



# **Physical Activity and Adolescent Health: What Should We Know?**

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

Adolescence is characterized by a period of physical, emotional, social and cultural transformations, significant increase in size and changes in physical appearance. At this stage of life the individual is very susceptible to influences of the environment, nutrition, climate, interpersonal relationships and physical activity, among others. This article presents some of the main physical and emotional characteristics of adolescence and the importance of physical activity, highlighting the benefits for physical and mental health, and proposing actions to increase this practice among adolescents.

*Keywords: Adolescence; physical activity; puberty; sedentary lifestyle.*

## **1. INTRODUCTION**

Adolescence is characterized by a period of physical, emotional, social and cultural transformations, significant increase in size and changes in physical appearance, as well as

confrontations with issues of personal, ethnic and sexual identity [1,2]. As this phase of life is a transitional period between childhood and adulthood, the development of physical and interpersonal skills is necessary to successfully integrate into society and community life [3,4].

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To develop healthy living in their social and family context, adolescents need adequate nutrition, protection from infectious diseases through vaccination, protection from unintentional injury and risk behavior, adequate night sleep and regular physical activity (PA) [5]. The way of life of many populations, especially in developed countries, has changed over time due to technological advances offered by smartphones, computers, video games, television and various other equipment with which we interact with the least possible effort [6]. This has contributed to the fact that the level of physical activity in all age groups is decreasing, making people more sedentary and isolated [7,8,9].

Modernization and urbanization of environments, combined with changes in work and leisure structures, can be barriers to the development of active lifestyles in adolescents. On the other hand, the environment in which adolescents live can condition the levels of physical activity, being the involvement of family and school essential to stimulate healthy living practices, supporting materially and emotionally the practice of regular PA. About 80% of teenagers worldwide are currently estimated to practice less physical activity than recommended [10,11,12].

## **2. ADOLESCENCE AND PUBERTY**

While adolescence is a multifactorial process involving physical, emotional, social, cognitive and cultural aspects, at this stage of life a fundamental biological phenomenon occurs to transform the child into a complete and reproducible human being, which is puberty, which can be understood as a biologically oriented process through which the mature body enters the adult state with changes in size, shape, function and appearance [13].

The spurt of pubertal growth is the most impressive aspect observed when the growth rate rises due to the increase in bones, muscles and all body systems. Adolescents exhibit a gradual linear increase in muscle mass and strength up to about 15 years for girls and 17 for boys, and these changes are associated with changes in body size and fitness of movement skills [14,15,16].

The linear growth that occurs during the pubertal spurt is the most easily observed phenomenon in adolescence, resulting from the composition of genetic, environmental, nutritional and social

factors. In addition, height increase is also influenced by physical activity which can induce significant increases in circulating growth hormone and insulin-like growth factor (IGF-1) concentrations [17,18]. This linear pubertal growth is characterized by three phases: 1) growth spurt that contributes more than 20% of the final adult height; 2) acquisition of bone mineral content or peak bone mass, when the process of bone formation overcomes bone resorption; 3) skeletal maturation that ends with the closure of the epiphysis [13,17,18,19].

## **3. PHYSICAL ACTIVITY**

Physical activity is a complex behavioral phenotype determined by the interaction of biological and psychological factors with the physical environment, and can simply be defined as any body activity that results in energy expenditure [1,20]. According to World Health Organization adolescents should be physically active daily as part of play, games, sports, transportation, recreation, physical education, or planned exercise, in the context of family, school, and community activities. Therefore, it is recommended that adolescents practice 60 minutes of moderate to vigorous PA every day to optimize health benefits [21,22,23].

The practice of PA is very important for the development and improvement of adolescents in morphological, physiological and emotional aspects due to the potential to improve their genetically determined physical capacity and the development of multiple skills to become a complete adult human being.

There is evidence that regular PA provides direct and indirect positive health benefits such as improved cardiorespiratory capacity, increased muscle capacity, strengthening of bone structure and changes in body composition, as well as reducing risks for emotional and metabolic diseases [16,24]. In addition there are benefits of AF for immediate and long-term bone health, since bone mass tissue is highly responsive to osteogenic stimuli [14,14,18,25]. PA-induced mechanical forces act on osteoblasts to form new bone tissue and [15,20,25,26] help to optimize peak bone mass through periosteal expansion, providing a more durable bone throughout life.

## **4. BENEFITS OF PA FOR ADOLESCENTS**

The benefits of PA are numerous and can be classified into physical, emotional and social aspects.

