Physical Education in Schools Helps Reduce Future Cardiovascular Risk

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In many parts of the world, the prevalence of childhood overweight and obesity has increased at an alarming rate. In the United States between 1963 to 1965 and 2003 to 2004, there was a 348% relative increase in overweight children 6 to 11 years of age. This figure has risen from 4.2% to 18.8% in the same period of time. If this trend continues, 1 in every 4 children in the United States will be obese by 2015. Similar increases in childhood overweight or obesity have also been observed in Canada, the United Kingdom, China, Germany, France, and Finland.

Overweight and obesity are associated with a number of comorbidities even in childhood. Although there is less information available in youths than in adults, it is very clear that children experience many detrimental effects of overweight or obesity similar to adults, and they often carry these comorbidities into adulthood. The list of the most alarming of these comorbidities includes, but is not limited to, type 2 diabetes mellitus, the metabolic syndrome, dyslipidemia, systemic hypertension, atherosclerosis, depression, pseudotumor cerebri, nonalcoholic fatty liver disease, nonalcoholic steatohepatitis, and obstructive sleep apnea.

The prevalence of the metabolic syndrome in adolescents is 4% overall but is 30% to 50% in overweight children. Concomitant with the rise in prevalence in overweight and obesity and the metabolic syndrome has been a dramatic increase in type 2 diabetes mellitus in youth. This increase is most noticeable in minority youth.

Studies in Muscatine, Iowa, and Bogalusa, La, have shown convincingly that obesity during childhood and adolescence is a major determinant of a number of other cardiovascular risk factors, including elevations in triglycerides and lowering of high-density lipoprotein lipoproteins. Studies also have confirmed the association between depression and obesity. Depression scores were highest in children with the greatest increase in body mass index (BMI).

Multiple risk factors for the development of overweight or obesity in youth have been implicated in this epidemic. These risk factors may be categorized into 3 groups. The first risk factor is an increase in energy consumption. A partial list of dietary habits that result in increased energy intake includes the consumption of fast foods, sugar-sweetened soft drinks, large portion sizes, and calorie-dense foods. A decreased consumption of fruits and vegetables is also a trend that contributes to obesity and overweight. A second risk factor is decreased energy expenditure. This occurs with excessive screen time (television, computers, and handheld games), decreased physical education and activity in school, and excessive homework. A third risk factor, which is unalterable, involves a child’s genetic makeup, which cannot be controlled by the child but may predispose to obesity.

However, the obesity epidemic in youth is, in a sense, the perfect storm. Obesity is the result of many risk factors, some that can be modified and others that cannot. Adding to the complexity of the perfect storm is the fact that these risk factors relate to each other, making the study of individual risk factors difficult at best. Children live in an obesogenic environment. This is a toxic environment in which multiple factors promoting obesity interact at the same time. Unless and until all these risk factors are simultaneously addressed and reduced, the obesity epidemic cannot be controlled and eventually decreased.

Weight reduction does help, however. Improvement in weight status and decrease in body fatness have been shown to be associated with a decrease in systolic and diastolic blood pressures; a decrease in total cholesterol, low-density lipoprotein cholesterol, and/or triglycerides; and a decrease in insulin resistance.

In this issue of Circulation, Walther et al describe a clever study that evaluated the effects of increased exercise on physical fitness and endothelial progenitor cells in school children. The study was carried out in Germany where physical education classes are required for all students in the sixth grade. These students served as the control group, although they did receive 2 units of physical education per week mandated by law to be 45 minutes per session. The intervention class in this study, however, had daily physical education classes. An interesting third group consisted of students who participated in competitive sports; they received 12 units of high-level endurance exercise training per week and participated in competitive sports activities. Multiple parameters were measured during this study in all 3 groups. It should be noted that most of these students were not overweight at the beginning of the study. It is no surprise that there were no significant differences observed in BMI during the study period in the control and intervention groups. Overall BMI is the result of multiple factors, and unless the majority of these factors are controlled and/or treated, there may be little reduction in BMI during the study period. An isolated intervention, however, may in fact reduce one or
more of the compounding factors that control BMI. The key result to be evaluated with this type of study then would be a change in the individual risk factor being manipulated rather than a global change in BMI. This change in a specific element, however, may decrease future cardiovascular risk.

Exercise capacity was evaluated in the study population, and there was an observed increase in maximal oxygen consumption at peak exercise compared with baseline. This increase in maximum oxygen consumption translates to a more efficient, as well as increased, overall exercise capacity. Lipid values did not change, but the majority of these students had normal lipids at the start of the study. It would have been interesting to observe any changes in the subpopulation who had either a decreased fitness level or an elevated lipid profile at the beginning of the study.

The most interesting parameter evaluated was the measurement of circulating progenitor cells. Impairment of the number and function of circulating progenitor cells has been linked to an increase in atherosclerotic disease risk. In this study, the number of circulating progenitor cells increased in the intervention population, suggesting that increased physical activity may have a role in the primary prevention of atherosclerosis.

Similar studies have also demonstrated that increased exercise and a proper diet will provoke a reduction in body weight and BMI and significantly increase the functional capacity of obese children. Studies have also demonstrated that a favorable effect will be observed on the metabolic profile. The study by Ribeiro et al demonstrated that diet plus exercise significantly increased vasodilation in muscle during exercise and decreased mental stress in obese children. This increase was so dramatic that the muscle vasodilation during these physiological maneuvers reached normal levels after training. This suggests that these alterations toward normal are more pronounced in obese children than in their lean counterparts.

In the study by Walther et al in this issue of Circulation, the majority of subjects were healthy and not overweight or obese. This does not fit the profile for most North American children, who have a much higher incidence of overweight and obesity. The positive effects observed in this study will perhaps be more pronounced in an obese or overweight population.

Extrapolation of the current data suggests that adolescent obesity will increase adult coronary heart disease by 5% to 16% over the next 25 years, with more than 100,000 excess cases of coronary heart disease attributable to increased obesity in childhood. Speculation would lead to the conclusion that an increase in physical activity would be helpful in the prevention of obesity and overweight and the subsequent comorbid conditions. The study reported by Walther et al supports the need to increase physical education and activity in school-aged children.

Disclosures

None.

References


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