

Physical Activity Interventions for Neurocognitive and Academic Performance in Overweight and Obese Youth: A Systematic Review



Eduardo E. Bustamante, PhD^a, Celestine F. Williams, MS^b,
Catherine L. Davis, PhD, FTOS^{c,*}

KEYWORDS

- Physical activity • Exercise • Childhood obesity • Brain • Cognition
- Executive function • Academic performance • Health disparities

KEY POINTS

- One-third of US children are overweight or obese and typically inactive, with poorer cognition and achievement than their peers; minorities have disparities on these factors.
- Physically active academic lessons seem to benefit cognition and academic performance in overweight and obese children more than normal-weight children.
- A few randomized trials have demonstrated efficacy of regular physical activity for improving cognitive and neurologic outcomes in overweight and obese children, including minorities.
- Improved executive function and increased physical activity might be mutually enhancing; more translational research is needed to harness this potential.
- These findings warrant promotion of physical activity for children, with emphasis on participation of overweight and obese children and minorities. T2 translation research is needed.

Disclosure Statement: The authors report no funding and no conflicts of interest.

Registration: PROSPERO: International prospective register of systematic reviews. 2016: CRD42016032340.

^a Department of Kinesiology & Nutrition, College of Applied Health Sciences, University of Illinois at Chicago, 1919 West Taylor Street, Room 626, MC 517, Chicago, IL 60516, USA;

^b Georgia Prevention Institute, Augusta University, 1125 15th Street, HS-1755, Augusta, GA 30912, USA; ^c Department of Pediatrics, Georgia Prevention Institute, Medical College of Georgia, Augusta University, 1125 15th Street, HS-1711, Augusta, GA 30912, USA

* Corresponding author.

E-mail address: cadavis@augusta.edu

Pediatr Clin N Am 63 (2016) 459–480

<http://dx.doi.org/10.1016/j.pcl.2016.02.004>

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INTRODUCTION

In the United States, 18% of children and adolescents are obese¹ with increasing rates of severe obesity.² Fully one-third of students are already overweight or obese in elementary school,¹ and these children are at high risk for chronic diseases,³ evidence low rates of physical activity^{3,4} and physical fitness,⁵ and perhaps most concerning, decrements in brain structure,^{6,7} cognitive function,^{8–13} and academic performance^{14–17} relative to normal-weight peers. Research on the impact of physical activity, both transient effects of single bouts and durable effects from prolonged training, in overweight and obese children are of special interest to children, parents, clinicians, educators, and policy makers because of their potential to improve health and academics. Increasing emphasis on standardized testing has reduced physical activity offerings at school, where children spend most of their waking time.¹⁸ Unfortunately, minority youth from underserved communities evidence substantially higher rates of overweight, obesity, and chronic disease, with fewer opportunities for physical activity, and perform worse on measures of classroom behavior, cognitive function, and academic performance than their peers.^{19–22}

This article focuses on T1 translation (efficacy) of physical activity interventions for neurologic, cognitive, and academic outcomes in overweight and obese children, with attention to minority representation. There is other T1 literature on physical activity in older adults,^{23,24} typically developing children,^{25–27} and children with attention-deficit/hyperactivity disorder.^{28–30} Research in overweight and obese youth is of interest for two main reasons: overweight and obese youth are a population in which researchers are likely to observe the impact of exercise training on children's cognition because of lower levels of the dependent variable (ie, aspects of cognitive function are impaired in children that are overweight or obese relative to normal weight peers)³¹ and low exposure to the independent variable (ie, physical activity and fitness levels are lower in overweight or obese children relative to children without these conditions); and evidence specific to overweight and obese youth is important to meet the growing needs presented by this epidemic.

The rationale for this area of research derives from basic research demonstrating benefits of physical activity on brain function and cognitive performance in rats³²; and observational studies establishing associations between physical activity, physical fitness, and weight status with brain function, cognitive function, and academic performance.^{33–35} Executive function, including core elements of inhibition, working memory, and cognitive flexibility, which together enable complex decision making, self-monitoring, and planning functions,³⁶ is poorer in obese children and adolescents,³¹ and is more responsive to physical activity than other cognitive abilities, such as memory.^{24,37,38}

METHODS

A systematic review of the literature was conducted.³⁹ See **Box 1** for details.

RESULTS

Acute Bout Studies

To date, there have been three studies investigating the impact of acute (single) bouts of physical activity on cognition and academic performance in overweight and obese school-age children.^{40–42} All three used within-subjects designs counterbalancing bouts of physical activity with bouts of sedentary time. Methodologic rigor was low to moderate (no randomization, or analyses ignored cluster randomization; per

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