## 1. Physical

Increase: Ref. [1,4,13,14,18,20,22,26,27,28,29]

Cerebral blood flow and circulating levels of endorphins, neurotrophic factor and hormones; angiogenesis and neurogenesis

Bone health, muscular fitness, strength, aerobic capacity, motor competence and endurance, healthy weight maintenance

Cardiovascular healthy (oxygen consumption, blood pressure, cholesterol and triglyceride levels)

Sleep quality, disease prevention and the treatment and rehabilitations

## 2. Emotional

Improve: Ref. [1,14,18,22,26,27,28,29,30,31,32,33].

Cognition measures: working memory, concentration, spatial learning, fine-tune interpersonal skill, academic achievement and classroom behavior

Mood, wellbeing, can alleviate symptoms of depression, anxiety and stress

Body image perception ability, self-esteem

Protection against the development of eating disorders

Conditions for treating mental illness

## 3. Social

Improve more effective communication and social connectedness

Develop quality peer relationships and team activities

Natural antidote for addictions of drugs, alcohol, cigarettes and marijuana

Ref. [1,13,18,22,26,28,34,35]

## 5. RISKS OF PA PRACTICE

The practice of PA may involve some risk for adolescents. However, they are considered very low compared to the potential health benefits [30]. The most frequent risks are: musculoskeletal injuries, osteochondrosis, tendonitis, apophysitis and fractures [18,36]. Therefore, to minimize these possible risks, the intensity of activities should be oriented according to the adolescent's body dimensions, maturity level and interest in practicing movements and developing natural activities. Also, choosing appropriate locations, times and weather conditions can also minimize the detrimental effects of physical activity.

## 6. STIMULATION AND ENCOURAGEMENT

According to WHO guidelines all adolescents, regardless of gender, ethnicity, race or income level, unless specific medical conditions indicate otherwise, should engage in physical activity. They should be encouraged to participate in a variety of physical activities that support the natural development and are enjoyable and safe. Whenever possible, adolescents with disabilities should follow these recommendations as long as they are under medical supervision to understand the types and amounts of physical activity appropriate for each person [23].

Although PA can be developed without prerequisites, it should be noted that social support from family and peers positively influences PA practice among adolescents [34]. Other factors such as social recognition, challenge and competition were identified as motivational elements, especially among boys [37]. In order to integrate certain communities emotional support with encouragement and minimal investment in physical resources can greatly increase the development of this behavior among adolescents [34,38].

In addition, school physical education can promote behaviors and skills related to emotional intelligence, such as empathy, self-concept, and altruism that trigger positive attitudes toward PA [39,40,41,42]. Therefore, it is very important to identify individual, cultural and social factors that may interfere with the PA, avoiding barriers that compromise this practice, such as unsafe environments, difficulties in accessing spaces for this practice and high costs related to public and private equipment [13, 43,44,45,46].

## 7. CONCLUSION

There is evidence to suggest that behavioral levels of activities performed during adolescence may follow into adulthood [10,24,35,47,48,49,50]. Although the effects of chronic noncommunicable diseases manifest in adulthood, their development begins in childhood and adolescence [29]. As the adolescent's brain is malleable and susceptible to lifestyle and PA patterns are established during adolescence, the promotion of this practice offers a tool that helps to reduce morbidity and mortality related to chronic non-communicable diseases that occur in adulthood [12,27,35,51,52,53].

PA should lead the adolescent to an energy expenditure in pleasurable, motivating and recreational activities, allowing relaxation and the possibility of perceiving their own body [19,54,55]. Chronological age, physical, cognitive and social maturity, developmental physiology, and family social and cultural conditions should be considered when guiding PA among adolescents.

Finally, it is up to the wider community to promote active travel behavior as less traffic exposure, pedestrian infrastructure for walking and cycling, squares, parks and other public [56] spaces with facilities to encourage the practice of PA.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### REFERENCES

