

Obesity and Student Performance at School

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ABSTRACT: To review the state of research on the association between obesity among school-aged children and academic outcomes, the authors reviewed published studies investigating obesity, school performance, and rates of student absenteeism. A table with brief descriptions of each study's research methodology and outcomes is included. Research demonstrates that overweight and obesity are associated with poorer levels of academic achievement. Data on the association of child overweight or obesity with levels of attendance are too sparse to draw conclusions. (J Sch Health. 2005;75(8):291-295)

An understanding of the impact of student health on educational outcomes has major implications. Among them are ramifications for how schools address health concerns. The National Coordinating Committee on School Health and Safety (NCCSHS), comprising representatives of federal departments and national nongovernmental organizations, encourages school districts to respond to evolving challenges by developing coordinated school health programs. To enhance awareness of existing evidence linking health and school performance and to identify gaps in knowledge, the NCCSHS has begun a project designed to ascertain the status of research in these areas. The project involves a literature search of peer-reviewed, published research reporting on the relationship between students' health and their performance in school. Compilations of research articles that explore the association between academic performance and health include various chronic conditions. This article summarizes what is known on the association of obesity with academic outcomes among school-aged children.

BACKGROUND ON OBESITY

The Centers for Disease Control and Prevention (CDC) reports a rapid 4-fold rise in child and adolescent obesity (ages 6-19) over the past 20 years.¹ In fact, the "obesity epidemic" has become front-page news across the country. Obesity is measured most typically using body mass index (BMI), although this method is not perfect because it does not account for increased muscle mass. BMI is calculated as weight in kilograms divided by the square of height in meters. The International Task Force on Obesity has agreed that BMI and BMI percentiles in children are the most practical tools available to define obesity and to screen for it.^{2,3} The CDC does not use the term "obesity" for children. The term used is "overweight," and this is defined as BMI

at or above the 95th percentile (using Centers for Disease Control and Prevention BMI-for-age growth charts, 2000). The American Obesity Association, a leading organization on education and advocacy related to obesity, defines "overweight" for adolescents (ages 13-17) as BMI greater than 25 or BMI greater than the 85th percentile, whereas "obesity" is measured as BMI greater than 30 or BMI charted over the 95th percentile. Given the various definitions of obesity and the fact that some published studies preceded these definitions, research on obesity and overweight collected here often do not share common terms or definitions of terms.

Childhood obesity often is accompanied by a parallel rise in type 2 diabetes,⁴ as well as increased rates of cardiovascular problems (eg, hypertension), hyperlipidemia, obstructive sleep apnea, asthma, orthopedic complications, nonalcoholic fatty liver disease, cancer, psychosocial complications, and lower measures of quality of life.⁵

The reasons for the obesity epidemic are varied and are slowly becoming better understood. During the first 5 years of the 1990s, per capita soft drink consumption increased by 41%. The increase is significant when contrasted with one estimate that the odds of becoming obese increase 1.6 times for each can of a sugar-sweetened beverage consumed every day.⁶ But as educators, parents, health professionals, and others know, heavily sugared soft drinks and other fast-food items are commonplace in schools. The CDC's School Health Policies and Programs Study (SHPPS), which surveyed state education agencies, school districts, and food service representatives, found in 2000 that one half of all districts had a soft drink contract and that of these, nearly 80% received a specified percentage of the sales receipts. The 2000 SHPPS found that almost two thirds of schools received incentives after sales reached a specified amount.⁷ One third of schools allowed advertising for foods in their buildings, and 56% of elementary schools and 93% of high schools allowed students to purchase such beverages in vending machines, school stores, canteens, or snack bars.⁸ When various dietary and physical activity habits are examined for their risk of causing a high BMI, insufficient vigorous physical activity is the most significant risk factor for adolescent boys and girls.⁹ Yet, only between 6% and 8% of schools provide the recommended daily physical education or its equivalent for the entire school year.¹⁰

SELECTION OF OBESITY ARTICLES

Articles meeting the following criteria were selected for review: (1) study subjects were school-aged children

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(5-18 years), (2) the article was published within the past 10 years (1994-2004) in a peer-reviewed journal, and (3) the research included at least one of the following outcomes—school attendance, academic achievement, or a measure of cognitive ability (such as general intelligence, memory). If a full article could not be retrieved, studies with detailed abstracts were included. Many studies cited here had major outcome measures other than those pertinent to the objectives of this project. These alternative outcomes may not be described at all or are briefly mentioned.

