

Research Summary

School Nutrition and Academic Achievement



Research tells us that school nutrition programs can be an effective tool to help children reach their full academic potential. Healthy and well-nourished children are more likely to attend class, be ready to learn, stay engaged, and perform well in school. School nutrition is linked to multiple indicators of academic success.



Literacy and Mathematics Scores



Grades and Performance on Standardize tests



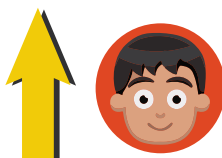
Aggressive Behavior



Discipline Problems



Cognitive Function



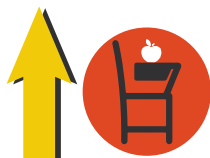
School Connectedness



Risk for Obesity and Diabetes



Hunger



School Attendance



Diet and Physical Health



Tardiness



Suspensions



Literacy and Math Scores

Summary of the Research Linking School Nutrition to Improved Literacy and Math Scores:

- Breakfast consumption has a positive impact on student literacy, independent of income level or parental education.¹
- The School Breakfast Program has a positive effect on academic performance, with the clearest effects upon mathematics among undernourished children.¹
- Research has found that children from food-insecure families perform worse in math as well as reading and achieve fewer educational gains than their peers over the course of the school year.^{2,3} School nutrition programs can decrease a child's risk for food insecurity.^{4,5}



Cognitive Function

Summary of the Research Linking School Nutrition to Improved Cognitive Function:

- Most children and adolescents do not consume enough water.⁶ Research shows that even mild dehydration can lead to significant impairments in cognitive function.^{7,8} Water supplementation has been shown to improve students' classroom focus and academic performance.^{9,10}
- According to experimental studies, students who eat breakfast have improved cognitive performance. They also have better visual perception and spatial memory ability. Results on short-term memory tests are higher for students who eat a nutritious breakfast than those who do not eat breakfast.¹¹
- After controlling for a number of factors related to children's outcomes, food insecurity negatively affects children's development and cognitive function. Even temporary exposure to food insecurity is related to lower cognitive development outcomes.¹² Participating in the school nutrition programs can decrease a child's risk for food insecurity.^{4,5}





Summary of the Research Linking School Nutrition to Improved School Connectedness:



- Research has demonstrated a strong relationship between school connectedness and educational outcomes, including school attendance; staying in school longer; and higher grades and classroom test scores.^{13,14,15,16,17} The school cafeteria, school gardens, and school food are vital components of a student's school experience. Students spend much of their time at school, and may eat as many as 2 out of 3 meals per day at school.
- Allowing students and their parents to use the school building and property outside of school hours for health promotion programs, such as utilizing school cafeterias as summer feeding sites, can increase student's and parent's feelings of being part of the school community.¹⁸
- Schools that have higher rates of participation in extracurricular activities during or after school tend to have higher levels of school connectedness.¹⁹ Promoting healthy choices and behavior is considered a key aspect of quality expanded learning programs.²⁰






Summary of the Research Linking School Nutrition to Improved School Attendance:

- School breakfast programs have been shown to improve attendance and reduce absenteeism. On average, school breakfast reduces absenteeism by 1.5 days per child.²¹
- Children who are overweight or obese are more likely to be absent from school.^{22,23,24,25} Participating in the school nutrition programs can decrease a child's risk for obesity.^{26,27,28}
- Food-insecure children and teenagers have been shown to miss school more frequently, and are more likely to repeat a grade than food-secure children.²⁹ Food-insecure children are also more likely to get headaches, stomachaches, and colds,

	<p>and to have chronic illnesses.³⁰ Participating in the school nutrition programs can decrease a child's risk for food insecurity.^{4,5}</p>
 <p>Grades and Performance on Standardized Tests</p>	<p><i>Summary of the Research Linking School Nutrition to Improved Grades and Performance on Standardized Tests:</i></p> <ul style="list-style-type: none"> • In a California Department of Education survey of students in grades 7, 9 and 11, schools with a higher percentage of pupils eating breakfast had significantly higher Academic Performance Index (API) scores.³¹ • Participation in the School Breakfast Program is associated with significant improvements in standardized test scores and grades among low-income elementary school children.^{32,33,31,1,34,35} • Multiple studies have demonstrated a link between inadequate dietary intake and at least one or more of the following: lower grades, lower standardized test scores, or increased likelihood of grade level retention.³³ The school nutrition programs are linked to healthier dietary intakes among participating students.³⁶
 <p>Aggressive Behavior</p>	<p><i>Summary of the Research Linking School Nutrition to Reduced Aggressive Behavior:</i></p> <ul style="list-style-type: none"> • Food-insecure children are more likely to have difficulty getting along with their peers.²⁹ Food insecurity increases the likelihood a child will experience developmental risk and behavior problems, primarily aggression, anxiety, depression, attention deficit disorder, hyperactivity and inattention.^{37,38,39} Children who become food insecure are more likely to have worse behavioral outcomes in first grade, including externalizing behaviors, self-control, and interpersonal skills.⁴⁰ Participating in the school nutrition programs can decrease a child's risk for food insecurity.^{4,5} • A study of a pilot classroom breakfast program in six Maryland school districts found that more than 80 percent of teachers and administrators said that

