Health Concern of Programmed Exercise and Sports in Children
運動對兒童健康的影響

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摘要

運動對身體健康的益處已是眾所皆知，而先進科技的運動產品更加把運動世界帶進另一新領域。現代的資訊配合運動明星不段地出現，使運動變得普及化，並吸引了大量青少年參與。運動可增進兒童的智慧、心理和社交的發展。同時，它也隱藏著創傷的危機。

Abstract

The well-documented health benefits of exercise, the introduction of large varieties of sports, the soaring technological advancements in sporting tools and facilities, coupled with the birth of numerous prodigy sports stars, made famous over-night by the help of modern telecommunications, have all led to the increasing popularity of sports amongst the community. This is especially true amongst the young age group.

Exercise creates not only a healthier and fitter being, but can enhance a child intellectually, mentally and socially. On the other hand, the risks that arise as the aftermath of increased sports activities cannot be taken lightly. The rising incidence of sports injuries in children has become a matter of concern.

Introduction

Towards the turn of the century, the number of young people participating in sports activities has been steadily increasing. The major contribution to this trend is no doubt the realisation of the importance of exercise in relation to health in the general public. Another important factor that helps to promote sports is of course the fame and wealth that is inevitably partnered with sporting success. This is reflected by the astronomical amounts of prize money channelled by commercial enterprises. Sporting stars like Michael Jordan, Andre Agassi, Steffi Graaf and Mike Powell are just a few names that numerous youngsters enviously admire.

Nowadays, more and more young people are beginning to participate in sports (McCoy, 1994; Cook, 1995; Baxter, 1995), be it competitively, or just for sheer fun. Children, even at an early age, are being exposed to a wide range of sporting activities, at school as well as at clubs and institutes. There, appropriate facilities, trainers and programmes are readily available to them. In the United States, of boys aged 8 to 16 years old, around half participate in organised competitive sport, whilst a quarter of females of this age group do the same (Baxter, 1995). We see young children roller-blading on the streets, and we also see those training intensively in one sport or another, with the goal of gaining international recognition. Whatever the intentions may be, the growing trend of sports involvement amongst young athletes has resulted in a necessity to more closely examine some important issues that they constantly face while practising sports.

Growth and development and its relation to athletic performance

Although the benefits of sports participation for children are abundant, it is also essential to consider the numerous risks that young athletes face every day. Good planning for sports activities involves careful consideration of the athlete's capabilities, age, sex and stage of maturity. It is not until the process of growth and development, together with the appropriate balances between the different systems of the young athlete's body, is understood thoroughly that unnecessary risks can be avoided.

Neurological development of children

Before 5 years of age, children generally do not have the ability of undertaking complex sports activities, such as those involving team work, because their motor as well as cognitive thinking skills are not well-developed (Dyment, 1991). Moreover, they have as yet little sense of judgement for safety (e.g. apprehension of falling over, or consideration of risks while being underwater as in swimming) (Dyment, 1991). After this age, children begin to acquire better motor and cognitive skills, and to grasp the idea of caution. It is not only until then that engaging in proper sports activities is appropriate.

Until beyond 9 to 10 years old, children experience difficulties in integrating information from different sources, and attention span is short. Thus there are frequent problems with laterality and directionality (Dyment, 1991). Instructions to children of this age during sports participation have to be well-planned — comments have to be short, simple and precise. By the time the child reaches the teenage age group, co-ordination and balance skills improve, reflex times shorten, and sports requiring complex skills, such as ball games and team exercises, can be better played (Dyment, 1991).

As the young athlete matures, learning and proprioceptive skills become further refined, enabling him/her to concentrate more on sporting skills and improve overall performance (Dyment, 1991). When sexual maturation is attained, myelination of motor nerves is complete and there is better neural control (Wilmore, 1994). By this time, the athlete can best determine the most suitable type of sport he/she ultimately desires to put in full devotion.

