DOWNLOAD PDF GROWTH, MATURATION, AND PHYSICAL ACTIVITY

Chapter 1 : Growth, Maturation and Physical Activity : Robert M. Malina :

Growth, Maturation, and Physical Activity, Second Edition, covers many additional topics, including new techniques for the assessment of body composition, the latest advances in the study of skeletal muscle, the human genome, the hormonal regulation of growth and maturation, clarification of dietary reference intakes, and the study of risk.

Import into RefWorks 1. Introduction Growth refers to measurable changes in size, physique and body composition, and various systems of the body, whereas maturation refers to progress toward the mature state. The processes of growth and maturation are related, and both influence physical performance. There are three broad stages of development: The definitions of these stages are organized around the primary tasks of development in each stage, though the boundaries of these stages are malleable [1]. Growth in stature is rapid in infancy and early childhood, rather steady during middle childhood, rapid during the adolescent spurt, and then slow as adult stature is attained [1 , 2]. This pattern of growth is generally similar for body weight and other dimensions with the exception of subcutaneous fat and fat distribution [1 , 2]. The growth rate of stature is highest during the first year of life then gradually declines until the onset of the adolescent growth spurt about 10 years in girls and 12 years in boys. With the spurt, growth rate increases, reaching a peak at about 12 years in girls and 14 years in boys, and then gradually declines and eventually ceases with the attainment of adult stature [2 , 3]. In adolescents the skeleton first grows in size and length, after which it gains in density and strength [2 , 3]. The principal sites of growth before the start of rapid adolescent growth are in the legs and arms [2 , 3]. During the adolescent growth spurt, the trunk grows most rapidly [2 , 3]. The long bones of the arms and legs increase their length by the activity of specialized cells located in a so-called growth plate at either end of the shaft of the long bones. As growth nears completion in later adolescence, the growth plate ceases its function, fuses firmly with the shaft of the long bone [2 , 3]. Changes in Physical Abilities during Childhood and Adolescence At the time of childhood, as boys and girls grow-resulting in longer levers and increased muscle tissue-both have the potential to increase their strength. Boys and girls show similar ability to perform motor skills prior to puberty [4 , 5]. In general, boys develop greater strength and thus surpass girls in the performance of most sport-related skills. During adolescence, males show a steady increase in performance and endurance that extends into early adulthood. There are dissimilarities among the girls. Because of physical changes that accompany adolescence, such as increases in fat, girls have a disadvantage for motor performance [4 , 5]. Like other aspects of motor skill, strength shows a steady increase during childhood, with boys being slightly stronger than girls. In boys there is a delay, on the average, of at least fourteen months between the period of the most rapid gain in height and the most rapid gain in muscle weight. The adolescent male who is nearing the completion of his rapid gain in height will have little muscle tissue and strength potential for the next year or two [4 , 5]. Thus, the adolescent male is not as strong as his stature might suggest. The best information available indicates that prior to the age of 14 years and the production of the male sex hormone testosterone , weight training cannot be expected to result in any worthwhile gains in either muscle development or strength [4 , 5]. In addition, weight training for preadolescent boys is an activity with high injury risk if not properly supervised. Sport Participation and Physical Maturity The body structure and a variety of basic functions that relate to athletic performance undergo striking change during the early years of adolescence. The age at which children are physically ready for many types of sports also vary greatly. It is important to identify early-maturing and late-maturing individuals if they are to be directed into appropriate sport experiences [5 , 6]. Early maturation in boys is an advantage in some sports, but the opposite applies in girls. There is an apparent delay in maturity in sports where females who maintain preadolescent physique seem to have an advantage [5 , 6]. Successful female athletes display physical characteristics that favor good performances successful young female athletes have similar somatotypes to older successful athletes [5 , 6]. There is a trend towards increase linearity in these athletes and this linear physique characterizes the physical attributes of late maturing girls [5 , 6]. Early maturing girls undergo a socialization process which does not motivate them any more to excel in physical exercise. On the other hand, late-maturing girls tend to be socialized into sports participation. The late mature athletes have less strength, endurance, and skeletal maturity and lower motor skills than their average peers [5 , 6]. More importantly, playing with and competing against larger, stronger, and more mature athletes, the late maturer have been a less skilled athlete, and is a prime candidate to drop out at the earliest opportunity. Parents and coaches should know the implications of delayed adolescent development, and they should develop their expectations accordingly [5 , 6]. Motor Skill Development Motor skills develop in the first eighteen years of life, although in girls their development tends to stabilize around puberty [6 , 7]. Strength and power rapidity increase in proportion to muscle mass under the influence of hormonal activity. The daily use of motor activities, games and physical education must allow children to acquire a set of motor skills i. During middle childhood, children continue to build on and improve gross motor skills; the large-scale body movement skills such as walking and running that they first learned during earlier developmental stages. In general, boys develop these skills slightly faster than do girls, except for skills involving balance and precise movements such as skipping, jumping and hopping. At this age, children run faster and jump higher than previously possible. These figures are average for children of this age range and will not apply to individual children. Middle-childhood-aged children also refine their control over gross motor skills, learning to master where they hop, skip, throw, and jump. They are able to gain this improved control and coordination due to increases in their flexibility, balance, and agility [6 , 7 , 8]. Due to their progress with regard to the growth and maturity of motor, cognitive, and social skills, many children will become capable and competitive participants on sports teams. Development of Strength Motor power rises gradually over the course of the growth process depending on the increase in body mass. Before puberty, maximum strength in boys and girls remains relatively similar. Improved nerve activation and increased muscle mass hypertrophy are the main explanation for the increase in strength [6 , 7 , 8]. Before puberty, improvement concerns mainly nerve activation. Other mechanisms, including improved elastic energy release, intensified excitation-contraction coupling, and improvement in strength transmission to different bone levers, are also involved [6 , 7 , 8]. This rise in strength has an impact on the capacity for motor skill performance in fitness activities and in the prevention of injuries during such activities. Since the increase in testosterone production in adolescent children is markedly higher in boys than girls, boys become stronger faster and to a higher degree [6 , 7 , 8]. Whole-body activities are more important and beneficial than the same exercises used for post-pubescent athletes. The development of these qualities quickens during the post-puberty period [6 , 7 , 8]. Development of Aerobic Power Aerobic power increases with age during childhood in both sexes and is quite similar. The maximal aerobic performance capacity in girls reaches a plateau from 14 years onwards while in boys it increases up to the age of 18 years [9 , 10]. Thus, even though the aerobic capacity is fully developed aerobic performance continues to improve. That is because other growth factors, such as larger levers, greater musculature, etc. Endurance training has been shown not to effect aerobic capacity before 11 years. After the age of 12 years, an improvement in VO2max has been shown in males [9 , 10]. This suggests that there is an increased trainability of the heart and circulatory system around puberty in males [9 , 10]. It takes a lot of intense aerobic training to produce shifts in aerobic factors in children. VO2max improvements are similar to those reported for adults when the training volumes and intensities are very high. Short-term training programs have no significant effect on improving VO2max in pre-pubertal children [9 , 10]. The improvements are probably due to motor coordination and running technique [9 , 10]. In pre-pubertal children, the gains from endurance training largely result from improvements in mechanical efficiency not a large change in physical aerobic power. Thus, for endurance improvements, an emphasis on the techniques of performance is more beneficial than the programming of assumed physiological stimulations of training. Development of Anaerobic Capacity Unlike aerobic capacity, the anaerobic capacity of children expressed per Kg of body weight is much smaller than adults. It is lowest in children and increases progressively with age in both boys and girls [6 , 7 , 8]. The ratio of aerobic: Children are best suited to adapt to aerobic exercises. Frequent and stressful stimulation of anaerobic metabolism will be particularly fatiguing and if overdone, could be harmful [6 , 7 , 8]. Children may fatigue rapidly in anaerobic work when compared to their response to endurance work. Conclusion Physical activity, whether through informal or organized sports, is important for optimal health, growth and development of children. Physical and physiological process influences on sports participation and performance in sports. The aspects of development influencing sport participation among children and adolescents. Understanding athlete development and outcome of sport participation is a key to effective coaching and teaching of young athletes, and helps coaches work more effectively with the young athletes. The maturation and environmental factors influence the progressive development of children and adolescents. Keeping these principles in mind, the sport talent of young athletes can be developed. Therefore, these factors need to accommodate as part of the effective sports skill instruction. These developmental issues help coaches to use their knowledge for development of effective training programme for children and adolescents. Growth, pubertal development, skeletal maturation and bone mass acquisition in athletes.