	<p>implementing breakfast in the classroom improved student behavior.⁴⁹</p> <ul style="list-style-type: none"> • Universal free school breakfast programs have been shown to improve teachers' assessments of student's behavior, focus and well-being.³⁵
 <p>Discipline Problems</p>	<p><i>Summary of the Research Linking School Nutrition to Reduced Discipline Problems:</i></p> <ul style="list-style-type: none"> • Children from families that report multiple experiences of food insecurity and hunger are more likely to be delinquent and show behavioral, emotional and academic problems on a standardized measure of psychosocial dysfunction than children from the same low-income communities that are not food insufficient.¹ Participating in the school nutrition programs can decrease a child's risk for food insecurity.^{4,5} • Children who eat breakfast also are sick less often, have fewer problems associated with hunger, such as dizziness, lethargy, and stomachaches, and do significantly better than their non-breakfasted peers in terms of cooperation, discipline, and interpersonal behaviors.⁴¹
 <p>Risk for Obesity and Diabetes</p>	<p><i>Summary of the Research Linking School Nutrition to Decreased Risk for Obesity and Diabetes:</i></p> <ul style="list-style-type: none"> • Participating in the school nutrition programs can decrease a child's risk for obesity.^{26,27,28} • School meal participants are less likely to drink sugar-sweetened beverages and more likely to drink nutritious milk.⁴² Children who eat school meals consume less added sugar and more fruit than children who eat a quick breakfast outside of school. Consuming less added sugar may also prevent childhood obesity and type 2 diabetes.⁴³ • Breakfast consumption can increase the feeling of fullness throughout the morning. Compared to students who do not eat breakfast, those who eat a

	<p>breakfast rich in protein, like school breakfast, consume fewer calories at lunch.⁴⁴ Eating breakfast more frequently may help control appetite and blood sugar, which has important implications for the risk of obesity and diabetes.⁴⁵</p>
 <p>Hunger</p>	<p><i>Summary of the Research Linking School Nutrition Programs to Reduced Hunger:</i></p> <ul style="list-style-type: none"> • Participating in the school nutrition programs can decrease a child’s risk for food insecurity.^{4,5,21}
 <p>Tardiness</p>	<p><i>Summary of the Research Linking School Nutrition to Reduced Tardiness:</i></p> <ul style="list-style-type: none"> • An analysis of the USDA’s School Breakfast Program found that it significantly improves school performance and reduces absenteeism and tardiness, all while improving children’s diets overall.^{46,21,49,47}
 <p>Suspensions</p>	<p><i>Summary of the Research Linking School Nutrition to Reduced Suspensions:</i></p> <ul style="list-style-type: none"> • Food-insecure teenagers also have an increased likelihood of being suspended from school.⁴⁸ Participating in the school nutrition programs can decrease a child’s risk for food insecurity.^{4,5} • A study of the pilot classroom breakfast program in six Maryland school districts found that disciplinary suspensions decreased at their schools.⁴⁹