1. Sherar LB, Cumming SP, Eisenmann JC, Baxter-Jones ADG, Malina RM. Adolescent biological maturity and physical activity: Biology meets behavior. *Ped Exer Science*. 2010;22:332-349.
2. Bernhardt N, Obst E, Neble S, Pooseh S, Wurst FM, Weinmann W, et al. Acute alcohol effects on impulsive choice in adolescents. *J Psychopharmacol*. 2019;33: 316-325.
3. Spear LP. The adolescent brain and age-related behavioral manifestations. *Neurosci Biobehav Rev*. 2000;24(4):417-63.
4. Campos CG, Muniz LAM, Belo VS, Romano MCC, Lima MC. Adolescents' knowledge about the benefits of physical exercises to mental health. *Cien Saúde Col*. 2019;24:2951-2958.
5. Sabiston CM, Pila E, Vani M, Thogersen-Ntoumani C. Body image, physical activity, and sport: A scoping review. *Psychol Sport Exerc*. 2019;42:48-57.
6. Bassett-Gunter R, McEwan D, Kamarhie A. Physical activity and body image among men and boys: A meta-analysis. *Body Image*. 2017;22:114-128.
7. Mohebi F, Mohajer B, Yoosefi M, Sheidaei A, Zokaei H, Damerchilu B, et al. Physical activity profile of the Iranian population: STEPS survey, 2016. *BMC Public Health*. 2019;10:1266-1274.
8. Santaliesra-Pasías AM, Rey-López JP, Aznar LAM. Obesity and sedentarism in children and adolescents: What should be done? *Nutr Hosp*. 2013;28(Supl.5):99-10.
9. Saunders TJ, Vallance JK. Screen time and health indicators among children and youth: Current evidence, limitations and future directions. *Appl Health Econ Health Policy*. 2017;15:323-331.
10. Al-Sheyab NA, Alomari MA, Hayajneh AA, Shah S. Attitudes and perceived barriers toward healthy lifestyle behaviors in Jordanian adolescents: A developing country perspective. *Adolesc Health Med Ther*. 2019;10:39-47.
11. Tremblay MS. Challenges in global surveillance of physical activity. *Lancet*; 2019. Available: [https://doi.org/10.1016/S2352-4642\(19\)30348-7](https://doi.org/10.1016/S2352-4642(19)30348-7)
12. Laird Y, Fawkner S, Kelly P, McNamee L, Niven A. The role of social support on physical activity behaviour in adolescent girls: A systematic review and meta-analysis. *Int J Behav Nutr Phys Act*. 2016; 13:79-87.
13. Hashem R, Rey-López JP, Hamer H, McMunn A, Whincup PH, Owen CG, et al. Physical activity and sedentarism behaviors levels of Kuwaiti adolescents: The study of health and activity among adolescents in Kuwait. *J Phys Act Health*. 2018;15:255-262.
14. Al-Thani M, Al-Thani A, Alyafei S, Al-Kuwari MG, Al-Chetachi W, Khalifa SE et al. Prevalence of physical activity and sedentary-related behaviors among adolescents: Data from the Qatar National School Survey. *Pub Health*. 2018;160:150-155.
15. Shin Y, Kim SK, Lee M. Mobile phone interventions to improve adolescents' physical health: A systematic review and meta-analysis. *Public Health Nurs*; 2019. DOI: 10.1111/phn.12655 [Epub ahead of print]
16. Pratt M, Ramirez Varela A, Salvo D, Kohl lii HW, Ding D. Attacking the pandemic of physical inactivity: What is holding us back? *Br J Sports Med*; 2019. pii: bjsports-2019-101392 DOI: 10.1136/bjsports-2019-101392 [Epub ahead of print]
17. McKay CD, Cumming SP, Blake T. Youth sport: Friend or foe? *Best Pract Res Clin Rheumatol*. 2019;141-157.