LITERATURE REVIEW

Articles found and reviewed are summarized in Table 1. Nine articles examined the link between obesity and school performance, and all demonstrated significant and discouraging associations. Three studies originated in the United States, 3 in Western Europe, 1 in South America, and 2 in Asia. Despite the small number of studies and the differences in outcomes measured by these researchers, there are some noteworthy strengths to this small body of research. Results of these studies when taken altogether are relatively consistent. Many investigated large populations. Some of the experimental designs controlled for influences of low family income and low levels of parent education. This is important because these social factors can independently affect both academic achievement and levels of obesity.¹¹ Other assets of this small body of literature are that when taken together, they cover school children of all ages and, not least, that every study found an unfortunate outcome in school performance for children who were overweight or obese.

It has been established that overweight and obese children are more likely to have low self-esteem and that they have higher rates of anxiety disorders, depression, and other psychopathology.¹²⁻¹⁴ These mental health conditions may be the mediating factors for an overweight or obese child to score poorly in school. Regrettably, the cause and effect for the association between obesity and poor academic performance has not yet been established through research. One large study (Datar et al 2004) suggests that obesity is a marker, not a cause, of low academic performance. Theoretically, doing poorly in school may increase the risk of obesity. Mental health problems (eg, low self-esteem or depression) or other factors may predispose children to both overweight/obesity and low school performance, with no other direct or indirect association between weight and achievement.

The only article that dealt with the association of obesity and absenteeism (Schwimmer et al 2003; Table 1) found that severely obese children and adolescents report many more missed school days than the general student population. The magnitude of missed school days was impressive and almost unbelievable (mean of 4 days per month and median of 1 day per month). Possibly this is because the population under study was not likely a typical population of obese children. These students were referred by a physician to a specialist, specifically for their weight. Additionally, the absenteeism data were derived from

a recall from the previous month. Since these students had at least one recent doctor's appointment, this may account for the median of 1 day's absence from school. In this study, control students and obese students had data collected in different months of the year and perhaps during different years. As absenteeism varies from year to year and month to month, conclusions drawn from such comparisons must be interpreted cautiously. What remains is a need for more research that compares absenteeism rates with levels of obesity. One large study of self-reported data from a nationally representative sample of adolescents compared BMI to school functioning. Unfortunately, although absence from school was elicited information, it was not separated from 8 other measures of school functioning in the analysis.¹⁵ Questions that need to be asked include the following: Are obese students missing school days because they are embarrassed to participate in physical activities? Are comorbidities with obesity responsible for more missed school days (eg, severe asthma,¹⁶ obstructive sleep apnea¹⁷)? Can an increased risk of being bullied or teased be responsible for missed school among an overweight population?¹⁸

Despite the current lack of understanding about the directionality of the association between obesity and poor school performance, the fact that there is an association may be adequate to influence change in school policies and practices. Parents, school board members, and other administrators must grapple with decisions about how to balance the benefits of lucrative district contracts with soft drink companies and of food sales that do not meet United States Department of Agriculture (USDA) standards against the benefits of forgoing these practices. Recommendations for daily physical education and activity at school^{19,20} and strong nutritional educational curricula²¹ are often not followed because they are perceived to supplant time and resources from reading, arithmetic, and other core subjects. These are the dilemmas of school board members and administrators. Knowledge that obesity and overweight may have detrimental ramifications on current academic performance may tip the balance on how administrators decide on these issues.