Chapter 2 : calendrierdelascience.com: Customer reviews: Growth, Maturation, and Physical Activity

The second edition of Growth, Maturation, and Physical Activityhas been expanded with almost new pages of material, making it the most comprehensive text on the biological growth, maturation, physical performance, and physical activity of children and adolescents.

Growth, Development, and Maturation Growth Growth is the normal process of increase in size as a result of accretion of tissues characteristic of the organism; growth is the dominant biological activity for most of the first two decades of life. Changes in size are the outcome of an increase in cell number hyperplasia , an increase in cell size hypertrophy , and an increase in intercellular substances accretion. Development Encompassing growth and maturation, development denotes a broader concept; when used in a biological context, development refers to differentiation and specialization of stem cells into different cell types, tissues, organs, and functional units. Development continues as different systems become functionally refined. Development also refers to the acquisition and refinement of behavior relating to competence in a variety of interrelated domains, such as motor competence and social, emotional, and cognitive competence. Maturation Maturation is the timing and tempo of progress toward the mature state and varies considerably among individuals; variation in progress toward the mature state over time implies variation in the rate of change. Two children may be the same size but at different points on the path to adult size or maturity. Adolescence is more difficult to define because of variation in its onset and termination, although it is commonly defined as between 10 and 18 years of age WHO, The rapid growth and development of infancy continue during early childhood, although at a decelerating rate, whereas middle childhood is a period of slower, steady growth and maturation. Differences between boys and girls are relatively small until adolescence, which is marked by accelerated growth and attainment of sexual maturity Tanner, Page Share Cite Suggested Citation: Relationship to Growth, Development, and Health. Educating the Student Body: The National Academies Press. For example, the head accounts for 25 percent of recumbent length in an infant and only 15 percent of adult height, while the legs account for 38 percent of recumbent length at birth and 50 percent of adult height. These changes in body proportions occur because body parts grow at different rates. From birth to adulthood, as the head doubles in size, the trunk triples in length, and arm and leg lengths quadruple. Coincident with these changes in body proportions, and in part because of them, the capacity to perform various motor tasks develops in a predictable fashion. For example, running speed increases are consistent with the increase in leg length. Neurological development also determines skill progression. Young children, for example, when thrown a ball, catch it within the midline of the body and do not attempt to catch it outside the midline or to either side of the body. As proximodistal development proceeds, children are better able to perform tasks outside their midline, and by adolescence they are able to maneuver their bodies in a coordinated way to catch objects outside the midline with little effort. Physically active and inactive children progress through identical stages. Providing opportunities for young children to be physically active is important not to affect the stages but to ensure adequate opportunity for skill development. Sound physical education curricula are based on an understanding of growth patterns and developmental stages and are critical to provide appropriate movement experiences that promote motor skill development Clark, The mastery of fundamental motor skills is strongly related to physical activity in children and adolescents Lubans et al. Mastering fundamental motor skills also is critical to fostering physical activity because these skills serve as the foundation for more advanced and sport-specific movement Clark and Metcalfe, ; Hands et al. Physical activity programs, such as physical education, should be based on developmentally appropriate motor activities to foster self-efficacy and enjoyment and encourage ongoing participation in physical activity. Biological Maturation Maturation is the process of attaining the fully adult state. In growth studies, maturity is typically assessed as skeletal, somatic, or sexual. The same hormones regulate skeletal, somatic, and sexual maturation during adolescence, so it is reasonable to expect the effect of physical activity on Page Share Cite Suggested Citation: Skeletal maturity is typically assessed from radiographs of the bones in the hand and wrist; it is not influenced by habitual physical activity. Similarly, age at peak height velocity the most rapid change in height , an indicator of somatic maturity, is not affected by physical activity, nor is the magnitude of peak height velocity, which is well within the usual range in both active and inactive youth. Discussions of the effects of physical activity on sexual maturation more often focus on females than males and, in particular, on age at menarche first menses. While some data suggest an association between later menarche and habitual physical activity Merzenich et al. While menarche occurs later in females who participate in some sports, the available data do not support a causal relationship between habitual physical activity and later menarche. Puberty is the developmental period that represents the beginning of sexual maturation. It is marked by the appearance of secondary sex characteristics and their underlying hormonal changes, with accompanying sex differences in linear growth and body mass and composition. Recent research suggests that the onset of puberty is occurring earlier in girls today compared with the previous generation, and there is speculation that increased adiposity may be a cause Bau et al. Conversely, some data suggest that excess adiposity in boys contributes to delayed sexual maturation Lee et al. Pubescence, the earliest period of adolescence, generally occurs about 2 years in advance of sexual maturity. Typically, individuals are in the secondary school years during this period, which is a time of decline in habitual physical activity, especially in girls. Physical activity trends are influenced by the development of secondary sex characteristics and other physical changes that occur during the adolescent growth spurt, as well as by societal and cultural factors. Research suggests that physical inactivity during adolescence carries over into adulthood Malina, a,b; CDC, It is critical that adolescents be offered appropriate physical activity programs that take into account the physical and sociocultural changes they are experiencing so they will be inspired to engage in physical activity for a lifetime. As discussed below, adequate physical activity during puberty may be especially important for optimal bone development and prevention of excess adiposity, as puberty is a critical developmental period for both the skeleton and the adipose organ. The adolescent growth spurt, roughly 3 years of rapid growth, occurs early in this period. An accelerated increase in stature is a hallmark, with about 20 percent of adult stature being attained during this period. Along with the rapid increase in height, other changes in body proportions occur that have important implications for sports and other types of activities offered in physical education and physical activity programs. As boys and girls advance through puberty, for example, biacromial breadth shoulder width increases more in boys than in girls, while increases in bicristal breadth hip width