable) in academic functioning, studied academic outcomes (dependent variables) include academic achievement (grades), academic skills (competence in math, reading, and critical thinking) and academic enablers (engagement, motivation, interpersonal skills, and study skills). It is expected that food insecurity will contribute to lower grades, lower academic skills, and lower academic enablers among middle school students over time.

METHOD

Procedure

The current study utilizes data from the Adolescent Diet Study, a longitudinal study examining diet, emotional functioning, and academic performance in middle school students. The sampled population were general education students in the first year of middle school (sixth or seventh grade) in the Birmingham, AL metropolitan area. Based on power analyses for primary project aims, the study aimed to recruit 15 schools and 20 students per school. As planned, 15 schools were recruited to represent socioeconomic,

racial/ethnic, and urban-rural diversity of the sampled region. A total of 288 students were recruited at baseline, of whom 69% were retained at 1 year follow up.

At baseline, study staff randomly contacted all public middle schools (N = 39) across 6 area school districts. Fifteen schools responded to an invitation to participate. Students were recruited from 1 or 2 sixth grade classrooms chosen by the principal in each participating school between January 2019 and December 2019. All children who spoke English and could complete study activities were invited to participate. Trained project staff presented information about the study to the students and distributed packets containing information about the study and consent forms. Signed parent consent and student assent forms were collected at school approximately 1 week later (45% participation rate) and a study visit was scheduled. All child data collection activities occurred at school during a regular week. Students completed study questionnaires in small groups on study-provided electronic tablets during a nonacademic class period in a quiet classroom setting. Staff monitored the students and were available to answer questions or provide clarification. For each student, 1 primary caregiver and 2 academic core teachers (eg, from math, science, social studies, reading) per child completed confidential questionnaires online; paper copies were also available.

The same procedures were used at the 1 year follow up, which began 12 months later. However, in March 2020, the COVID-19 pandemic led to school closures that lasted into the next academic year. Because of inconsistencies in school reopenings and severe restrictions on school visitors including research staff, data collection transitioned to home- and lab-based protocols in September 2020 for the remainder of the follow up. Due to remote learning and the project's inability to conduct school-based assessments, teacher reports could not be collected for students who participated after March 2020 in the 1 year follow up during the COVID-19 pandemic. For baseline and 1 year follow up, children, parents, and teachers (before COVID-19) were compensated with gift cards. University Institutional Review Board approved all study procedures.

Participants

The current study utilizes a subsample of students from baseline that returned for the 1 year follow up assessment and before the onset of the COVID-19 pandemic. Participants included 112 adolescents ($mean_{age}$ = 12.14 years, SD = 0.41; 50% female; 68% black/African American, 14% white, 13% Hispanic/Latino, 5% other) across classrooms in 6 schools in Birmingham, AL, and surrounding areas (Table 1).

Table 1. **Sample Demographics**

Demographic Variable	Baseline (N = 112) N (%)	One Year Follow Up (N = 92) N (%)
Child sex		
Male	56 (50)	47 (51)
Female	56 (50)	45 (49)
Race/ethnicity		
White	16 (14)	16 (17)
Black/African American	76 (68)	60 (65)
Hispanic or Latino	14 (13)	12 (13)
Other	5 (4)	4 (5)
Missing	1 (1)	0 (0)
Parent education		
<12th grade, no diploma	14 (12)	11 (12)
High school graduate/GED	20 (18)	16 (18)
Some college no degree	27 (24)	24 (26)
Technical school/associate degree	19 (17)	16 (17)
Bachelor's degree	20 (18)	19 (21)
Graduate or professional degree	4 (4)	1 (1)
Missing	8 (7)	5 (5)
Household income per year (median)	$40,000-50,000	$40,000-50,000

This study also includes reports from the students' parents (N = 104; $mean_{age}$ = 38.59 years, SD = 6.89; 72% female; 68% black/African American, 17% white, 10% Hispanic/Latino, 5% other) and teachers (N = 18; $mean_{age}$ = 38.22 years, SD = 9.97; 89% female; 56% black/African American, 44% white).