CONCLUSION

Although the number of articles examining the link between obesity and school performance is limited, there are notable strengths to this small body of research and consistent findings of detriment to school performance among children who are overweight or obese. One research article suggests that obese children and adolescents may miss more school days. There are a great number of gaps in knowledge about the extent of the association between absenteeism and school performance among overweight and obese children. For pure health benefits, perhaps schools' adherence to stricter physical activity and nutrition recommendations will occur before we fully understand the connection between achievement and obesity. ■

Table 1

Published Research Articles That Address Obesity and Either Student Performance or Attendance (Continued on next page)

Citation (Origin)	Research Design	Outcomes Related to School Performance
Campos AL, Sigulem DM, Moraes DE, Escrivao AM, Fisberg M. Intelligent quotient of obese children and adolescents by the Weschler scale. <i>Rev Saude Publica</i> . 1996;30(1):85-90. (Brazil)	Intellectual characteristics of 65 obese children (ages 8-13 years) were compared to those of a control group (from same communities) comprising 35 well-nourished, tall (>95th percentile for height) children who had normal weights for their height. Intelligence was measured using the WISC.	Children with normal height/weight ratios had significantly better performance in IQ than those in the obese group, had a wider range of interests, better capacity for social adaptability, and greater speed and dexterity. There was a weak correlation between income level and IQ as well.
Datar A, Sturm R, Magnabosco JL. Childhood overweight and academic performance: national study of kindergartners and first-graders. <i>Obes Res</i> . 2004;12(1):58-68. (USA)	A nationally representative sample of 11,000 kindergartners from the Early Childhood Longitudinal Study. This study collected parent, teacher, and student characteristics at multiple time points. Cross-sectional analysis of the relationship of overweight and test scores was done at school entry. Longitudinal regression analyses were performed on data collected later, controlling for baseline test scores at school entry, to examine the independent effect of obesity on academic achievement as a result of being in school.	Overweight children had significantly lower math and reading scores compared with nonoverweight children in kindergarten that persisted through end of first grade. These could be attributed to socioeconomic and behavioral variables, indicating that overweight may be a marker, but not a causal factor, of low test scores.
Falkner NH, Neumark-Sztainer D, Story M, Jeffery RW, Behrning T, Resnick MD. Social, educational, and psychological correlates of weight status in adolescents. <i>Obes Res</i> . 2001;9(1):32-42. (USA)	Cross-sectional study of approximately 10,000 students in 7th, 9th, and 11th grades; anonymous survey; self-reported height/weight; educational experiences, and more. Overweight, >85th percentile BMI; obese, >95th percentile BMI; adjustment made for grade, race, socioeconomic status.	Obese girls were 1.5 times more likely to be held back a grade and 2.1 times more likely to consider themselves poor students compared to average weight girls. Obese boys were 1.5 times more likely to consider themselves poor students, and 2.2 times more likely to expect to quit school.
Laitinen J, Power C, Ek E, Sovio U, Jarvelin MR. Unemployment and obesity among young adults in a northern Finland 1966 birth cohort. <i>Int J Obes Relat Metab Disord</i> . 2002;26(10):1329-1338. (Finland)	Longitudinal study of approx 10,000 subjects; Measurements were taken at ages birth, 1, 14, and 16 years. School grades from national registers; BMI.	Obesity at age 14 years was associated with a low school performance at 16 years and a low level of education persisting until at least age 31.
Li X. A study of intelligence and personality in children with simple obesity. <i>Int J Obes Relat Metab Disord</i> . 1995;19(5):355-357. (China)	102 obese children (defined as percentage overweight 20% above standard weight for height) matched with 102 normal weight children (for sex, height, and age); ages 6-13 years; WISC IQ testing done; Eysenck Personality Questionnaire; school records of grades.	Full-scale IQ and performance IQ of obese children significantly lower than normal weight; "block design" and "object assembly" most significant; lower verbal IQ score not significant. Confounding influence of medical problems and parent education ruled out; moderately severe obese (>50% overweight) lower by average of 11 IQ points; obese children had significantly lower grades in 6 of 8 categories (Chinese, Arithmetic, Foreign Language, General Knowledge, Art, and "Gym").

