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Cytokines, Growth Mediators and Physical Activity in Children during Puberty

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Preface

Over many centuries, scientists have been fascinated by the complexities of human growth and development and, accordingly, extensive research investigations have been undertaken. We understand, for example, that linear growth and sexual maturation are governed by the actions of the endocrine system, including the growth hormone (GH)-insulin-like growth factor 1 (IGF-1) axis, the hypothalamic-pituitary-gonadal (HPG) axis and thyroid hormone concentrations. While prepubertal growth is almost exclusively dependent on GH, IGF-1 and thyroid hormones, the marked acceleration in growth velocity during puberty is dependent on the interaction of the GH-IGF-1 and HPG axes with the continued permissive effect of thyroid hormones. A number of excellent monographs have addressed the role of the endocrine system in the growth and development of children and adolescents.

Somatic growth and maturation are also influenced by the nutritional status and level of physical activity of an individual. Growth and maturation are slowed during undernutrition, while chronic overnutrition may result in early maturation and increased growth velocity. The influence of nutritional status on linear growth and pubertal timing is also demonstrated by the fact that a critical amount of body fat is known to be essential for the onset of puberty. Similarly, the level of physical activity may have profound effects on children's health during pubertal development and influence the development of fat, muscle and bone tissue. These effects are mediated, at least partially, by the relationship between nutritional status, physical activity level, growth factors and also circulating inflammatory mediators/cytokines. These mediators are secreted from adipocyte, muscle and bone cells, and include, for example, leptin, interleukin-6 and osteocalcin, respectively. To date, the most extensively studied adipocytokine is leptin, which appears to be the molecular link between adequacy of energy stores, adipose tissue and the onset of puberty in children. The initiation of puberty has been linked to increased leptin and decreased ghrelin concentrations, while the recently discovered obestatin has been associated with obesity in childhood. The discovery of different inflammatory mediators/cytokines that contribute to the regulation of energy intake and energy expenditure is growing rapidly. For example, we have recently demonstrated that visfatin, a newly discovered marker of visceral adipose tissue, may have a metabolic role in adolescent male swimmers.
As an increasing proportion of children worldwide are involved in sport and physical activity, there is a need for more research on the exercise-related adaptation of adipose and bone tissue markers in young athletes. Increased participation of children and adolescents in competitive sport, especially when associated with inadequate caloric intake, exposes young athletes to numerous health risks including anorexia nervosa and reproductive dysfunction. The female athletic triad is characterized by late menarche, restrained eating behavior, and increased predisposition to stress fractures. We know that prolonged energy deficiency is related to alterations in body composition, including bone mineral density and bone turnover markers in adolescent athletes. Therefore, it is important to monitor pubertal athletes to better understand the influence of training loads on various hormonal markers that are responsible for growth and energy homeostasis. These hormonal markers also include different growth factors and circulating inflammatory mediators/cytokines.

To the best of our knowledge, no monographs to date have focused specifically on the complex relationship between inflammatory mediators/cytokines, growth factors, body composition, physical fitness and physical activity during puberty. In this book we focus on the latest research regarding mediators of growth and sexual maturation. Special emphasis has been given to the role of recently discovered inflammatory mediators/cytokines in the development of possible metabolic risk factors, in bone metabolism and other body composition parameters, in the development of possible menstrual irregularities and also in the adaptation to acute and chronic exercise. The 12 chapters comprising this monograph represent the latest information regarding the role of different inflammatory mediators/cytokines in the growth and pubertal development of children. Contributors include leading international researchers in this area who provide details of new developments regarding growth and development with particular relevance to researchers, students, pediatricians, coaches and other sport specialists.

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