Instrumentation

Academic competency and evaluation scales. At baseline and 1 year follow up, 2 academic core teachers completed the 32-item short form[33] of the Academic Competency and Evaluation Scales (ACES)[27] for each participating student. ACES is a norm referenced rating scale to assess academic outcomes of students in kindergarten through college. Factor analysis demonstrated a 2-factor structure with academic skills and academic enablers scales.[27] The Academic Skills scale includes math, reading, and critical thinking subscales, whereas the academic enablers scale includes interpersonal skills, engagement, motivation, and study skills subscales. These subscales show moderate to strong associations (r = .38 to .87) with other measures of academic functioning, such as the Iowa test of basic skills (ITBS)[34] and grade point averages (r = .56 to .90).[27] Additionally, STAR reading and Mathematics scores have moderate positive relationships with the academic skills scale (r = .47 to .56) and small to moderate positive relationships with the academic enablers scale (r = .24 to .33).[33]

Academic skills. This scale includes 14 items related to general academic competencies: Math (4 items; eg, using numbers to solve daily problems), reading (6 items; eg, reading comprehension), and critical

thinking (4 items; eg, drawing conclusions from observations). Answer choices ranged from 1 (far below grade level expectations) to 5 (far above grade level expectations). Items were averaged, with higher scores indicating higher academic skills ($\alpha = .99$). Ratings from the 2 teachers rating each child were averaged ($r = 0.58$, $p < .01$).

Academic enablers. This scale includes 18 items related to behaviors that enable academic success: Interpersonal skills (5 items; eg, interacts appropriately with other students); engagement (4 items; eg, participates in class discussions); motivation (5 items; eg, is goal oriented); and study skills (4 items; eg, completes homework). These items were rated on a 5-point scale (1 = never to 5 = almost always). The 18 items were averaged, with higher scores indicating more academic enablers ($\alpha = .97$). Ratings from the 2 teachers reporting on each child were averaged ($r = 0.49$, $p < .01$).

Academic achievement. Math and English/Language Arts (ELA) grades were used as separate indicators of academic achievement due to the relevance of these academic subjects in federally mandated annual testing in grades 3-8. For the current study, end of year grades were provided in baseline and 1 year follow up by each student's school. End of year grades were calculated as an average of quarter-term grades for the school year when the student participated in the study. Values range from 0 to 100 with higher values indicating better performance. Many schools describe grades of 70 or higher as ''passing.''

Food insecurity. Food insecurity was reported by students at baseline using the 9-item self-administered Food Security Survey Module for Children,[35] which has small to moderate negative relationships with food expenditure, household income, and income relative to poverty line ($r = -.12$ to $-.33$).[36] Students indicated how true each statement was for them in the last month (eg, Did you worry that food at home would run out before your family got money to buy more?). Items were rated on a 3-point scale (0 = never, 1 = sometimes, 2 = a lot) and averaged with higher scores indicating higher food insecurity ($\alpha = 0.90$).

Demographic characteristics. Parents reported their child's sex (0 = male; 1 = female) and race/ethnicity. Non-Hispanic white children were coded as 0 (nonminority status) whereas black/African American and Hispanic students were recoded as 1 (minority status). At baseline, parents also reported annual household income (13-point scale from 1 = <$5000 to 13 = >$90,000) and educational attainment (1 = less than 12th grade/no diploma to 7 = graduate or professional degree). At 1 year follow up, parents reported annual household income and educational attainment (Table 1).

Data Analyses

Descriptive statistics and distributions of all variables were examined. Bivariate relationships among food insecurity and academic skills, academic enablers and academic achievement were examined with Pearson's correlations. Paired samples t tests tested differences in academic outcomes across waves. A single multivariate regression analysis conducted in Mplus v. 8.1 predicted the 4 academic outcomes (academic skills, academic enablers, math grades, and ELA grades) at 1 year follow up from food insecurity at baseline, adjusting for child sex, race, household income, parent education, and academic outcomes at baseline. Missing data (7.4%) were handled with full information maximum likelihood which preserves the full sample size (N = 112) and reduces bias under data missing at random.[37]

RESULTS

Preliminary Analyses

Table 1 presents demographic data for the sample for both baseline and 1 year follow up. During baseline data collection a total of 112 students participated in the study; 92 students (82%) were retained at 1 year follow up. At baseline, the vast majority of participants were either black/African American (68%) or white (14%). During the 1 year follow up, black/African American (65%) and white (17%) students again comprised the majority of participants. The sample was socioeconomically heterogeneous, with a median household income of $40,000 to 50,000/year and median parent educational of attainment of ''some college but no degree.'' The sample closely mirrored the demographic composition of the Birmingham metropolitan area.