GPA, Grade point average; IQ, Intelligence quotient; WISC, Wechsler Intelligence Scale for Children.

Table 1

Published Research Articles That Address Obesity and Either Student Performance or Attendance (Continued from previous page)

Citation (Origin)	Research Design	Outcomes Related to School Performance
Mikkilä V, Lahti-Koski M, Pietinen P, Virtanen SM, Rimpela M. Associates of obesity and weight dissatisfaction among Finnish adolescents. <i>Public Health Nutr.</i> 2003;6(1):49-56. (Finland)	Written survey of over 60,000 Finnish adolescents, ages 14-16 years. Obesity defined as >120% of sex/height specific mean weight for age.	Good school performance was inversely associated with being obese for both boys and girls.
Mo-suwan L, Lebel L, Puetpaiboon A, Junjana C. School performance and weight status of children and young adolescents in a transitional society in Thailand. <i>Int J Obes.</i> 1999;23:272-277. (Thailand)	2252 primary school children; schools randomly selected; classrooms in schools randomly selected; weight/height measured; BMI calculated; overweight, >85th percentile; GPA scores and subject scores from school records; GPA compared to current weight as well as to weight status recorded 2 years earlier.	Low GPA only associated with current weight, not weight 2 years earlier. School performance (GPA) lower in overweight children in grades 7 through 9 (low language and math scores); association not found in children in grades 3 to 6. More overweight, greater risk of low GPA.
Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. <i>JAMA.</i> 2003;289(14):1813-1819. (USA)	105 children (ages 5-18) referred by their physicians to a specialty clinic (nutrition or gastroenterology) for severe obesity were studied with a health-related quality of life inventory. Number of days of school missed in previous 30 days was part of inventory. Control group data were taken from 8000 healthy children from another study.	Severely obese children missed a median of 1 day in preceding month, as compared to 0 days for healthy children. The mean number of days missed was 4.2 days for severely obese children and 0.7 days for healthy children.
Sargent JD, Blanchflower DG. Obesity and stature in adolescence and earnings in young adulthood. Analysis of a British birth cohort. <i>Arch Pediatr Adolesc Med.</i> 1994;148(7):681-687. (UK)	A birth cohort of 12,537 respondents at age 23 years (National Study of all born on March 3-9, 1958, in England/Scotland); survey; heights and weights measured; obesity, BMI >95%.	Men and women who had been obese at age 16 had significantly fewer years of schooling. Obese women performed poorer on math and reading tests at ages 7, 11, and 16; no similar associations for males.
Tershakovec AM, Weiler SC, Gallagher PR. Obesity, school performance and behaviour of black, urban elementary school children. <i>Int J Obes Relat Metab Disord.</i> 1994;18(5):323-327. (USA)	104 3rd- and 4th-grade children in Philadelphia; obesity defined as triceps skinfold thickness > 85th percentile; school records provided information on school absences and placement in remedial classes. Parents were also interviewed by telephone for demographics, birth weight, and standardized questionnaire for attention disorders. Results controlled for birth weight, age, sex, family income, and school absences.	No association between obesity and classroom failure, but obese children twice as likely to be placed in special education or remedial class.

GPA, Grade point average; IQ, Intelligence quotient; WISC, Wechsler Intelligence Scale for Children.