are quite similar. Consequently, hip-shoulder width ratio, which is similar in boys and girls during childhood, decreases in adolescent boys while remaining relatively constant in girls Malina et al. Ratios among leg length, trunk length, and stature also change during this period. Prior to adolescence, boys have longer trunks and shorter legs than girls Haubenstricker and Sapp, In contrast, adolescent and adult females have shorter legs for the same height than males of equal stature. Body proportions, particularly skeletal dimensions, are unlikely to be influenced by physical activity; rather, body proportions influence performance success, fitness evaluation, and the types of activities in which a person may wish to engage. For example, there is evidence that leg length influences upright balance and speed Haubenstricker and Sapp, Individuals who have shorter legs and broader pelvises are better at balancing tasks than those with longer legs and narrower pelvises, and longer legs are associated with faster running times Dintiman et al. Also, longer arms and wider shoulders are advantageous in throwing tasks Haubenstricker and Sapp, , as well as in other activities in which the arms are used as levers. According to Haubenstricker and Sapp , approximately 25 percent of engagement in movement-related activities can be attributed to body size and structure. Motor Development Motor development depends on the interaction of experience e. The period of fundamental motor patterns occurs approximately between the ages of 1 and 7 years, when children begin to acquire basic fundamental movement skills e. Practice and instruction are key to learning these skills, and a great deal of time in elementary school physical education is devoted to exploration of movement. Around age 7, during the so-called context-specific period of motor development, children begin to refine basic motor skills and combine them into more specific movement patterns, ultimately reaching what has been called skillfulness. Compensation, the final period of motor development, occurs at varying points across the life span when, as a result of aging, disease, injury, or other changes, it becomes necessary to modify movement. A full movement repertoire is needed to engage in physical activities within and outside of the school setting. Thus, beyond contributing to levels of physical activity, physical education programs should aim to teach basic fundamental motor skills and their application to games, sports, and other physical activities, especially during the elementary years i. At the same time, it is important to be mindful of the wide interindividual variation in the rate at which children develop motor skills, which is determined by their biological makeup, their rate of physical maturation, the extent and quality of their movement experiences, and their family and community environment. An increasing amount of evidence suggests that people who feel competent in performing physical skills remain more active throughout their lives Lubans et al. Conversely, those who are less skilled may be hesitant to display what they perceive as a shortcoming and so may opt out of activities requiring higher levels of motor competence Stodden et al. Children who are less physically skillful tend to be less active than their skillful counterparts Wrotniak et al. Fundamental skills are the building blocks of more complex actions that are completed in sports, physical activities, and exercise settings. For example, throwing is a fundamental skill that is incorporated into the context-specific throw used in activities such as handball, softball, and water polo. Fundamental skills are of primary interest to both physical education teachers and coaches, and physical Page Share Cite Suggested Citation: The workshop convened 21 experts from a wide range of academic disciplines. One recommendation resulting from the proceedings was for future research to describe the temporal relationship between motor development and physical activity Fulton et al. The assumption of this relationship is implied in multiple models of motor development Seefeldt, ; Clark and Metcalfe, ; Stodden et al. Seefeldt proposed a hierarchical order of motor skills development that includes four levels: With improved transitional motor skills, children are able to master complex motor skills e. The progression through each level occurs through developmental stages as a combined result of growth, maturation, and experience. If children are able to achieve a level of competence above the proficiency barrier, they are more likely to continue to engage in physical activity throughout the life span that requires the use of fundamental motor skills. Conversely, less skilled children who do not exceed the proficiency barrier will be less likely to continue to engage in physical activity. For example, to engage successfully in a game of handball, baseball, cricket, or basketball at any age, it is important to reach a minimum level of competence in running, throwing, catching, and striking. Lubans and colleagues recently examined the relationship between motor competence and health outcomes. They reviewed 21 studies identifying relationships between fundamental motor skills and self-worth, perceived physical competence, muscular and cardiorespiratory fitness, weight status, flexibility, physical activity, and sedentary behavior. Overall, the studies found a positive association between fundamental motor skills and physical activity in children and adolescents, as well as a positive relationship between fundamental motor skills and cardiorespiratory fitness. Other research findings support the hypothesis that the most physically active preschool-age Fisher et al. The proficiency barrier is located between the fundamental and transitional motor skills periods. The transition between these two levels of motor competence is expected to occur between the early and middle childhood years. Stodden and colleagues suggest that the relationship between motor competence and physical activity is dynamic and changes across time. The relationship between skills and physical activity is considered reciprocal. It is expected that as motor skills competence increases, physical activity participation also increases and that the increased participation feeds back into motor skills competence. The reciprocal relationship between motor skills competence and physical activity is weak during the early childhood years ages because of a variety of factors, including environmental conditions, parental influences, and previous experience in physical education programs Stodden et al. Also, children at this age are less able to distinguish accurately between perceived physical competence and actual motor skills competence Harter and Pike, ; Goodway and Rudisill, ; Robinson and Goodway, ; Robinson, , and thus motor skills are not expected to strongly influence physical activ- Page Share Cite Suggested Citation: In older children, perceived competence is more closely related to actual motor skills competence. Older, low-skilled children are aware of their skills level and are more likely to perceive physical activity as difficult and challenging. Older children who are not equipped with the necessary skills to engage in physical activity that requires high levels of motor skills competence may not want to display their low competence publicly. As children transition into adolescence and early adulthood, the relationship between motor skills competence and physical activity may strengthen Stodden et al. Investigators report moderate correlations between motor skills competence and physical activity in middle schoolâ€”age children Reed et al. Okely and colleagues found that motor skills competence was significantly associated with participation in organized physical activity i.

