

*Participation in youth sports can provide a wide range of health-enhancing benefits and gains in health-related fitness. However, participation alone may not always meet the physical activity and energy expenditure requirements to achieve these expected results.*

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### Improving health through youth sports: Is participation enough?

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WITHOUT QUESTION, REGULAR physical activity plays a significant role in enhancing and maintaining health;<sup>1</sup> however, participation in school-based physical education programs remains unacceptably low, and time for free play is becoming increasingly scarce. These trends continue while the percentage of overweight young people and prevalence of related health risk factors at an earlier age escalate.<sup>2</sup> Parents often see sports, both team and individual, as a regular opportunity for structured, healthy activity and fun, and they believe their children will profit from what are viewed as the myriad health-related benefits of athletic participation. Is this an effective strategy? Does consistent participation in one or more recreational or competitive youth sports always yield the expected and desired results with respect to body composition, musculoskeletal and cardiovascular health, and overall fitness? This article is not intended to review the trends, extent, and consequences of inactivity or other increasingly prevalent negative health-related



behaviors of youth.<sup>3</sup> And it does not emphasize the overwhelming evidence supporting, or strategies for implementing, regular physical activity to enhance health and fitness in school-age youth.<sup>4</sup> The focus of this article instead is on organized recreational and competitive youth sports, in particular, how parents and those administering these activities can better provide opportunities for young people to achieve the projected health and fitness advantages associated with sports participation, through maintaining sufficient and appropriate physical activity levels and energy expenditure.

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### ***Health and fitness advantages of youth sports participation***

While there is a recognized potential risk of incurring a variety of acute and overuse injuries for the millions of youth who are regularly involved in popular community- and school-based and other organized youth sports programs (for example, junior tennis, which is operated and regulated by the national governing body),<sup>5</sup> appropriate and safe youth sports participation can provide a wide range of complementary health-enhancing benefits and gains in health-related fitness compared to those achieved through other moderate to vigorous physical activity outside of organized sports (for example, recreational exercise and free play).<sup>6</sup> Moreover, regular participation in organized sports and consequent enhanced (that is, improved as a result of regular participation) health and physical fitness in youth may have a positive impact on cardiovascular and other measures of health later in life.<sup>7</sup>

A brief sampling of health-enhancing benefits and health-related fitness responses and profiles in selected popular youth sports participants reinforces these perspectives. Sport and competitive-level-specific advantages in cardiorespiratory fitness and general and functional muscular strength, endurance, and power have been shown in boys and girls across a variety of youth sport activities such as soccer, swimming, tennis, and gymnastics.<sup>8</sup> Studies examining trained young athletes and other regular participants in youth

sports, compared to untrained boys and girls, have found lower total cholesterol and other favorable profiles in serum lipid parameters associated with cardiovascular health and risk (HDL and LDL cholesterol, lipoprotein subfractions, and triglycerides); however, these measures are reportedly not always strongly associated or consistent with training status or volume, fitness, or sports participation in youth.<sup>9</sup> In terms of body composition, favorable changes and maintenance (that is, higher percentage of fat-free mass and lower percentage of body fat) are associated with participation in school-sponsored and other organized youth sports programs.<sup>10</sup> Moreover, regular participation in high-volume impact-loading and running-based sports (for example, basketball, gymnastics, tennis, soccer, lacrosse, and distance running) and training activities is associated with enhanced whole-body and regional bone mineral content and density.<sup>11</sup>

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### ***The lack of sufficient physical activity and energy expenditure***

Despite extensive evidence of numerous health-enhancing benefits and gains in health-related fitness from certain organized youth sports, many sports and related practice drills do not require or provide sufficient physical activity and energy expenditure to achieve measurable health and fitness advantages. This is especially true in the early stages of learning a sport and its specific primary skills, such as when first learning to catch, throw accurately, serve, dribble, or use correct mechanics when swimming. Moreover, volunteer organized youth sports coaches are not always adequately trained to keep children appropriately active for their level of development and readiness to participate,<sup>12</sup> while still maintaining an emphasis on fun, fitness, and basic skill development. For example, there is often too much standing around while “waiting for a turn.” This can be compounded by limited resources and space, inappropriate coach-to-child ratios, and personal priorities and expectations of coaches and administrators that do not always

match or fit with those of the children and parents. Consequently many children routinely leave practices and even competition events feeling bored and as though they did not do much activity at all. If youth are not sufficiently active and expending enough energy, they are less likely to achieve measurable health and fitness advantages. Moreover, youth who are not meaningfully active are less likely to remain interested and motivated to continue practicing and developing skills, and competing becomes an increasingly challenging task, with dropping out more likely to occur.