Descriptive statistics and bivariate correlations for all variables are presented in Table 2. Approximately 45% of children reported food insecurity ''sometimes'' or ''a lot.'' Teachers reported in both waves that on average students had academic skills slightly above grade expectations and engaged in academic enablers ''sometimes'' to ''often.'' Correlations determined that baseline food insecurity was weakly to moderately associated with lower levels of all academic outcomes at baseline and 1 year follow up, except for baseline ELA grades ($r = -.24$ to $-.45$, $p < .05$). Among the covariates, food insecurity was also related to male sex and lower family income and parental education. As expected, academic outcomes were intercorrelated within and between waves. Paired samples t tests determined that academic enablers on average declined (mean = 4.06 vs 3.71; $t(92) = 4.71$, $p < .001$) from baseline to 1 year follow up, whereas math grades improved (mean = 82.86 vs 85.43; $t(125) = -2.64$, $p < .05$). There was no change in academic skills or ELA grades over time.

Table 2. **Descriptive Statistics and Pearson Correlations of Key Variables and Covariates**

Variable	Mean (SD) or %	1	2	3	4	5	6	7	8	9	10	11	12
1. W1 food insecurity	0.21 (0.34)	—											
2. W1 academic skills	3.09 (0.78)	−.25**	—										
3. W2 academic skills	3.10 (0.71)	−.45**	.58**	—									
4. W1 academic enablers	4.00 (0.81)	−.27**	.71**	.54**	—								
5. W2 academic enablers	3.71 (0.88)	−.33**	.48**	.69**	.64**	—							
6. W1 math grades	82.14 (10.71)	−.25*	.74**	.54**	.68**	.55**	—						
7. W2 math grades	85.52 (6.96)	−.26*	.52**	.53**	.64**	.57**	.56**	—					
8. W1 ELA grades	83.35 (8.74)	−.18	.62**	.50**	.52**	.49**	.79**	.51**	—				
9. W2 ELA grades	82.88 (9.36)	−.24*	.35**	.51**	.52**	.65**	.32**	.58**	.43**	—			
10. Female sex†	49%	−.20*	.12	.22**	.39**	.30**	.16	.32**	.22**	.26**	—		
11. Minority status†	85%	−.17	−.27**	−.04	−.12	−.08	−.28**	−.18	−.29**	−.05	.15	—	
12. Income	7.84 (3.85)	−.27**	.34**	.38**	.18	.22*	.34*	.19	.34	.16	−.05	−.25**	—
13. Parent education	3.22 (1.41)	−.28**	.18	.28**	.14	.15	.16	.11	.11	.22**	−.07	.07	.51**

*$p < .05$.
**$p < .01$.
***$p < .001$.
† Spearman correlations.

Table 3. **Multivariate Regression Models Predicting 1 Year Follow Up Academic Outcomes From Baseline Food Insecurity and Covariates**

	One Year Follow Up Outcomes			
Baseline Predictors	**Academic Skills, β (SE)**	**Academic Enablers, β (SE)**	**Math Grades, β (SE)**	**ELA Grades, β (SE)**
Food insecurity	**−.31 (.10)****	−.07 (.10)	−.03 (.13)	−.06 (.14)
Academic skills	.20 (.14)	−.05 (.10)	.16 (.12)	.002 (.13)
Academic enablers	−.02 (.14)	**.51 (.16)****	**.48 (.13)****	**.43 (.15)***
Math grades	.001 (.17)	.06 (.14)	−.06 (.16)	**−.44 (.17)***
ELA grades	**.28 (.11)***	.13 (.14)	.21 (.12)	**.53 (.15)****
Female	.08 (.10)	.04 (.09)	.02 (.10)	.03 (.12)
Minority status	.09 (.09)	−.04 (.09)	−.03 (.10)	−.05 (.10)
Household income	.13 (.10)	.002 (.11)	−.05 (.10)	−.10 (.12)
Parent education	.02 (.10)	.02 (.11)	−.04 (.08)	.15 (.11)

*$p < .05$.
**$p < .01$.
***$p < .001$.
Significant coefficients are bolded.