Chapter 3 : Growth, Maturation, and Physical Activity by Robert M. Malina

The second edition of "Growth, Maturation, and Physical Activity" has been expanded with almost new pages of material, making it the most comprehensive text on the biological growth.

Measurements should be performed often and accurately to detect alterations from physiologic growth. Linear growth within the first 2 y of life generally decelerates but then remains relatively constant throughout childhood until the onset of the pubertal growth spurt. Because of the wide variation among individuals in the timing of the pubertal growth spurt, there is a wide range of physiologic variations in normal growth. Nutritional status and heavy exercise training are only 2 of the major influences on the linear growth of children. In the United States, nutritional deficits result from self-induced restriction of energy intake. That single factor, added to the marked energy expenditure of training and competition for some sports, and in concert with the self-selection of certain body types, makes it difficult to identify the individual factors responsible for the slow linear growth of some adolescent athletes, for example, those who partake in gymnastics, dance, or wrestling. The linear growth of a child-adolescent athlete may also reflect the adequacy of energy intake for a particular training regimen. Measurement of growth may also be used as an index of the general health and nutrition of a population or subpopulation of children. Most children and adolescents who have a normal growth pattern but who remain below the lower 2. Cross-sectional data are derived from the measurements of many children at various ages and are generally used to derive standard growth charts. However, individual children do not necessarily grow according to these standard curves. Longitudinal growth charts derived from growth points of the same child over time more accurately describe the growth pattern of an individual. In adolescence, there may be quite large deviations from the derived percentile lines, depending on the timing and tempo of the pubertal growth spurt. An average pubertal growth pattern is built into the percentiles derived from cross-sectional data, but virtually no one individual adheres strictly to that pattern. Two common devices are adequate for such measurements and were described by Rogol and Lawton 2. Infants should be placed with the top of the head against the fixed headboard of the measurement device and with the eye-ear plane perpendicular to the base of the device Figure 1. Growth measurement length of an infant. Reprinted with permission from reference 2. Children and adolescents Growth in children older than 2 y is measured with the child standing. Children should be measured without shoes while standing against the vertical plane to which the measuring tape is attached. The eye-ear plane should be perpendicular to the wall and the feet, including the heels, should be flat on the floor. With the child in this position, the right-angle device is lowered until it touches the top of the head, and the height is recorded on the appropriate physical growth curve. View large Download slide Growth measurements: An important parameter of growth is height velocity, which can be derived from measurements taken every 3â€”4 mo in infants and every 6 mo in older children. Growth velocity in children has a wide normal range, according to the percentile along which a child is growing. Children growing along the third percentile average 5. To maintain growth along the 10th percentile for height, a child must grow at the 40th percentile for velocity, whereas to maintain growth along the 90th percentile for height, a velocity at the 60th percentile is required. This implies that a child who persistently grows at the 10th percentile for velocity will progressively cross percentiles downward on the standard height curve. Some children have a small increase in growth velocity at approximately 6â€”7 y midgrowth spurt , but this is not a consistent finding, and the gain in height is generally of small magnitude 4. Seasonal variations in growth have been noted in some children. Linear growth tends to be greater in the spring than in the fall, but weight gain is greater in the fall months. Growth assessment Linear growth and physical maturation are dynamic processes encompassing molecular, cellular, somatic, and organismal changes. Traditionally, stature has been primarily used for growth assessment, but changes in body proportion and composition are also essential elements of growth, especially of maturation. Growth standards have been derived for several populations and parameters within a population and are often codified into a series of growth charts. The following discussion emphasizes the genetic, nutritional, hormonal, and physical activity factors that might alter the growth process. This point indicates the mean age of children of that measured height in the normal population. The intersection of the latter line with the age axis is the height age. Growth in several dimensions shows a significant family resemblance. Adult stature is best correlated with calculations of midparental height the difference in the mean adult heights of the parents , but the polygenic mode of inheritance of height results in greater variation in the size of children born to parents of disparate heights than in children of parents who are both of medium height 6. Mature height can be predicted on the basis of midparental height. Other methods also exist for predicting the adult stature of an individual on the basis of mathematical formulations derived from the growth history of that child or from the attained height and bone age of the child as calculated from specific tables. The overall contribution of heredity to adult size and shape varies with environmental circumstances, and the 2 continuously interact throughout the entire growth period. Children with similar genotypes, who would reach the same adult height under optimal conditions, may be differentially affected by adverse circumstances. Thus, the interaction between genetic makeup and the environment is complex and nonadditive. The genetic control of the tempo of growth appears to be independent of that for body size and shape, and environmentally induced changes in tempo do not seem to significantly alter adult height or shape 4. The correlation coefficient for adult height is only 0. There is also evidence that not all genes are actively expressed at the time of birth, which probably accounts for the observation that the correlation between the sizes of the parents and the child is weak during the first year of life but increases to the adult value of 0. Differences in growth and development also vary as a function of sex and ethnic origin. Sex-specific patterns in the tempo of growth, the timing of the adolescent growth spurt, overall size, and the age of skeletal maturity are well known, but differences between the sexes are apparent from the time of fetal life. At birth, the skeletal maturation of females is 4â€”6 wk more advanced than that of males, and this