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***Ensuring that participation in sports provides sufficient physical activity***

A number of activity and lifestyle strategies effectively contribute to enhancing and maintaining a young person's health, such as regular active free play, walking, bicycle riding, good nutrition, and sufficient rest. If participation in organized recreational and competitive sports, however, is the primary means for meeting health-promoting physical activity requirements, then certain physical activity criteria (specifically, frequency, intensity, and duration), appropriate supplemental or cross-training (that is, concomitant training for more than one sport or multiple fitness components, such as endurance, strength, and flexibility), and other factors should be considered for such an approach, so that optimal enjoyment and health are more likely realized.

***Frequency, intensity, and duration***

To achieve measurable gain in musculoskeletal and cardiovascular health and fitness through sports, a child or adolescent must participate regularly—four to five times or more per week—in moderate to vigorous sport activities.<sup>13</sup> Moderate and vigorous activities are measured by a standard metric called metabolic equivalent (MET). One MET is equal to the energy (oxygen) that the body uses while the person sits quietly, perhaps while talking on the phone or reading a book. The harder the body works during an activity, the higher

the METs. Moderate activities have a metabolic cost (that is, oxygen consumption) of 3 to 6 METs, and vigorous activities involve more than 6 METs. Moderate and vigorous sports activities should occur four to five times or more per week, and each session should prompt sufficient energy expenditure for an extended period of time—generally at least near 50 percent of maximum effort (overall) for sixty minutes or more. That is, the frequency, intensity, and duration of activity (also known as dose) must be challenging enough to prompt the desired health-related effects on body composition and other musculoskeletal and cardiovascular health- and fitness-related characteristics and risk factors.<sup>14</sup> Soccer, singles tennis, basketball, and field hockey are notable examples of popular sports that require extensive physical effort over an extended length of time when a child or adolescent achieves a certain level of play.<sup>15</sup>

The amounts of regular activity and energy expenditure provided by practice and competition in these and other similarly active sports<sup>16</sup> readily meet these physical activity requirements for achieving and maintaining health and fitness. This is especially true when children participate regularly throughout the year in school varsity programs, intramurals, leagues, or other community-based structures. Naturally, even when an experienced and well-trained young athlete is required to perform or train too much, especially at a high intensity or in a challenging (hot) environment, the youth is often at great risk for poor performance and injury. This underscores the adage that more is not always better or even safe. Yet young participants who are less proficient in one of the active sports (soccer, tennis, basketball, and other high-activity sports) are less likely to consistently have sufficient physical activity dose and energy expenditure. With other popular sport activities (for example, baseball, softball, and volleyball), even advanced players are likely to reach the moderate MET range for only brief periods of time and a vigorous level even less often.

### ***Cross-training***

If a chosen sport does not provide enough vigorous exercise to maintain or enhance health and health-related fitness due to the low activity levels of the sport or limited skill level of the youth participant,

then incorporating regular supplemental cross-training can be a viable and appropriate means to increase overall daily physical activity and energy expenditure levels. Complementary exercise, with an emphasis on progressively developing cardiovascular fitness, muscular strength and endurance, flexibility, balance, and coordination, will increase functional and overall fitness and reduce the risk for incurring injury during sport participation and training. Suitable activities could include other sports or sport skill drills (such as dribbling and passing drills or repeat shuttle runs), resistance training, running, bicycling, and a variety of other exercises using the body and appropriate training devices, such as jump ropes, weighted balls, agility ladders, plyometric boxes and hurdles, and cones.

In addition to ensuring that a young person is engaging in adequate levels of moderate and vigorous activities for health and fitness, appropriate and progressive supplemental cross-training readily translates to sport-specific benefits, such as a child's increased perceived and actual development and competence on the field or court and increased ability to participate for longer periods at a higher intensity and more effectively. These outcomes could potentially improve a youth's perception of participating in the sport because it is more fun, engaging, and health enhancing. Given that novel and challenging supplemental training can readily increase the risk for fatigue, injury, and reduced performance, cross-training activities (as with the sports themselves) need to be well monitored and appropriate for a young person's maturation, fitness, goals, and motivation.<sup>17</sup> Of course, cross-training is appropriate and beneficial with skilled young athletes participating in high-activity sports as well.

