Mini Review

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Physical activity in preschool children to fight obesity and related sleep disorders

Abstract

Sleep disorders are frequently associated to obesity, a major public health problem affecting adults as well as a large proportion of children in western countries. Unhealthy lifestyle habits and eating behavior, lack of physical activities are risk factors to develop obesity with consequences on quality of sleep. Despite children enjoy movement; sedentary behavior and lack of environmental opportunities for active play dominate in the preschool child day. Here we discuss the relationship between sleep, physical activity and health, with special interest on obesity. Providing appropriate conditions for children engagement in physical activities is mandatory in western Countries where social organization and cultural tradition limit the opportunities for movement. Improving acquisition of motor competences in children is a must that also involves health professionals as physical activity provides benefits on individual fitness levels and of quality of sleep. In the following pages we will review the links connecting physical activity and obesity with sleep and related disorders. We will then focus on the recent evidences on the determinants of child motor development which provide the scientific rationale for educational interventions promoting quality of health and sleep.

Keywords: physical activity, motor skill competence, obesity, sleep, perception of competence

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Abbreviation: PA, physical activity; MVPA, moderate/vigorous physical activity; WHO, world health organization

Introduction

Sleep and physical activity (PA) play critical roles in the metabolic and hormonal systems that drive growth and development in children.[1] On the other hand, the relationship between these two components of the human behavior is still a controversial issue.[2] Indeed, contrasting results have been reported depending on age of the subject,[3] the timing of the activity,[4] the type of activity performed[5] and the context.[6,7] Concerning children, it is not clear the directionality of the relationship between PA and sleep, the quantity of exercise and when it should be practiced to be effective.[8] Another factor affecting the relationship between sleep and PA is the presence of diseases,[2] with special emphasis for metabolic disorders and obesity.[9] Obesity has an impact on the quality of sleep.[10] Obesity is also a major public health epidemic worldwide with a strong impact on children: it modifies immediate health and quality of life and may lead to early-onset of "metabolic syndrome", which includes hypertension, hyperinsulinemia, hyperlipidemia, type 2 diabetes mellitus, an increased risk of atherosclerosis and cardiovascular diseases.[11,12] It is estimated that by year 2020 three quarters of all deaths in the developing world will be due to non-communicable diseases related to obesity.

An increasing number of epidemiological evidences suggest a link between sleep duration and obesity in children. A short sleep duration is associated to overweight and obesity,[13,14] probably by the changes induced by sleep deprivation on the hormonal homeostasis involving leptin, ghrelin, insulin, cortisol and growth hormone.[15,16] On the other hand, the link between sleep habits and obesity in children still needs further studies; indeed, most of the epidemiological data are based on parent-reported sleep habits with only a few studies using objectively measurements. In a 1 year long longitudinal study examining 111 preschoolers with objective measurements Butte et al.[17] found not association between sleep duration and weight, On the other hand, fat mass changes occurring during the 1 year of observation were inversely associated with sleep duration;[17] similar results were reported by a different study.[10] A tighter link is seen between obesity/adiposity and PA. Moderate/vigorous physical activity (MVPA) seems to be inversely related to adiposity in preschoolers[18] even though levels of MVPA do not seem to drive the timing of the adiposity rebound.[19] It is interesting to note that adiposity appears to have an impact on the levels of physical activity in children as levels of PA are inversely related to percentage body fat in preschool children[19] and fatness in 4 to 5 years old children was associated to low levels of vigorous activity.[20] On the other hand, the associations between physical activity and adiposity has been questioned[18,21] and adiposity does not appear to be linked to sedentary behavior.[22]

Discussion

Promoting motor development

Because of the links connecting PA with obesity, sleep and health in general,[23] knowledge of the factor(s) influencing motor behavior will become a priority among health professionals, including those interested in sleep disorders and their correction. Indeed, the World Health Organization (WHO) has developed an integrated package

of recommendations to address childhood obesity which include promotion of PA for school age children.[24] The children of most of the Western Countries do not meet the WHO recommendation of physical activity levels.[25,26] This is particularly negative as motor skill acquisition by practice in early childhood is a fundamental prerequisite for participation in physical activities.[27,28] Practice leads to competence and motor competences lead to increasing physical activity levels across the life span.[29–31] In this context, especially relevant for stimulating high levels of MVPA in preschoolers appears to be the acquisition of gross-motor skills.[32] The physical education guidelines describe motor competence as development of fundamental motor skills such as locomotor (walking, running, jumping, skipping), manipulative (gross and fine skills as throwing, catching and kicking, fine precision object-handling activities) and balance skills (postural stability during body movement).[33]

In developing children, motor skill competences form the foundation of future movement and physically active behavior.[34,35] Training (and the opportunity of training) provides the fundamental for competence acquisition.[32] A common misconception in that learning movement competences occurs spontaneously (maturation), a misconception that has led to generation of physically illiterate subjects with insufficient levels of fundamental motor skills and poor attitude toward physically active lifestyles.[36,37] On the contrary, children educated to high levels of motor skill competence in early childhood become very active adults, suggesting the importance of strengthening the development of motor skill competences in early life.[38] The relationship between development of motor skill competence and physical activity over time is probably mediated by several factors, including perceived motor competence.[29,39] A positive and negative spiral of engagement or disengagement relates motor competence and physical activity to the risk of obesity, with the mediation of perceived motor competence and health related fitness.[29] Thus, children with high levels of both motor skill competence and perceived motor skill competence participate more in physical activity, finding it more enjoyable and satisfactory. It is interesting to note that increasing BMI to overweight/obesity values during childhood growth leads to a decline in motor competence[40] thus leading to a decline of PA levels and further obesity and low fitness levels.[41] Providing conditions for learning motor competences and promoting their consolidation is therefore a most important mission for (communities of) educators and governments. In countries, such as Italy, where the school system and the cultural tradition give little emphasis to physical activities and where space for movement is also restricted by an adult-centered social environment, promoting development of motor competences is a challenging task. An example of efficient intervention is the playground Primo Sport 0246 located in Trviso, northern Italy, which we have designed to specifically promote gross motor skills in 3-6 y old children.[42] The published study emphasizes the relevant role played by educators in fostering children motor competences; contrary to old believes on the significance of free-play in building motor expertise in children, the study showed the high impact that activities organized by educators (structured activities) had on increasing gross motor skills. Indeed, a relatively minimal participation to structured activities (1 hour repeated 10 times once a week for 10 weeks) caused significant advancements in skills related to manuality and balance. Interestingly, acquisition of these skills had impact on BMI as well (unpublished observation).

Conclusion

In conclusion, physical activity is required for fitness and well-being of children and adults. Lack of adequate levels of activity and sedentary behavior are associated to low quality of life including high occurrence of sleep disorders. Their correction requires specific educational approaches and efforts supporting the growth of fundamental motor skills that should be initiated early during childhood. Do to the impact on quality of health, this knowledge must not be limited to the educational system and the family context; it must also be shared and put in practice by health care professionals, including those interested in the quality of sleep and the correction of the related disorders.

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Conflict of interest

The author declares no conflict of interest.

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