Literature Cited

- ¹ Adolphus, K., Lawton, C. L., & Dye, L. (2013). The effects of breakfast on behavior and academic performance in children and adolescents. *Frontiers in Human Neuroscience*.
- ² Winicki, J., & Jemison, K. (2003). Food Insecurity and Hunger in the Kindergarten Classroom: Its Effect on Learning and Growth. *Contemporary Economic Policy*, 21 (2), 145-157.
- ³ Jyoti, Diana F.; Frongillo, Edward A.; Jones, Sonya J. . 2005. Food Insecurity Affects School Children's Academic Performance, Weight Gain, and Social Skills. *Journal of Nutrition* 135: 2831-2839.
- ⁴ Craig Gundersen, Brent Kreider, and John Pepper, "The Impact of the National School Lunch Program on Child Health: A Nonparametric Bounds Analysis," *Journal of Econometrics* 166, (2012): 79–91, doi: 10.1016/j.jeconom.2011.06.007.
- ⁵ Nord M, Romig K. Hunger in the summer: seasonal food insecurity and the National School Lunch and Summer Food Service programs. *J Child Poverty*. 2006;12:141–58
- ⁶ D'Anci KE, Constant F and Rosenberg IH. Hydration and cognitive function in children. *Nutrition Reviews* 64.10 Pt. 1 (2006): 457-464.
- ⁷ Edmonds CJ and Jeffes B. Does having a drink help you think? 6-7-Year-old children show improvements in cognitive performance from baseline to test after having a drink of water. *Appetite* 53.3 (2009): 469-472.
- ⁸ Kempton MJ, Ettinger U, Foster R, et al. Dehydration affects brain structure and function in healthy adolescents. *Hum Brain Mapp*. 2011; 32:71-79.
- ⁹ Benton D and Burgess N. The effect of the consumption of water on the memory and attention of children. *Appetite*, 53.1 (2009): 143-146.
- ¹⁰ Edmonds CJ and Jeffes B. Does having a drink help you think? 6-7-Year-old children show improvements in cognitive performance from baseline to test after having a drink of water. *Appetite* 53.3 (2009): 469-472.
- ¹¹ Mahoney, C. R., Taylor, H. A. , Kanarek, R. B., & Samuel, P. (2005). Effect of breakfast composition on cognitive processes in elementary school children. *Physiology & Behavior*, 85: 635-645
- ¹² Hernandez, Daphne C.; Jacknowitz, Alison. 2009. Transient, but Not Persistent, Adult Food Insecurity Influences Toddler Development. *Journal of Nutrition* 139: 1517-1524
- ¹³ McNeely C. Connections to school as an indicator of positive development. Paper presented at the Indicators of Positive Development Conference, Washington, DC; 2003.

-
- 14 Klem AM, Connell JP. Relationships matter: linking teacher support to student engagement and achievement. *Journal of School Health* 2004;74(7):262–273.
 - 15 Rosenfeld LB, Richman JM, Bowen GL. Low social support among at-risk adolescents. *Social Work in Education* 1998;20:245–260.
 - 16 Battin-Pearson S, Newcomb MD, Abbot RD, Hill KG, Catalano RF, Hawkins JD. Predictors of early high school dropout: a test of five theories. *Journal of Educational Psychology* 2000;92(3):568–582.
 - 17 Barber BK, Olsen JA. Socialization in context: connection, regulation, and autonomy in the family, school and neighborhood, and with peers. *Journal of Adolescent Research* 1997;12(2):287–315.
 - 18 Evenson K, McGinn A. Availability of school physical activity facilities to the public in four U.S. communities. *American Journal of Health Promotion* 2004;18:243–250.
 - 19 Blum RW, McNeely C, Rinehart PM. Improving the odds: the untapped power of schools to improve the health of teens. Minneapolis: Center for Adolescent Health and Development, University of Minnesota; 2002.
 - 20 California Department of Education. “Quality Standards for Expanded Learning in California.” 2014. Accessed from: <http://www.cde.ca.gov/ls/ba/as/documents/qualstandexplearn.pdf>
 - 21 Murphy, J. “Breakfast and Learning: An Updated Review.” *Current Nutrition & Food Science* 3.1 (2007): 3-36.
 - 22 Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. *JAMA*. 2003;289(14): 1813-1819.
 - 23 Gortmaker SL, Must A, Perrin JM, Sobol AM, Dietz WH. Social and economic consequences of overweight in adolescence and young adulthood. *N Engl J Med*.1993;329:1008-1012.
 - 24 Liping Pan, M.D., M.P.H.*, Bettylou Sherry, Ph.D., R.D., Sohyun Park, Ph.D., M.S., and Heidi M. Blanck, Ph.D., M.S. The Association of Obesity and School Absenteeism Attributed to Illness or Injury Among Adolescents in the United States, 2009. Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention. Atlanta, Georgia.
 - 25 Daniels BY. Examining attendance, academic performance, and behavior in obese adolescents. *The Journal of School Nursing*. 2008;24 (6):379-387.
 - 26 Szajewska H, Ruszczynski M. Systematic review demonstrating that breakfast consumption influences body weight outcomes in children and adolescents in Europe. *Crit Rev Food Sci Nutr*. 2010;50:113-119.
 - 27 Murphy, J. “Breakfast and Learning: An Updated Review.” *Current Nutrition & Food Science* 3.1 (2007): 3-36.

