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EXERCISE EFFECTS ON CHILDREN'S HEALTH

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KEY POINTS

1) The appropriate amount of exercise (neither too little nor too much) is presumably important in the healthful growth and development of children.
2) Many young children and adolescents who are obese, have elevated blood lipid levels, or exhibit other risk factors for cardiovascular disease that may be ameliorated by an appropriate exercise program. These children should be identified early so that suitable education and intervention programs may be planned; public and private schools are proper venues to help children initiate a healthy lifestyle.
3) No sport is risk-free, but sports-related injuries may be minimized with proper preparticipation screening, supervision, regulations, and equipment.
4) Children in weight-dependent sports such as gymnastics may be vulnerable to eating disorders and related consequences, such as premature loss of bone mass.

INTRODUCTION

From a public health perspective, regular exercise can play a major role in preventing several leading degenerative diseases in industrialized societies. Although most degenerative diseases such as coronary artery disease manifest themselves in adulthood, their genesis may be traced to unhealthy behaviors in earlier years. In Healthy Children 2000, the United States Department of Health and Human-Services (1992) noted that childhood is a critical time for developing healthy attitudes and behavior patterns related to tobacco use, diet, physical activity, and other health-related behaviors that may persist into adulthood.

The proper amount of exercise is presumably important for the optimal development and health status of children. Too much or too little exercise may have some adverse effects (McKeag, 1991). The purpose of this report is to provide a broad overview of the exercise-related concerns of pediatric health professionals.

CHILDREN, EXERCISE, AND CHRONIC DISEASES

There is a popular perception that North American children are neither physically fit nor physically active, but this perception has been challenged recently and is the focus of considerable debate. Corbin and Pangrazi (1992) suggested that the evaluation of fitness in children by norm-referenced standards has led to an excessive failure rate, which is reduced significantly upon changing to the use of newly developed criterion-referenced health (CRH) standards. The CRH standards are based on criteria such as aerobic power and body fatness that are thought to produce specific health benefits or to affect specific health risks. The evidence underlying the establishment of CRH standards for children has been questioned (Updyke, 1992), but Blair (1992) agrees with Corbin and Pangrazi that we can at least be reasonably comfortable with the current standards for aerobic power and obesity.

Assuming that children should expend at least 3 kcal/kg body weight per day through physical activity, Blair (1989) noted that roughly 90 percent of American children could be classified as physically active. Nevertheless, both Blair (1989, 1992) and Corbin and Pangrazi (1992) acknowledge that up to 8-9 million school-aged children may be at increased risk for degenerative diseases because of insufficient physical fitness.

Exercise Effects on Risk Factors for Coronary Heart Disease in Children

About one-half of North American children will eventually die of coronary heart disease (CHD). Many children, even those as young as 5-6 years, have several risk factors for CHD, the most common of which are obesity, high blood pressure, and elevated serum cholesterol levels (Chandra, 1992). Obesity may be critical because it is associated with both high blood pressure and high cholesterol (Lohman, 1992). Although adolescent obesity certainly has adverse implications for long-term health, it also imposes a harmful psychological burden because of an obesity-related social stigma (Williams, 1986).

The etiology of childhood and adolescent obesity is unclear (Williams, 1986), but experts in human growth and development note that physical inactivity is a major risk factor (Malina, 1989). Although caloric restriction is a key element in the prevention and treatment of obesity and related CHD risk factors, such restric-tion in children may suppress growth and development (Rowland, 1990). Accordingly, increasing caloric expenditure by habitual exercise may be even more important for children than for adults in preventing and controlling obesity. In addition, properly designed exercise programs can lower blood pressure and serum lipid levels in obese children (Endo et al. 1992).

CHILDREN, EXERCISE, SPORT, AND APPEARANCE

Children may participate in sports or in exercise fitness programs in an attempt to improve their bodily appearance and thereby enhance their social status. Sports programs for children, particularly girls, have increased extensively over the past two decades, and children appear to be exercising more intensely in order to improve their performance. In certain sports, such as gymnastics and figure skating, children may focus not only on skill improvement but also on weight control as a means to enhance performance. Although increased sports participation and proper weight control are behaviors generally deemed to be desirable for children, there are also reasons for concern if the behaviors are pursued without adequate supervision.