trend continues throughout childhood and adolescence. Thereafter, children of both sexes grow at approximately the same rate until the adolescent growth spurt. On average, females enter puberty 2 y earlier than males but have a lesser peak height velocity 9 cm compared with Overall size and rate of development vary significantly among ethnic populations. Black infants tend to be smaller at birth but experience an acceleration of linear growth that results in greater height than in white children during the first few years of life. Skeletal maturity in black children, especially girls, also tends to be more advanced and the age at peak height velocity earlier 10 , Black girls also tend to be taller and heavier than white girls during puberty and have a tendency toward greater body mass index and greater skinfold-thickness measurements. Growth in the first 2 y of life Growth during the first 2 y of life is characterized by a gradual deceleration in both linear growth velocity and rate of weight gain, both of which level off at 2â€”3 y of age. It is during this period that infants exhibit the pattern of growth consistent with their genetic backgrounds. Two-thirds of all infants cross percentiles on the growth curve, either upward catch-up growth or downward lag-down growth 6. Catch-up growth typically begins within the first 3 mo and is complete by 12â€”18 mo, whereas lag-down growth commences a little later and may not be complete until 18â€”24 mo 6. With the exception of puberty, the crossing of growth percentiles at any other time is cause for concern and further evaluation. Prepubertal growth Growth during childhood is a relatively stable process. The infancy shifts in the growth pattern are complete and the child follows the trajectory attained previously. A general rule of thumb is that a child grows 10 cm 25 inches in the first year of life, half that [12â€”13 cm 5 inches] in the second year, and then 5â€”6 cm 2. Assuming an average birth length of 51 cm 20 inches , an average 1-y-old is 76 cm 30 inches long, a 2 y-old is 89 cm 35 inches , a 4-y-old is cm 40 inches , and an 8-y-old is cm 50 inches. Pubertal growth Puberty is a dynamic period of development marked by rapid changes in body size, shape, and composition, all of which are sexually dimorphic. On average, girls enter and complete each stage of puberty earlier than do boys. The timing and tempo of puberty vary widely, even among healthy children. The bone age is determined as the mean of the skeletal ages of several of the small bones of the hand and wrist. Pubertal maturation status is based on the development of breasts and pubic hair in girls and of pubic hair and genitals in boys. This range of normal variability is expanded to an even greater degree by alterations in energy intake and expenditure. Although moderate activity is associated with cardiovascular benefits and favorable changes in body composition, excessive physical activity during childhood and adolescence may negatively affect growth and adolescent development. Sports that emphasize strict weight control and high energy outputâ€”for example, scholastic wrestling, gymnastics, and dancingâ€”are of particular concern for growth disorders, although selection criteria for certain body types make selection bias a confounding variable in assessing the effect of training on growth and adolescent development. One must consider that some of these change are transient, at least in wrestlers. One of the hallmarks of puberty is the adolescent growth spurt. The timing of the pubertal growth spurt in girls is typically at Tanner breast stage 3 and does not reach the magnitude of that in boys. Boys, on average, attain a peak height velocity of The longer duration of prepubertal growth in boys, combined with a greater peak height velocity, results in an average adult height difference of 13 cm between men and women. After a period of decelerating height velocity, growth virtually ceases because of epiphyseal fusion, typically at a skeletal age of 15 y in girls and 17 y in boys 4. The rate of weight gain decelerates in a manner similar to height velocity during the later stages of pubertal development. Marked changes in body composition, including alterations in the relative proportions of water, muscle, fat, and bone, are a hallmark of pubertal maturation and result in typical female-male differences. Under the influence of the gonadal steroid hormones and growth hormone GH , increases in bone mineral content and muscle mass occur and the deposition of fat is maximally sexually dimorphic. The changes in the distribution of body fat central compared with peripheral, subcutaneous compared with visceral, and upper compared with lower body results in the typical android and gynoid patterns of fat distribution of the older adolescent and adult Under the influence of testosterone, boys have a significant increase in growth of bone and muscle and a simultaneous loss of fat in the limbs 4. The maximal loss of fat and increase in muscle mass in the upper arms corresponds to the time of peak height velocity. In boys, the significant increase in lean body mass exceeds the total gain in weight because of the concomitant loss of adipose tissue. As height velocity declines, fat accumulation resumes in both sexes but is twice as rapid in girls. The increase in skeletal size and muscle mass leads to increased strength in males. In girls, nearly one-third of total skeletal mineral is accumulated in the 3â€”4-y period immediately after the onset of puberty 16 , Adolescents with delayed puberty or secondary amenorrhea may fail to accrue bone mineral normally and have reduced bone mineral density as adults. During pubertal development, interactions between GH and the sex steroid hormones are striking and pervasive. Studies of adolescent boys showed that the rising concentrations of testosterone during puberty play a pivotal role in augmenting spontaneous secretion of GH and production of insulin-like growth factor I IGF-I. The ability of testosterone to stimulate pituitary GH secretion, however, appears to be transient and expressed only peripubertally; GH and IGF-I concentrations decrease significantly during late puberty and into adulthood, despite continued high concentrations of gonadal steroid hormones In contrast with testosterone, estrogen modulates GH secretory activity in a disparate manner; low doses of estrogen stimulate IGF-I production through enhanced GH secretion, but higher doses inhibit IGF-I production at the hepatic level Assessment of skeletal maturation is perhaps the best indicator of biological age or maturity status, because its development spans the entire period of growth. Several methods exist for determining the former 21 â€” Each uses a single radiograph of the left hand and wrist and makes comparisons with children of normal stature by using an atlas and scoring system. Because girls are more developmentally mature than boys at any given chronologic age, separate standards exist for females and males. Familial short stature On average, children of smaller parents will eventually attain lesser height than children of taller parents.