Children and adolescents respond well, much like adults do, to progressive and periodized increased training loads (that is, the intended training adaptations are similarly achieved in youth as in adults). Resistance training (for example, free weights, weight machines, medicine balls, elastic tubing, and body weight), once thought to be inappropriate and unsafe for children, can be effective in increasing strength in boys and girls if it is introduced progressively and done correctly with appropriate supervision.<sup>18</sup> Resistance training can increase motor unit activation, motor skill

coordination, and other neurological adaptations, which translate to increased strength, enhanced sport performance, and reduced risk of injury.<sup>19</sup> Moreover, with appropriate and regular moderate-to-vigorous interval, circuit, and endurance training, young people, like adults, can experience similar improvements in aerobic fitness as well.<sup>20</sup> *Interval training* is broadly defined as repetitions of high-speed and high-intensity work followed by periods of rest or low activity. *Circuit training* is a type of interval training in which strength exercises are combined with endurance and aerobic exercises, ranging from hydraulic equipment, free weights, resistance training, squat thrusts, push-ups, star jumps, sit-ups, or other exercises. *Endurance training* is exercise training to increase an individual's duration tolerance for aerobic exercise.

To encourage young children to be more active and enjoy exercise and to complement other activities such as sports, health clubs and kids-only gyms are providing “kid-size” equipment, such as elliptical trainers, treadmills, stationary bikes, weight machines, and play- and sport-oriented workouts. These adaptations to traditional adult exercise equipment and activities can increase safety and enthusiasm to exercise, especially if the program is well supervised. However, accessibility to these opportunities in terms of availability and costs could well limit their use, especially among youth from lower socioeconomic status.

### ***Active participation and access points***

Because children and adolescents have an increasing number of demands on their time, parents are attracted to the concentrated time frame of physical activity that organized youth sports participation tends to offer. However, to meet the physical activity and energy expenditure guidelines for a healthy lifestyle, sports program organizers need to be deliberate and establish teams and groups with small numbers of youth per coach, court, and field. This can increase overall exercise intensity and energy expenditure through maximized activity and playing time. Without implemented policies that enable more active participation, youth are likely to become disenchanted and disengaged from the sport.

Ideally there should also be readily accessible safe and sufficient facilities and opportunities for young athletes to practice, play, and compete on their own or in other community-sponsored organized leagues and events such as local tournaments.

### *Nutrition and rest*

Increased participation in youth sports training and competition necessitates a corresponding appropriate increase in caloric and selected nutrient intake, with emphasis on sufficient carbohydrates, protein, water, and certain minerals (iron, calcium, and sodium), to meet the energy and nutrient demands of normal growth and development, as well as the additional physical activity, performance, and recovery requirements.<sup>21</sup> Despite the competing energy requirements of intense and frequent training and competition, inappropriate and insufficient dietary practices may be much more likely to be the reason for any observed or suspected negative effects on growth and maturation.<sup>22</sup> For example, chronic mild undernutrition, that is, a negative energy balance, is often characteristic of young female gymnasts attempting to maintain body weight for performance reasons, even though it is in opposition to the natural course of normal growth and appropriate weight gain. Concerned parents, coaches, and youth should consult with physicians, nutritionists, and other certified health professionals in their community when they suspect an inappropriate dietary behavior or strategy or simply need guidance. There are also a number of useful Web sites to refer to for appropriate guidelines and recommendations related to youth, physical activity, and nutrition, including the American Academy of Pediatrics (<http://www.aap.org>), American College of Sports Medicine (<http://www.acsm.org>), and National Institutes of Health (<http://health.nih.gov>).

In addition to proper nutrition, sufficient rest and recovery plays an often unappreciated yet equally fundamental role in any young athlete's health, development, and adaptation to training, as well as safe and effective performance in youth sports. Rest and recovery is particularly critical between same-day workouts or competitions. During football two-a-days or soccer and tennis tournaments, for



example, young athletes are often required to train or perform for a second or third time, following a prior strenuous exercise session or competitive match, on the same day with a minimal recovery time between bouts. Sport governing bodies' rules, tournament directors, and coaches often do not provide appropriate and sufficient recovery time that would allow a young athlete to compete or train again safely and optimally on the same day. In sanctioned junior tennis tournaments, for example, young players are often faced with having to play again after only one hour of rest, even after a long, arduous match.<sup>23</sup> Empirical evidence indicates that during the second round of training or competition, a young athlete has much less tolerance to the activity and often succumbs to the strain of the excessive demands. This is particularly evident in hot environments.