References

1. Centers for Disease Control and Prevention, National Center for Health Statistics. *Percentage of Children Ages 6 to 18 Who Are Overweight by Gender, Race, and Hispanic Origin, 1976-1980, 1988-1994, and 1999-2002*. National Health and Nutrition Examination Survey; 2003. Available at: <http://www.childstats.gov/americaschildren/xls/HEALTH3.xls>. Accessed August 17, 2005.
2. Dietz WH, Robinson TN. Use of the body mass index as a measure of overweight in children and adolescents. *J Pediatr*. 1998;132:191-193.
3. Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. *Am J Clin Nutr*. 1994;59:307-316.
4. Neufeld N, Raffel L, Landon C, Chen Y-D, Vadheim C. Early presentation of type 2 diabetes in Mexican-American youth. *Diabetes Care*. 1998;21:80-86.
5. Friedlander SL, Larkin EK, Rosen CL, Palermo TM, Redline S. Decreased quality of life associated with obesity in school-aged children. *Arch Pediatr Adolesc Med*. 2003;157(12):1206-1211.
6. Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet*. 2001;357(9255):505-508.
7. Wechsler H, Brener ND, Kuester S, Miller C. Food service and foods and beverages available at school: results from the School Health Policies and Programs Study 2000. *J Sch Health*. 2001;71(7):313-324.
8. Story M, French S. Food advertising and marketing directed at children and adolescents in the US. *Int J Behav Nutr Phys Act*. 2004;1:3.
9. Patrick K, Norman GJ, Calfas KJ, et al. Diet, physical activity, and sedentary behaviors as risk factors for overweight in adolescence. *Arch Pediatr Adolesc Med*. 2004;158(4):385-390.
10. Burgeson CR, Wechsler H, Brener ND, Young JC, Spain CG. Physical education and activity: results from the School Health Policies and Programs Study 2000. *J Sch Health*. 2001;71(7):279-293.
11. Lin BH, Huang CL, French SA. Factors associated with women's and children's body mass indices by income status. *Int J Obes Relat Metab Disord*. 2004;28(4):536-542.
12. Zimetkin AJ, Zoon CK, Klein HW, Munson S. Psychiatric aspects of child and adolescent obesity: a review of the past 10 years. *J Am Acad Child Adolesc Psychiatry*. 2004;43(2):134-150.
13. Vila G, Zipper E, Dabbas M, et al. Mental disorders in obese children and adolescents. *Psychosom Med*. 2004;66(3):387-394.
14. Mustillo S, Worthman C, Erkanli A, Keeler G, Angold A, Costello EJ. Obesity and psychiatric disorder: developmental trajectories. *Pediatrics*. 2003;111(4 pt 1):851-859.
15. Swallen KC, Reither EN, Haas SA, Meier AM. Overweight, obesity and health-related quality of life among adolescents: the National Longitudinal Study of Adolescent Health. *Pediatrics*. 2005;115:340-347.
16. Tantisira KG, Litonjua AA, Weiss ST, Fuhlbrigge AL. Association of body mass with pulmonary function in the Childhood Asthma Management Program (CAMP). *Thorax*. 2003;58(12):1036-1041.
17. Blunden S, Lushington K, Kennedy D. Cognitive and behavioural performance in children with sleep-related obstructive breathing disorders. *Sleep Med Rev*. 2001;5(6):447-461.
18. Janssen I, Craig WM, Boyce WF, Pickett W. Associations between overweight and obesity with bullying behaviors in school-aged children. *Pediatrics*. 2004;113(5):1187-1194.
19. Taras H, Duncan P, Luckenbill D, Robinson J, Wheeler L, Wooley S. *Health, Mental Health and Safety Guidelines for Schools* [Guideline 3-01]. 2004. Available at: <http://www.nationalguidelines.org>. Accessed August 17, 2005.
20. National Association for Sport and Physical Education. *Moving Into the Future: National Standards of Physical Education*. 2nd ed. Reston, Va: NASPE; 2004.
21. Centers for Disease Control and Prevention. Guidelines for school health programs to promote lifelong healthy eating. *MMWR Morb Mortal Wkly Rep*. 1996;45(RR-9):1-41.

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