Chapter 4 : Infant Physical Development & Growth Activities | SimilacÂ®

Topics include prenatal growth and functional development, motor development, thermoregulation, obesity in childhood and adolescence and more. Num Pages: pages, black & white illustrations, 41 black & white halftones.

Suggestions for Individual and Group Activities Index Audiences Textbook for undergraduate and graduate courses focusing on an understanding of growth, maturation, and physical activity; reference for human biology and physical anthropology pediatricians, pediatric exercise physiologists, nutritionists, growth and physical development and motor development specialists, kinathropometry and body composition specialists, physical educators, health educators, and APA specialists. He was a professor of kinesiology and anthropology at the University of Texas at Austin from to and then moved to a similar position in kinesiology and anthropology at Michigan State University. Malina retired from Michigan State University in the summer of Professor Malina served as editor in chief of the American Journal of Human Biology , editor of the Yearbook of Physical Anthropology , and section editor for growth and development for Exercise and Sport Sciences Reviews and Research Quarterly for Exercise and Sport He also serves on the editorial boards of 13 journals in the sport sciences and biological anthropology. His primary area of interest is the biological growth and maturation of children and adolescents with a focus on performance, youth sports and young athletes, and the potential influences of physical activity and training for sport. He has also worked extensively with the anthropometric correlates of physique and body composition in female athletes at the university level. Related areas of interest are the role of physical activity in the well being of children, adolescents, and young adults and the influence of chronic undernutrition on the growth, performance, and physical activity of Latin American youth. Bray chair in nutrition. His research deals with the genetics of adaptation to exercise and to nutritional interventions as well as the genetics of obesity and its comorbidities. He has authored or coauthored several books and more than scientific papers. Henry Sebrell Award from the Weight Watchers Foundation in , and of an honorary doctoral degree in science from the Katholieke Universiteit Leuven in He has been a foreign member of the Royal Academy of Medicine of Belgium since and was the Leon Mow visiting professor at the International Diabetes Institute in Melbourne in In , he became a member of the Order of Canada as well as professor emeritus of the faculty of medicine at Laval University. Bouchard is a former president of the North American Association for the Study of Obesity and the president of the International Association for the Study of Obesity Prior to coming to Pennington, he held the Donald B. Brown research chair on obesity at Laval University. His year research and clinical career focused on the effects of physical activity and inactivity on the health, well-being, and performance of healthy children and those with disease. In , the University of Blaise Pascal in France awarded him an honorary doctorate degree. This book will be very useful for upper level undergraduate and graduate students as well as for researchers in human biology, physical anthropology, exercise physiology, etc.

Chapter 5 : Growth, Maturation, and Physical Activity-2nd Edition - Claude Bouchard, Robert Malina, Oded

The second edition of Growth, Maturation, and Physical Activity has been expanded with almost new pages of material, making it the most comprehensive text on the biological growth, maturation, physical performance, and physical activity of children and adolescents.