Main Analyses

Results from the multivariate regression model indicated that after adjusting for sociodemographics and academic outcomes at baseline, food insecurity at baseline uniquely predicted lower academic skills at 1 year follow up (Table 3). However, baseline food insecurity was not uniquely related to changes in academic enablers or grades over time. Among the covariates, academic enablers and ELA grades were stable over time, and academic enablers at baseline predicted higher math and ELA grades at 1 year follow up. Baseline ELA grades predicted higher academic skills at 1 year follow up, but math grades predicted lower ELA grades over time, which appeared to result from a suppressor effect due to the zero-order correlation of baseline math grades with 1 year follow up ELA grades that was positive and moderate in size. Child sex, minority status, household income, and parent education did not uniquely predict academic outcomes at 1 year follow up.

DISCUSSION

The current study examined the prospective effects of food insecurity on multiple academic outcomes in ethnically and socioeconomically diverse middle school students. Results showed that food insecurity at baseline was associated with lower family income and parental education, as well as lower academic skills, fewer academic enablers, and poorer math grades both concurrently and 1 year later, as well as with poorer ELA grades a year later. After adjusting for sociodemographics and concurrent academic functioning, food insecurity predicted fewer academic skills 1 year later, but was unrelated to changes in academic enablers and math or ELA grades.

This study was the first to determine that greater food insecurity is associated with lower academic skills over time. Although no study to date has examined the effect of food insecurity on academic skills, the present results are consistent with at least

2 longitudinal studies linking food insecurity with academic achievement. For example, 1 study found that kindergarten children living in food insecure homes (parent reported) had lower math and reading proficiency in third grade.[38] In another longitudinal study, kindergarteners with any food insecurity had lower math gains from fall to spring.[39] DiPerna suggests that for students to be academically successful, they must possess general intelligence, as well as academic skills (math, reading, critical thinking) and academic enablers.[28] The current study is the first to demonstrate longitudinal effects of food insecurity on academic skills among middle school students.

Contrary to expectations, this study found no relationship between food insecurity and changes in academic enablers over time once it controlled for sociodemographics and baseline levels of academic enablers. This is contradictory to evidence showing that food insecurity in elementary school was associated with lower noncognitive skills (interpersonal relations, self-control, and approaches to learning) in fifth grade.[40] However, the reported effects were of very small magnitude and only reached significance for food insecurity occurring in third grade, but not fifth grade, suggesting that food insecurity may be more relevant to academic enablers in early elementary school, but less so in late elementary and middle school. Another possible reason for these discrepancies is the use of parent- vs. child-reported food insecurity, as each informant may have different perceptions of food insecurity. Finally, it is possible that the specific components of the academic enablers subscale may be differentially impacted by food insecurity, and the composite score was not able to fully capture these effects. Future studies should examine the effects of food insecurity on multiple nonacademic outcomes across different grades using both parent and child reports of food insecurity.

Finally, food insecurity did not predict changes in end of year grades in this study, although it was related to lower math grades in the same academic year and both math and ELA grades in the following year. These findings contrast with prior results of food insecurity predicting lower math gains in kindergarten[39] and lower math and reading proficiency from kindergarten to third grade.[38] It is possible that grades are a less sensitive measure of academic outcomes compared to academic skills, which were significantly predicted by food insecurity in this study. Clearly, more research is needed to investigate the prospective effects of food insecurity on multiple academic outcomes across K-12 grades.

Strengths and Limitations

Key strengths of this study include the longitudinal design, use of multiple informants, and an ethnically and socioeconomically diverse sample of middle school students. However, the study is not without limitations. First, the sample included primarily African American and white students residing in a large metropolitan area in the Southeast United States, so results may not generalize to other geographic regions, ethnicities, or cultures. Second, food insecurity was generally low, possibly due to a lack of knowledge by youth about the financial situation in the household or because there are compensatory resources in the neighborhood.[41] It is also possible that some adolescents under reported food insecurity due to feelings of shame or embarrassment about not having enough food.[42] Third, documents and study activities were only offered in English and may not have been the preferred language for some families. Next, interrater reliability among the 2 teachers for academic skills and enablers was relatively low. Clearly, teachers differed in how they perceived their students' abilities, possibly due to differences in students' behavior across subjects and teachers.[43] Finally, the sample was incomplete due to the interruption of the larger study by the COVID-19 pandemic, limiting ability to detect small effect sizes and possibly reducing generalizability due to differences from the full sample.

