

Health Benefits of Physical Activity During Childhood and Adolescence

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HIGHLIGHT

“Children are not little adults. Their responses to activity are quite different from those of adults. Activity programs should be planned with these differences in mind.”

INTRODUCTION

The beneficial effects to health of enhanced physical activity (PA) during adult years are numerous. There is mounting evidence that such benefits include a reduction in morbidity and mortality from diseases of several body systems (Bouchard et al., 1994). Much less evidence is available regarding the effects of an active lifestyle during childhood and adolescence on adult health.

The main reason for the paucity of information on the possible carryover of benefits from childhood to adulthood is the lack of longitudinal studies that have followed the same individuals over many years. Ideally, one would need randomly to assign children into those who are given enhanced PA programs and those who remain sedentary over years and then observe the long-term effects of PA or of inactivity. On ethical grounds, such studies are hard to justify (it is unethical to demand that children not engage in PA for an extended period of time). In addition, they are extremely expensive and logistically most complicated. A second-best alternative would be to conduct controlled intervention studies that last shorter periods and include several groups of subjects who span a wide age range (from childhood to middle age). Such “mixed longitudinal” studies are feasible, but have yet to be launched. Another approach is to identify adults with and without diseases and question them about their PA during earlier years. Such “retrospective” studies are easier to perform, but their outcome depends on the ability of people to correctly remember and report their PA behavior during earlier years. Conclusions derived from retrospective studies are less valid than those derived from longitudinal interventions.

The purpose of this article is to examine briefly the current evidence that enhanced PA during childhood and adolescence imparts immediate health benefits, or reduces risk for adult chronic disease. Emphasis will be given to the following conditions: obesity, hypertension, abnormal plasma lipoprotein profile, and osteoporosis. Table 19.1 summarizes the evidence attesting to such benefits.

SHORT-TERM BENEFITS

Before analyzing the carryover effects of childhood PA, one should identify the *immediate* effects of a training program (or an active lifestyle) on health-related risk factors. These are measured while the program is still in progress, or immediately upon its conclusion. Evidence for such benefits has been sought from intervention training programs that last a few weeks or several months at the most. An alternative approach has been cross-sectional studies that compare children (or youth) who habitually engage in athletic pursuit with those who lead a sedentary lifestyle. The drawback of the latter approach is that differences in health-related risk between groups might not be a result of the physical activity per se. They may instead reflect heredity or events that took place before the child became physically active.

Body fatness. (See Bar-Or & Baranowski, 1994, for a review.) Many, although not all, cross-sectional studies suggest that obese children and youth are less active than their leaner peers. There is only scant evidence, though, that inactivity is *a cause of* juvenile obesity (Roberts, 1993). Training studies with nonobese youth have shown little or no reduction in body adiposity (Wilmore, 1983). However, enhanced PA with or without a low-calorie diet, did reduce % body fat or excess body weight in obese children and youth.

Blood pressure. (See Alpert & Wilmore, 1994, for a review.) Some cross-sectional studies show a slightly higher resting blood pressure among sedentary adolescents compared with their active peers. Most studies, however, do not show such a difference, particularly if the groups have the same adiposity level. Training of healthy, previously inactive children or adolescents who have a normal blood pressure induces little (1-6 mmHg) or no drop in blood pressure. However, in adolescents with hypertension, training over several months does induce a reduction of both systolic and diastolic blood pressure. Even though such a reduction is modest (around 10 mmHg), it may be beneficial for some individuals with mild hypertension who otherwise may require medication to control their blood pressure. The training programs that induced a decline in blood pressure were comprised mostly of aerobic activities. In one study (Hagberg et al., 1984), the inclusion of a five-month weight training regimen following a six-month aerobic program further reduced the blood pressure of adolescents with hypertension. Such beneficial effects of exercise disappear within several months of termination of the program.

Blood lipids. (See Armstrong & Simons-Morton, 1994, for a review.) Based on some cross-sectional studies, children and adolescents who are physically active, or whose aerobic fitness is high, have a more favorable blood lipid profile than their sedentary, or less fit, peers. This difference is particularly apparent in high-density lipoprotein cholesterol (HDL-C = the “good” cholesterol), which is higher in the active groups. Other cross-sectional comparisons, however, do not reveal such differences. In most of the cross-sectional studies it is impossible to separate a high activity level from a high fitness level.

Training studies of several weeks’ duration have failed to show any beneficial effect on the blood lipid profile in healthy children or adolescents. More beneficial responses have been shown for groups who have a high coronary risk. These include children and adolescents with insulin-dependent diabetes mellitus, obesity, or with at least one parent who has three or more coronary risk factors.

Skeletal health. (See Bailey & Martin, 1994, for a review.) The possible link between skeletal health and PA has received attention in recent years with the finding that physically active postmenopausal women, and elderly populations in general, have a higher bone mineral density (BMD) and less osteoporosis than less active controls. One of the determinants of bone health in old age is the “peak” BMD reached by young adulthood. Bone mass and BMD subsequently (and inevitably) decline with the years, until the bones become fragile.

This topic has an important pediatric relevance, because the great majority of bone build-up occurs during adolescence. A question of major public health relevance is whether enhanced PA during childhood and adolescence will result in a higher peak BMD.