Relationship to Growth, Development, and Health Key Messages Regular physical activity promotes growth and development and has multiple benefits for physical, mental, and psychosocial health that undoubtedly contribute to learning. Specifically, physical activity reduces the risk for heart disease, diabetes mellitus, osteoporosis, high blood pressure, obesity, and metabolic syndrome; improves various other aspects of health and fitness, including aerobic capacity, muscle and bone strength, flexibility, insulin sensitivity, and lipid profiles; and reduces stress, anxiety, and depression. Physical activity can improve mental health by decreasing and preventing conditions such as anxiety and depression, as well as improving mood and other aspects of well-being. Physical activity programming specifically designed to do so can improve psychosocial outcomes such as self-concept, social behaviors, goal orientation, and most notably self-efficacy. These attributes in turn are important determinants of current and future participation in physical activity. Sedentary behaviors such as sitting and television viewing contribute to health risks both because of and independently of their impact on physical activity. Health-related behaviors and disease risk factors track from childhood to adulthood, indicating that early and ongoing opportunities for physical activity are needed for maximum health benefit. Frequent bouts of physical activity throughout the day yield short-term benefits for mental and cognitive health while also providing opportunities to practice skills and building confidence that promotes ongoing engagement in physical activity. Technological advances of modern society have contributed to a sedentary lifestyle that has changed the phenotype of children from that of 20 years ago. Children today weigh more and have a higher body mass index BMI than their peers of just a generation earlier Ogden et al. Behaviorally, most children fail to engage in vigorous- or moderate-intensity physical activity for the recommended 60 minutes or more each day, with as many as one-third reporting no physical activity in the preceding 5 days CDC, This lack of participation in physical activity has contributed to a greater prevalence of pediatric obesity, a decrease in fitness e. See Box for an overview of the relationship between physical activity and physical fitness. While more can always be learned, the evidence for the health benefits of physical activity is irrefutable HHS, , Adults engaged in regular physical activity have lower rates of chronic disease e. And while the ill effects of chronic disease are manifested mainly in adults, it is increasingly better understood that the development of these conditions starts in childhood and adolescence Hallal et al. It appears evident, then, that promotion of health-enhancing behaviors must also start early in life. Indeed, growing evidence points to long-term effects of child and adolescent physical activity on adult morbidity and mortality in addition to its more immediate effects Hallal et al. Physical activity has both immediate and long-term health benefits: Evidence for both direct and indirect health effects of physical activity has been reported Hallal et al. To understand the relationship of physical activity and aerobic fitness to health during childhood, it is important first to recognize the developmental changes that occur throughout maturation. During the early stages of adolescence, for example, participation in physical activity and corresponding physical fitness begin to decline Duncan et al. Such differences across stages of development highlight the importance of examining the effects of growth and maturation on physical and cognitive health. Accordingly, this chapter reviews how physical activity may influence developmental processes and other aspects of somatic growth and maturation. A complete review of the effects of physical activity on all tissues and systems is beyond the scope of this report. Rather, the focus is on components of body composition and systems that underlie engagement in physical activity, physical fitness, and chronic disease risk and that in turn influence other aspects of health and academic performance discussed in Chapter 4. Addressed in turn is the relationship between physical activity and physical, psychosocial, and mental health. Structural and functional brain maturation and how physical activity may influence those developmental processes and cognitive health are also reviewed in Chapter 4. Somatic Growth, Development, and Function Growth occurs through a complex, organized process characterized by predictable developmental stages and events. Although all individuals follow the same general course, growth and maturation rates vary widely among individuals. Just as it is unrealistic to expect all children at the same age to achieve the same academic level, it is unrealistic to expect children at the same age to have the same physical development, motor skills, and physical capacity. Regular physical activity does not alter the process of growth and development. Rather, developmental stage is a significant determinant of motor skills, physical capacity, and the adaptation to activity that is reasonable to expect see Box Growth is the normal process of increase in size as a result of accretion of tissues characteristic of the organism; growth is the dominant biological activity for most of the first two decades of life. Developmental Stages Postnatal growth is commonly divided into three or four age periods. Infancy spans the first year of life. Childhood extends from the end of infancy to the start of adolescence and is often divided into early childhood, which includes the preschool years, and middle childhood, which includes the elementary school years, into the 5th or 6th grade. Adolescence is more difficult to define because of variation in its onset and termination, although it is commonly defined as between 10 and 18 years of age WHO, The rapid growth and development of infancy continue during early childhood, although at a decelerating rate, whereas middle childhood is a period of slower, steady growth and maturation. Differences between boys and girls are relatively small until adolescence, which is marked by accelerated growth and attainment of sexual maturity Tanner, For example, the head accounts for 25 percent of recumbent length in an infant and only 15 percent of adult height, while the legs account for 38 percent of recumbent length at birth and 50 percent of adult height. These changes in body proportions occur because body parts grow at different rates. From birth to adulthood, as the head doubles in size, the trunk triples in length, and arm and leg lengths quadruple. Coincident with these changes in body proportions, and in part because of them, the capacity to perform various motor tasks develops in a predictable fashion. For example, running speed increases are consistent with the increase in leg length. Neurological development also determines skill progression. Young children, for example, when thrown a ball, catch it within the midline of the body and do not attempt to catch it outside the midline or to either side of the body. As proximodistal development proceeds, children are better able to perform tasks outside their midline, and by adolescence they are able to maneuver their bodies in a coordinated way to catch objects outside the midline with little effort. Physically active and inactive children progress through identical stages. Providing opportunities for young children to be physically active is important not to affect the stages but to ensure adequate opportunity for skill development. Sound physical education curricula are based on an understanding of growth patterns and developmental stages and are critical to provide appropriate movement experiences that promote motor skill development Clark, The mastery of fundamental motor skills is strongly related to physical activity in children and adolescents Lubans et al. Mastering fundamental motor skills also is critical to fostering physical activity