Physiological growth and development

Physiological changes in the young athlete invariably affects athletic performance. Both motor ability and strength increase with age, but the former plateaus at puberty and the latter at around 20 to 30 years of age (Wilmore, 1994). The times of peak motor ability and peak strength differ for the different genders. Girls generally have less motor ability than boys due to their higher percentages of body fat. They also reach puberty about two years earlier, and thus acquire peak strength earlier. Their strength gains are experienced gradually, unlike boys whose rate of strength gain at puberty is obviously evident (Dyment, 1991; Wilmore, 1994; Maffulli, 1995).

Also improving with age is pulmonary function. Up till physical maturity, lung volume and peak flow rate both increase. The same applies to maximum ventilatory capacity and maximum expiratory ventilation; these increases are in direct proportion with body size growth. Thus, girls, who are smaller in size than their opposite sex, have lower absolute values of pulmonary function (Dyment, 1991; Wilmore, 1994; Maffulli, 1995).

Body size also varies directly with many measures of cardiovascular function. Such factors include heart size, stroke volume and blood pressure. Children have lower stroke volumes and blood pressure, and higher heart rates than adults. In maximal exercise, maximum heart rate decreases around 0.5 beats/min per year. At age 10, a child's maximum heart rate is around 210 beats/min, whereas a person aged 20 would have a corresponding 195 beats/min (Wilmore, 1994). Small children are more likely to experience tachypnea and tachycardia during exercise so as to adapt to their small cardiorespiratory systems. In submaximal exercise, a child's arterial-venous oxygen difference is greater than an adult, in order to further compensate for the smaller stroke volume. In effect, a child's athletic performance is limited owing to the low capacity for oxygen delivery even at high absolute work rates (Dyment, 1991; Wilmore, 1994; Maffulli, 1995).

With improvements in pulmonary and cardiovascular functions as the child grows, aerobic capacity is increased. Peaks are experienced at ages 17 to 21 for males, and ages 12 to 15 for females (Wilmore. 1994). The younger the child, the lower the aerobic capacity, and the more limited the endurance performance. By the time adolescence is reached, the cardiopulmonary system grows disproportionally larger than the rest of the body; exercise and competition then become more efficient (Dyment, 1991; Wilmore, 1994; Maffulli, 1995).

Having low glycolytic capacities and phosphofructokinase activities, children possess low anaerobic capacities. Until puberty, when such parameters increase, young athletes are unable to attain high respiratory exchange ratios during maximal exercise, and lactate production is minimal (Wilmore, 1994).

A small but significant point to note is that children are put at greater risk of hypothermia than adults as they are exposed to greater conductive heat loss . However, they sweat less, and thus are capable of heat dissipation through evaporation (Wilmore, 1994).

Body composition is a major determinant of athletic performance. Preschoolers have very low percentages of body fat, and thus exercising to the stage of maximum oxygen uptake and power output is not possible. The situation is different for girls, whose body fat percentage and mass increase markedly as the oestrogen : testosterone ratio rises during puberty. Fat deposition in this case lowers motor capabilities significantly, and it is partly for this factor that girls cannot perform as well athletically as their opposite sex (Dyment, 1991; Wilmore, 1994; Maffulli, 1995).

Reduction of flexibility and change in body shape and size with age both affect sports performance. It is often a sad event to see young athletes tearfully giving up their all-too-beloved sport due to technique breakdown, especially during puberty, when the body is no longer flexible enough or capable of performing high-skilled actions, as in gymnastics or ballet (Dyment, 1991; Maffulli, 1995).

Physiological growth and development indeed plays a vital role in determining the athletic performance of young athletes.

Anatomical development

The consequences of injury for young athletes can sometimes be very serious, as a child's musculoskeletal system is immature, and is undergoing maturation and modifications. Being most vulnerable during the period of peak height velocity of pubescent children, the musculoskeletal system frequently suffers from overuse injuries. Most uniquely is the presence of open physes in children; injury to these areas are not only detrimental, but can also be permanent (Buckley, 1994). Overuse trauma can result in long-term disturbances on growth, and even disability (Committee on Sports Medicine, 1990). Until ossification of the growth plates is complete, that is, after sexual maturation (Moore, 1992), epiphyseal injuries have to be cautiously prevented and monitored at all times.

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