Unfortunately, little is known about on-field or on-court heat strain or fatigue profiles in youth sports, and much less regarding appropriate and sufficient recovery time that would allow a young athlete to compete or train again safely and optimally on the same day. Moreover, the degrees to which residual effects from a training or competition bout are carried over and affect a young athlete during a subsequent same-day bout are not well studied. Consequently little information exists to guide sport governing bodies, tournament directors, and coaches on recovery time for any age or level of fitness. Therefore, numerous young athletes are put at risk for poor performance and injury due to inadequate recovery and subsequent uncompensable physiological strain. New information strongly suggests that one hour is insufficient for even very fit young athletes to adequately recover from strenuous exercise in the heat.<sup>24</sup> Similarly, three or four hours may not be enough in certain conditions and situations, for example, in extreme heat or following extensive exertion.<sup>25</sup>

In particular, parents should be mindful that travel demands in youth sports, with a team or as an individual, can sometimes interfere with a young athlete's schoolwork and rest and recovery opportunities, and thus should be curtailed if their child's health or school or sport performance is noticeably affected. Finally, tapering training volume leading up to an important or difficult competition and allowing enough rest and recovery time following a challenging

training period or event is also integral to optimizing performance and reducing injury or overtraining risk.

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### ***How much is too much?***

Participation in organized youth sports should complement other activities, including physical education and play during unstructured free time. But how much physical activity is too much? While the reported percentages of overweight children and adolescents continue to grow, a growing number of youth specialize in one or two sports and compete and train at a very high level year-round. Whether preparing for a college scholarship or professional sport career opportunity, these young athletes are training and competing hard and often. While various surveys and other injury reporting methods have described the incidence and associated risks of injuries in various youth sports, the primary focus has been on acute traumatic injuries.<sup>26</sup> Overuse and other injuries (for example, heat exhaustion, muscle cramps and strains, tendon impingement, or sprains) in sports-active youth prompted by excessive repetitive stress or overload, muscle imbalances, environmental stress, and training and competition scheduling demands are often less readily identified or even reported.<sup>27</sup> Moreover, it is challenging to find evidence-based information to guide youth sports coaches, parents, and administrators on effective age-appropriate training and competition strategies and limitations. Recent published recommendations and guidelines are intended to improve the safety profile of young athletes and reduce the incidence of heat-related injuries and fatalities during the preseason in youth football (<http://www.acsm.org>).<sup>28</sup> However, similar specific guidelines and supporting research to address training and competition demands and scheduling are lacking in most other youth sports.

Children and adolescents can usually tolerate a variety of vigorous activities, including intensive sports training and competition. Even marathon and triathlon participation by children and adolescents can be safe.<sup>29</sup> However, with any sport or supplemental training program, the exercise load (its frequency, intensity, or duration),

rest and recovery times, and training expectations must be individualized and appropriate for the level of maturation, fitness, motivation, goals, time constraints, and other conflicting demands (for example, family obligations, school responsibilities, and other interests) of the child or adolescent. Otherwise the health-, fitness-, and performance-related benefits of these additional training activities will be negated by fatigue, injury, frustration, and resentment.

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### ***Conclusion***

While the focus here is on increasing regular activity and energy expenditure to enhance health-related outcomes from organized youth sports participation, numerous other contributing factors are critical to this process. Youth do not necessarily acquire the health and health-related fitness benefits that many parents and other adults assume will be achieved through participating in youth sports without deliberate efforts to ensure that the amount of moderate to vigorous exercise is sufficiently maintained for each young person. Indeed better awareness education for parents, volunteer coaches, and sport organization staff about what is reasonable from a health perspective is also needed (see, for example, American Academy of Pediatrics: <http://www.aap.org>; National Institutes of Health: [http://www.niams.nih.gov/hi/topics/childsports/child\\_sports.htm](http://www.niams.nih.gov/hi/topics/childsports/child_sports.htm); National Association for Sport and Physical Education: <http://www.aahperd.org/naspe/>). Organizations requiring coaching certifications with high coaching competency standards and continuing education in areas such as child development and training and injury prevention specific to youth for those coaches and administrators involved in youth sports reinforce the positive contributions that organized youth sports can have on a young person's health. Through increased knowledge and appropriate policies, youth sports programs can be contexts that collectively and effectively foster a lifetime of safe sports participation and other healthy activity-related habits, thereby lessening the growing prevalence of inactivity and overweight in America.

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