-
- ²⁸ Terry-McElrath, Y. M., O'Malley, P. M., & Johnston, L. D. (2015). Potential impact of national school nutritional environment policies: cross-sectional associations with US secondary student overweight/obesity, 2008 – 2012. *JAMA Pediatrics*, 169(1), 78-85.
- ²⁹ Alaimo, K., Olson, C. M., Frongillo, E. A., & Briefl, A. A. Food insufficiency, family income, and health in US preschool and school-aged children. *American Journal of Public Health*, 2001; 781-786.
- ³⁰ Coleman-Jensen, A., McFall, W., & Nord, M. (2013). Food insecurity in households with children: Prevalence, severity, and household characteristics, 2010-11.
- ³¹ Hanson, T.L. & Austin, G.A. (2002). Health risks, resilience, and the Academic Performance Index. (California Healthy Kids Survey Factsheet 1). Los Alamitos, CA: WestEd.
- ³² Meyers AF, Sampson AE, Weitzman M, et al. School breakfast program and school performance. *Am J Dis Child* 1989;143:1234e9.
- ³³ Bradley, BJ, Greene, AC. Do Health and Education Agencies in the United States Share Responsibility for Academic Achievement and Health? A review of 25 years of evidence about the relationship of adolescents' academic achievement and health behaviors. *Journal of Adolescent Health*, 52 (2013): 523-532.
- ³⁴ Nansel TR, Huang TK, Rovner AJ, Sanders-Butler Y. Association of school performance indicators with implementation of the Health Kids, Smart Kinds program: Case study. *Public Health Nutr* 2010;13:116e22.
- ³⁵ Murphy JM, Pagano ME, Nachmani J, et al. The relationship of school breakfast to psychosocial and academic functioning: Cross-sectional and longitudinal observations in an inner-city school sample. *Arch Pediatr Adolesc Med* 1998;152:899e907
- ³⁶ Schwartz Marlene B., Henderson Kathryn E., Read Margaret, Danna Nicole, and Ickovics Jeannette R.. *Childhood Obesity*. June 2015, 11(3): 242-247. doi:10.1089/chi.2015.0019.
- ³⁷ Cook, J. T., & Frank, D. A. (2008). Food security, poverty, and human development in the United States. *Annals of the New York Academy of Sciences*, 1136, 193-209.
- ³⁸ Whitaker, R. C., Phillips, S. M., & Orzol, S. M. (2006). Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics*, 118(3), e859-68.
- ³⁹ Melchior M, Chastang J-F, Falissard B, et al. Food Insecurity and Children's Mental Health: A Prospective Birth Cohort Study. Uddin M, ed. *Plos ONE*. 2012; 7(12): e52615.
- ⁴⁰ Kimbro RT, Denney JT. Transitions into food insecurity associated with behavioral problems and worse overall health among children. *Health Affairs*. 2015; 34(11): 1949-1955.

-
- ⁴¹ Brown, J. L., Beardslee, W. H., & Prothrow-Stith, D. (2008). Impact of school breakfast on children's health and learning: An analysis of the scientific research.
- ⁴² Condon, E. S., Crepinsek, M. K., & Fox, M. K. (2009). School meals: types of food offered to and consumed by children at lunch and breakfast. *Journal of the American Dietetic Association*, 109:S67-S78
- ⁴³ Gleason, P., & Suitor, C. (2001). Children's Diets in the Mid-1990s: Dietary Intake and Its Relationship with School Meal Participation. Nutrition Assistance Program Report Series, No. CN-01-CD1. Alexandria, VA: USDA, FNS, Office of Analysis, Nutrition and Evaluation. p149.
- ⁴⁴ Leidy H. J., & Racki E. M. (2010). The addition of a protein-rich breakfast and its effects on acute appetite control and food intake in 'breakfast-skipping' adolescents. *International Journal of Obesity (Lond)*, Feb 2: 1-9.
- ⁴⁵ Pereira, M. A., Erickson, E., McKee, P., Schrankler, K., Raatz, S. K., Lytle, L. A., & Pellegrini, A. D. (2011). Breakfast frequency and quality may affect glycemia and appetite in adults and children. *Journal of Nutrition*, 141(1), 163-168.
- ⁴⁶ Kennedy E, Davis C. US Department of Agriculture School Breakfast Program. *Am J Clin Nutr*. 1998;67(4):798S-803S.
- ⁴⁷ Murphy, J. M., Drake, J. E., & Weineke, K. M. (2005). Academics & Breakfast Connection pilot: Final report on New York's classroom breakfast project. Albany, NY: Nutrition Consortium of New York State.
- ⁴⁸ Alaimo K, Olson CM, Frongillo EA Jr. (2001) "Food Insufficiency and American School-Aged Children's Cognitive, Academic and Psychosocial Development." *Pediatrics*, 108(1):44-53
- ⁴⁹ Murphy, J. M., & Pagano, M. (2001). Effects of a universally free, in-classroom school breakfast program, final report from the third year of the Maryland Meals for Achievement Evaluation. Boston, MA: Massachusetts General Hospital.