Sports Injuries

Among school-aged children, unintentional injury is the leading cause of morbidity and mortality (Lenaway et al., 1992). Participation in youth sports is relatively safe, but injuries become more prevalent with increasing age, body size, and skill (Landry, 1992; Lenaway et al., 1992). Catastrophic injuries to the head, face, eye, and mouth may be minimized if the requirement for protective devices is enacted by all organizations sponsoring sporting and recreation events that pose risks of injury.

Overuse injuries may be caused by excessive exercise. Of special concern is the potential for repeated bouts of long distance running to damage the epiphyseal growth plates in the leg bones of growing children. Although there is some absence of adequate scientific evidence that such running is actually harmful, Rowland (1990) supports the recommendation of the American Academy of Pediatrics that children should avoid participating in long-distance competitive running events that are designed primarily for adults. However, it is the overall mileage logged during training, rather than that covered on the day of competition that matters.

Heat Injuries

In general, prepubescent children can maintain adequate body temperature regulation during exercise in thermoneutral or warm environments but, compared to postpubescents and adults, they are at increased risk for heat injuries while exercising in hot environments. Contributing to this increased risk are the facts that prepubescent children exhibit (1) a greater oxygen cost and heat production for a standard submaximal exercise task; (2) lower sweating rates with similar tasks; (3) lower rates of sweat production per eccrine gland, and (4) lower sensitivities of eccrine glands to a given change in core temperature (Bar-Or, 1988; 1989). Obese or anorexic girls are at special risk for heat-related disorders (Bar-Or, 1988). Furthermore, because prepubertal children rely heavily on increased circulation to the skin to control body temperature, a decreased central circulation as a result of dehydration may impair their ability to perform endurance exercise in the heat (Bar-Or, 1988). Thus, caution should be used in scheduling hot-weather events for children, and fluid replacement during exercise should be of high priority.

Resistance Training Injuries

Increasing numbers of children and adolescents are using resistance training (weight training) to improve their appearance, to increase strength for sports performance, or to help prevent sports-related injuries, even though there is little direct evidence that stronger muscles lead to less frequent or less severe injuries (Rowland, 1990). On the other hand, there is substantial evidence that improper weight training, such as employing maximal lifts, may cause serious musculoskeletal injuries, including ruptured intervertebral discs and damage to epiphyseal growth centers (Risser, 1991; Rowland, 1990; Sale, 1989). Although the incidence of weight-training injuries in children and adolescents is not well documented, several reports indicate that few injuries occur in programs that are carefully supervised and involve proper instruction on technique. Poor technique is the main cause of injury when heavy weights are lifted (Risser, 1991), but children should nonetheless avoid maximal and explosive lifts (Sale, 1989).

Weight Loss

Physical appearance is an important determinant of social status in adolescents, so it is not surprising that 70 percent of high school girls and 30 percent of boys in a nationally representative sample were

attempting to lose weight or prevent weight gain (National Institutes of Health, 1992). Children at an increasingly earlier age seem to be concerned that body weight affects their appearance. In a recent study of fourth graders, approximately 60 percent of the girls and 40 percent of the boys desired to be thinner and were already resorting to dietary modifications in hopes of restricting their caloric intakes (Gustafson-Larson & Terry, 1992). This concern about body size exists even in kindergarten students (Chase & Dummer, 1992). Under proper medical guidance, weight control programs for children and young athletes may be safe and effective (Horswill, 1992). However, unsupervised programs should be discouraged (National Institutes of Health, 1992). Good nutrition is vital for young athletes undergoing important changes in growth and development. But their desire to achieve a lower than normal body weight to become eligible to compete in a lower weight classification for a specific sport may result in poor dietary practices. Research comparing young female gymnasts at different ages suggests that poor diets may impair growth, but the lower than normal body weights of these gymnasts may simply reflect the fact that youngsters with inherited traits leading to small muscular bodies are more likely to be participants in gymnastic teams and clubs (Benardot & Czerwinski, 1991).

Numerous studies have revealed nutrient deficiencies and pathogenic weight-control behaviors in young athletes in weight-classified sports. Unfortunately, there are few data relative to the long-range health effects of such practices (Williams, 1992). On the other hand, anaerobic capacity and other measures of athletic fitness may be impaired by improper eating habits (Williams, 1992).