Cross-sectional comparisons have shown that young athletes in weight-bearing sports such as gymnastics, soccer and volleyball (but not in non-weight-bearing sports such as swimming) have a higher BMD than do nonathletes. Likewise, bones of the dominant limb in “asymmetrical” sports, such as tennis or little-league pitching, have a higher BMD than the nondominant limb. Conversely, bones of a limb immobilized for several weeks or months had a lower BMD than in the contralateral, nonimmobilized limb.

Retrospective studies, in which adults were asked about their PA during childhood, suggest that women who had been physically active during childhood had a higher BMD in the third and fourth decades of life than women who had been less active as children.

Longitudinal results of weight-bearing training programs are equivocal. Most controlled interventions yielded little or no increase in BMD or bone mass of exercising adolescents (e.g., Blimkie et al., 1993).

CARRYOVER TO ADULT LIFE

There are several models that may explain a possible link between an adult person’s health and her or his activity behavior in earlier years. As suggested by Blair et al. (1989) there are conceivably three avenues by which an enhanced PA level during childhood might improve adult health:

1. Childhood activity improves child health which, in turn, is beneficial to adult health.
2. An active lifestyle during childhood has a direct benefit to health in later years.
3. An active child becomes an active adult who, in turn, has a lower risk for disease than an inactive adult.

Research provides no proof, or disproof, for any of these links. However, because a sedentary lifestyle in adults has been proven to entail a high risk for several chronic diseases (Bouchard et al., 1994), the most plausible link is that an active lifestyle during childhood and adolescence would be carried over through adulthood which, in turn, would reduce risk for disease. There are, however, no prospective studies that have tracked activity patterns from childhood to adulthood. Even though activity patterns and attitudes toward PA remain quite stable during late adolescence (but less so around age 10–12 years) (Malina, 1990), there is a low relationship between the two.

HOW MUCH PHYSICAL ACTIVITY?

There are practically no data as to the *optimal dose* of PA during childhood and adolescence that might maintain and/or enhance health. However, a group of experts from various countries has recently generated a consensus statement (Sallis & Patrick, 1994), which includes the following guidelines for adolescents:

1. *All adolescents should be physically active daily, or nearly every day*, as part of play, games, sports, work, transportation, recreation, physical education, or planned exercise; in the context of family, school, and community activities.
2. Adolescents should engage in *three or more sessions per week* of activities that last 20 minutes or more at a time and that require *moderate to vigorous* levels of exertion.

There is no formal consensus statement for preadolescents although Corbin, Pangrazi, and Welk (1994) have made recommendations for physical activity levels for this group in a previous issue of the *President's Council on Physical Fitness and Sports Physical Activity and Fitness Research Digest*.

TABLE 19.1

Possible effects of enhanced physical activity during childhood and adolescence on risk for chronic disease.

Observed Variable/Risk

Adiposity/ Obesity

Resting Blood Pressure/Hypertension

Blood Lipid Profile

Bone Mineral Density/ Osteoporosis

Cross-Sectional Comparisons

Obesity is associated with hypoactivity.

Less active groups have similar or slightly higher BP compared with active groups.

Young athletes sometimes have a better profile than sedentary controls (mostly in HDL-cholesterol).

Athletes (weight-bearing activities) have higher BMD than nonathletes.

Short-Term Effects of Intervention Programs

General Population: Little or not reduction in % fat

Obese: reduction in % fat

General Population: Little or no reduction in blood pressure

Hypertensives: 5–12 mmHg reduction in SBP and less in DBP

General Population: No improvement in profile

High-risk Population: Improved profile

Immobility induces loss of BMD. Training over several months induces no increase in BMD.

General Population: No information

Obese: % fat returns to pretraining levels in most patients

Carry over to Adult Life

General Population: No information

Hypertensives: BP returns to pretraining values within weeks

General Population: No information

High-risk Population: No information

Retrospective data suggest a possible carryover.

CONCLUSION

Based on current information, no long-term studies exist that support or reject the notion that physical activity during childhood and adolescence is beneficial to adult health. There is, however, some evidence for short-term benefits of enhanced PA during the early years, particularly among children and youth who are at a high risk for chronic illness in later years. Much more research is needed to study this important issue further. In particular, it is essential to identify means of keeping young people motivated to maintain an active lifestyle as they reach young adulthood and middle age.

The contrast between cross-sectional data and those generated through training studies is intriguing. The former suggest favorable health characteristics among active children and youth, compared with sedentary controls. Training studies, on the other hand, show little or no beneficial effect of training among healthy children and youth. This contrast may reflect a preselection of those who become active, and are healthier to start with, versus those who choose to pursue a sedentary lifestyle. It is possible, though, that interventions more vigorous than those commonly used in research would yield greater effects. It has been shown, for example, that army recruits who undergo an intense eight hours per day training regimen for several months respond with an increase in bone mineral content (Margulies et al., 1986) and an improved lipid profile (Rubinstein et al., 1995). Likewise, it is possible that longer interventions (e.g., 1–2 years) than those used in most studies would yield more positive training-induced results.

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