IMPLICATIONS FOR SCHOOL HEALTH

The whole school, whole community, whole child (WSCC) model is a student-centered framework, consisting of 10 components which emphasize the role of the community in supporting the school as well as the connections between health and academic achievement. Given the findings from this research supporting the connection between food insecurity and academic skills over time, it is important to use a systems framework to address food insecurity. Although components of the WSCC model may not directly apply to this topic, the following strategies exemplify several WSCC model components that can improve food security and support academic success.

There are many ways that strong child nutrition programming can decrease food insecurity. *School breakfast and lunch programs* have been shown to improve student attendance,[20] decrease tardiness, and provide quality nutrient intake for students.[21] These programs decrease the amount of time between meals for students with low food access and/or security at home. Some schools now provide free meals during the school day regardless of income. As part of the Healthy, Hunger-Free Kids Act of 2010, the community eligibility provision allows schools with moderate to high poverty to offer meals to all students at no cost. By serving all students free breakfast and lunch, students do not have to suffer the embarrassment of not having enough money to eat. Some schools now serve breakfast in the classroom

after first bell, allowing students that ride the bus or get in late to also eat.

After school meal programs and *backpack food programs* are other ways that schools can provide food to children who may be hungry. These programs help to close the gap in meals for children outside of the regular school day or providing food for children over weekends and over breaks during the school year. Some of these programs may receive funding from the National School Lunch Program and typically collaborate with community agencies to help fund the program and help manage the logistics. Because food insecurity can change over time, ongoing efforts to assess food insecurity in the school is helpful to estimate the costs associated with the programs.

Summer meal programs are an important means to increases access to food throughout summer months for students by providing free meals and snacks to children who might otherwise go hungry. This was especially critical for families who live in areas considered to be food deserts, or where there are lack of supermarkets. As part of pandemic relief legislation, federal officials waived the requirement that schools serve meals in a group setting, increased reimbursement rates to schools and granted more flexibility in how food is prepared and packaged.[44] These allowances helped offset rising food prices and higher pay for cafeteria staff. Those COVID-19 waivers, however, will soon end and with it essential services for many students. Some schools are working with community partners to advocate for state legislation that would fund high-poverty schools to provide meals during the summer indefinitely.

Training programs for school staff and *classroom curricula* for students should be incorporated throughout the school year so adults and students understand the importance of eating a healthy balanced diet and its connections to brain development, concentration, and other components linked to academic success. Nutrition-related programming can provide valuable information for understanding of the issue of food security and can increase awareness and understanding of the issue as well as resources available in the community to improve food security. Additionally, faculty and staff should also be educated on signs of food insecurity among students in their classrooms. Initiating dialogue on hunger, food insecurity, and poverty with teachers and students can be especially informative and helpful in decreasing the shame and stigma surrounding these issues. Importantly, it is essential that teachers feel capable of approaching a student about the issue in a competent, culturally appropriate, and confident manner.

Among inequities that have been exposed and amplified by the pandemic, access to affordable and healthy food is increasingly a crisis for many students and their families. In tandem with studies to help better understand relationships between food insecurity and academic outcomes, intervention efforts in schools should seek to better identify and address instances of food insecurity.

Conclusions

Children and adolescents who experience food insecurity are at risk for poorer academic outcomes, and more recently, food insecurity in the United States doubled at the height of COVID-19 pandemic, particularly for minority children.[45] Food insecurity not only includes missing meals but can also be characterized by poor access to healthy fresh produce and eating cheaper, highly processed foods more often. Teachers and school personnel should evaluate this possibility when considering the performance of individual students as well as consider multiple sources of stress in a child's life. Findings from this study document the detrimental and lasting impact of food insecurity on academic skills of middle school students, adding to a growing body of research on the detrimental effects of food insecurity on psychological and physical development of youth. Future research related to family- and school-centered interventions and policies are needed to further decrease the negative implications of food insecurity among adolescents.

Human Subjects Approval Statement

This study was reviewed and approved by the University of Alabama at Birmingham Institutional Review Board.

Conflict of Interest

All authors of this article declare they have no conflicts of interest.

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