because these skills serve as the foundation for more advanced and sport-specific movement Clark and Metcalfe, ; Hands et al. Physical activity programs, such as physical education, should be based on developmentally appropriate motor activities to foster self-efficacy and enjoyment and encourage ongoing participation in physical activity. Biological Maturation Maturation is the process of attaining the fully adult state. In growth studies, maturity is typically assessed as skeletal, somatic, or sexual. The same hormones regulate skeletal, somatic, and sexual maturation during adolescence, so it is reasonable to expect the effect of physical activity on these indicators of maturity to be similar. Skeletal maturity is typically assessed from radiographs of the bones in the hand and wrist; it is not influenced by habitual physical activity. Similarly, age at peak height velocity the most rapid change in height , an indicator of somatic maturity, is not affected by physical activity, nor is the magnitude of peak height velocity, which is well within the usual range in both active and inactive youth. Discussions of the effects of physical activity on sexual maturation more often focus on females than males and, in particular, on age at menarche first menses. While some data suggest an association between later menarche and habitual physical activity Merzenich et al. While menarche occurs later in females who participate in some sports, the available data do not support a causal relationship between habitual physical activity and later menarche. Puberty is the developmental period that represents the beginning of sexual maturation. It is marked by the appearance of secondary sex characteristics and their underlying hormonal changes, with accompanying sex differences in linear growth and body mass and composition. Recent research suggests that the onset of puberty is occurring earlier in girls today compared with the previous generation, and there is speculation that increased adiposity may be a cause Bau et al. Conversely, some data suggest that excess adiposity in boys contributes to delayed sexual maturation Lee et al. Pubescence, the earliest period of adolescence, generally occurs about 2 years in advance of sexual maturity. Typically, individuals are in the secondary school years during this period, which is a time of decline in habitual physical activity, especially in girls. Physical activity trends are influenced by the development of secondary sex characteristics and other physical changes that occur during the adolescent growth spurt, as well as by societal and cultural factors. Research suggests that physical inactivity during adolescence carries over into adulthood Malina, a , b ; CDC, It is critical that adolescents be offered appropriate physical activity programs that take into account the physical and sociocultural changes they are experiencing so they will be inspired to engage in physical activity for a lifetime. As discussed below, adequate physical activity during puberty may be especially important for optimal bone development and prevention of excess adiposity, as puberty is a critical developmental period for both the skeleton and the adipose organ. Adolescence is the transitional period between childhood and adulthood. The adolescent growth spurt, roughly 3 years of rapid growth, occurs early in this period. An accelerated increase in stature is a hallmark, with about 20 percent of adult stature being attained during this period. Along with the rapid increase in height, other changes in body proportions occur that have important implications for sports and other types of activities offered in physical education and physical activity programs. As boys and girls advance through puberty, for example, biacromial breadth shoulder width increases more in boys than in girls, while increases in bicristal breadth hip width are quite similar. Consequently, hip-shoulder width ratio, which is similar in boys and girls during childhood, decreases in adolescent boys while remaining relatively constant in girls Malina et al. Ratios among leg length, trunk length, and stature also change during this period. Prior to adolescence, boys have longer trunks and shorter legs than girls Haubenstricker and Sapp, In contrast, adolescent and adult females have shorter legs for the same height than males of equal stature. Body proportions, particularly skeletal dimensions, are unlikely to be influenced by physical activity; rather, body proportions influence performance success, fitness evaluation, and the types of activities in which a person may wish to engage. For example, there is evidence that leg length influences upright balance and speed Haubenstricker and Sapp, Individuals who have shorter legs and broader pelvises are better at balancing tasks than those with longer legs and narrower pelvises, and longer legs are associated with faster running times Dintiman et al. Also, longer arms and wider shoulders are advantageous in throwing tasks Haubenstricker and Sapp, , as well as in other activities in which the arms are used as levers. According to Haubenstricker and Sapp , approximately 25 percent of engagement in movement-related activities can be attributed to body size and structure. Motor Development Motor development depends on the interaction of experience e. The period of fundamental motor patterns occurs approximately between the ages of 1 and 7 years, when children begin to acquire basic fundamental movement skills e. Practice and instruction are key to learning these skills, and a great deal of time in elementary school physical education is devoted to exploration of movement. Around age 7, during the so-called context-specific period of motor development, children begin to refine basic motor skills and combine them into more specific movement patterns, ultimately reaching what has been called skillfulness. Compensation, the final period of motor development, occurs at varying points across the life span when, as a result of aging, disease, injury, or other changes, it becomes necessary to modify movement. A full movement repertoire is needed to engage in physical activities within and outside of the school setting. Thus, beyond contributing to levels of physical activity, physical education programs should aim to teach basic fundamental motor skills and their application to games, sports, and other physical activities, especially during the elementary years i. At the same time, it is important to be mindful of the wide interindividual variation in the rate at which children develop motor skills, which is determined by their biological makeup, their rate of physical maturation, the extent and quality of their movement experiences, and their family and community environment. An increasing amount of evidence suggests that people who feel competent in performing physical skills remain more active throughout their lives Lubans et al. Conversely, those who are less skilled may be hesitant to display what they perceive as a shortcoming and so may opt out of activities requiring higher levels of motor competence Stodden et al. Children who are less physically skillful tend to be less active than their skillful counterparts Wrotniak et al. Fundamental skills are the building blocks of more complex actions that are completed in sports, physical activities, and exercise settings. For example, throwing is a fundamental skill that is incorporated into the context-specific throw used in activities such as handball, softball, and water polo.

Chapter 6 : Download [PDF] Growth Maturation And Physical Activity Free Online | New Books in Politics

Book Review Growth, maturation and physical activity. By Robert M. Malina and Claude Bouchard. Champaign, IL: Human Kinetics Publihsers, Inc. pp. $ (cloth).

Chapter 7 : Growth, Maturation, and Physical Activity | Robert M. Malina | Academic Room

Physical activity, whether through informal or organized sports, is important for optimal health, growth and development of children. Physical and physiological process influences on sports participation and performance in sports.