Girls who are overly concerned about their body weight may find that excessive exercise and/or caloric restriction adversely affects their menstrual status. Although there is no experimental evidence that athletic training delays menarche in girls (Loucks, 1989), exercise and caloric restriction are strongly implicated as causative factors in the etiology of secondary amenorrhea in postpubescent girls. Although one of the benefits of exercise for children is possibly incrementals in bone mass (Slemenda et al, 1991), excessive exercise leading to secondary amenorrhea may lead to bone demineralization (Loucks, 1989) with implications for premature osteoporosis and bone fractures.

Adolescent females overly concerned with their body weight are also prone to anorexia nervosa, a psychological disorder characterized by self-starvation and excessive exercise. Severe medical consequences of anorexia nervosa include cardiac arrhythmias and death. In recent years, the term anorexia athletica has been applied to those athletes who exhibit some of the characteristics of anorexia nervosa.

HEALTHY CHILDREN - HEALTHY ADULTS

Although the major focus of this paper has been health risks associated with exercise in children, the potential health - related benefits of physical activity far out-weigh the risks. Too much or too little exercise may pose health risks, but there are considerably more children in the latter category who could benefit by increasing their physical activity. Although parents, pediatricians and others in the community may foster increased opportunities for physical activity in childhood, school administrators may have the greatest potential for impacting children's exercise behavior. Implementing the action plan in Healthy Kids for the Year 2000 (American Association of School Administrators, 1992), would make regular exercise an important component of an educational plan designed to help all children develop a healthy life-style. School-based programs that focus on proper exercise and nutrition, such as the Heart Smart Family Health Promotion Program (Arbeit et al).,1992), have been effective in reducing health risk factors.

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Supplement

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HEALTHY KIDS

Children and adolescents are at a critical stage in life for the development of numerous health-related attitudes and behaviors that may affect their health status during adulthood. For example, patterns of physical inactivity, tobacco use, and inappropriate eating habits may persist through childhood and adolescence into adulthood, establishing a foundation for the premature onset of chronic degenerative diseases such as coronary artery disease, diabetes, hypertension, obesity, and cancer. Most children are not concerned about the devel-opment of disease far into their future, but if provided the opportunity, they might be better able to develop a life-style that could mitigate risk factors for chronic diseases.

In Healthy Children 2000: National Health Promotion and Disease Prevention Objectives Related to Mothers, Infants, Children, Adolescents, and Youth, the United States Department of Health and Human Services has provided the blueprint for what needs to be done. Healthy Children 2000 deals with a wide variety of health issues facing children, including the following recommendations related to physical activity.

· Increase to at least 75 percent the proportion of children and adolescents aged 6 through 17 who engage in vigorous physical activity that promotes the development and maintenance of cardiorespiratory fitness; such activity should be performed three or more days per week for 20 or more minutes per occasion.

· Increase to at least 50 percent the proportion of children and adolescents in 1 st through 12th grades who participate in daily school physical education.

· Increase to at least 50 percent the proportion of school physical education class time that students spend being physically active, preferably engaged in lifetime physical activities.

. Reduce overweight to no more than 15 percent among adolescents aged 12 through 19.

Other objectives relative to the development of strength and flexibility, the reduction of obesity, and the prevention of diabetes also incorporate guidelines for increased levels of physical activity.

A concerted community effort is needed to implement a plan to achieve these physical activity objec-tives and other components of a healthful lifestyle. Parents, teachers, school administrators, family physicians, pediatricians, civic leaders, city or town officials, and the students them-selves need to cooperate in order to provide a comprehensive community approach, but one of the best venues for implementing a total wellness program is the school. The American Association of School Administrators published a manual, Healthy Kids for the Year 2000: An Action Plan for Schools, detailing approaches for providing direct instruction on life skills and behaviors related to wellness and disease prevention, a healthy school environment, and health services.

The health and welfare of our children need to be local, state, and national priorities. At whichever of these levels is most appropriate, practition-ers in health and physical education, exercise science, and sports medicine all have a responsibility to encourage specific programs or legislation that may enhance the health status of the nation's children.