18. Smith JJ, Eather N, Morgan PJ, Plotnikoff RC, Faigenbaum AD, Lubans DR. The health benefits of muscular fitness for children and adolescents: A systematic review and meta-analysis. *Sports Med.* 2014;44:1209-1223.
19. López MR, Olmedillas H, Fuente FP, Cabello AG, Gonzáles-Aguero A, Casajús JA. Bone metabolism in child and adolescent athletes: A systematic review. *Nutr Hosp.* 2017;34:1469-1481.
20. Vanhelst J, Vidal F, Turck D, Drumez E, Djeddi D, Devouge E, et al. Physical activity is associated with improved bone health in children with inflammatory bowel disease. *Clin Nutr*; 2019. pii:S0261-5614(19)30300-0 DOI: 10.1016/j.clnu.2019.07.018 [Epub ahead of print]
21. Yang X, Zhai Y, Zhang J, Chen J, Liu D, Zhao W. Combined effects of physical activity and calcium on bone health in children and adolescents: A systematic review of randomized controlled trials. *World J Pediatr*; 2020. DOI: 10.1007/s12519-019-00330-7 [Epub ahead of print]
22. Silva CC, Goldberg TBL, Teixeira AS, Marques I. Does physical exercise increase or compromise children's and adolescent's linear growth? Is it a myth or truth? *Rev Bras Med Esport.* 2004;10:525-532.
23. Alves C, Lima RVB. Linear growth and puberty in children and adolescents: Effects of physical activity and sports. *Rev Paul Pediatr.* 2008;26:383-391.
24. Tenforde AS, Nattiv A, Ackerman K, Barrack MT, Fredericson M. Optimising bone health in the young male athlete. *Br J Sports Med.* 2017;51:148-149.
25. Alahmed Z, Lobelo F. Physical activity promotion in Saudi Arabia: A critical role for clinicians and the health care system. *J Epidemiol Global Health.* 2018;7:S7-S15.
26. Alves JGB, Alves GV. Effects of physical activity on children's growth. *J Pediatr (Rio J).* 2019;95:S72-S78.
27. Global Accelerated Action for the Health of Adolescents (AA-HA!): Guidance to support country implementation. World Health Organization; 2017. Geneva.
28. Marker AM, Steele RG, Noser AE. Physical activity and health-related quality of life in children and adolescents: A systematic review and meta-analysis. *Health Psychol.* 2018;37:893-903.
29. World Health Organization. Global recommendations on physical activity for health. Geneva: WHO; 2010. Available: [http://whqlibdoc.who.int/publications/2010/9789241599979\\_eng.pdf](http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf)
30. Dumith SC, Gigante DP, Domingues MR, Kohl HW. Physical activity change during adolescence: A systematic review and a pooled analysis. *Int J Epidemiol.* 2011; 40:685-698.
31. Barros RV, Abad CCC, Kiss MAPD, Serrão JC. Bone mass and physical activity in childhood and adolescence. *Rev Mack Ed Fis Esp.* 2008;7:109-118.
32. Archer T. Health benefits of physical exercise for children and adolescents. *J Nov Physiother.* 2014;4:2-9.
33. Nelson VR, Masocol RV, Asif IM. Associations between the physical activity vital sign and cardiometabolic risk factors in high-risk youth and adolescents. *Sports Health.* 2019;1941738119884083. DOI: 10.1177/1941738119884083 [Epub ahead of print]
34. Faude O, Donath L. Neuromuscular performance during lifespan: Assessment methods and exercise interventions. *Front Physiol.* 2019;10:1348.
35. Esteban-Cornejo I, Tejero-Gonzales CM, Sallis JF, Veiga OL. Physical activity and cognition in adolescents: A systematic review. *J Sci Med Sport.* 2015;18:534-539.
36. Kumar B, Robinson R, Till S. Physical activity and health in adolescence. *Clin Med.* 2015;15:267-272.
37. Tomporowski P. Cognitive and behavioral responses to acute exercise in youths: A review. *Pediatr Exerc Sci.* 2003;15:348-359.
38. Hallal PC, Victora CG, Azevedo MR, Wells JCK. Adolescent physical activity and health. *Sports Med.* 2006;36:1019-1030.
39. Biddle SJH, Asare M. Physical activity and mental health in children and adolescents: A review of reviews. *Br J Sports Med.* 2011;45:886-895.
40. Ramezankhani A, Alipour-Anbarani M, Saeidi M. The factors determining the physical activity of students: A systematic review. *Int J Pediatr.* 2016;4:9977-9986.
41. Uaffe Y. Physical activity among Israeli-Arab adolescent males: How do parenting styles matter? *Am J Men's Health.* 2018; 126:2037-2043.

42. Alharbi M. Influence of individual and family factors on physical activity among Saudi girls: A cross-sectional study. *Ann Saudi Med.* 2019;39:13-21.
43. Herting MM, Chu X. Exercise, cognition, and the adolescent brain. *Birth Def Res.* 2017;109:1672-1679.
44. Ashdown-Franks G, Sabiston CM, Vancampfort D, Smith L, Firth J, Solmi M et al. Cannabis use and physical activity among 89,777 adolescents aged 12-15 years from 21 low- and middle-income countries. *Drug Alcohol Depend.* 2019; 205:107584.  
DOI: 10.1016/j.drugalcdep.2019.107584  
[Epub ahead of print]
45. Portela-Pino I, López-Castedo A, Martínez-Patiño MJ, Valverde-Esteve T, Domínguez-Alonso J. Gender differences in motivation and barriers for the practice of physical exercise in adolescence. *Int J Environ Res Public Health.* 2019;17:1-9.
46. Singh A, Uijtdewilligen L, Twisk J. Physical Activity and performance at school a systematic review of the literature including a methodological quality assessment. *Arch Pediatr Adolesc Med.* 2012;166:49–55.
47. Padial-Ruz R, Pérez-Turpin JA, Cepero-González M, Zurita-Ortega F. Effects of physical self-concept, emotional isolation, and family functioning on attitudes towards physical education in adolescents: Structural equation analysis. *Int J Environ Res Public Health.* 2019;17:8-17.
48. Aljuhani O, Sandercock G. Contribution of physical education to the daily physical activity of schoolchildren in Saudi Arabia. *Int J Environ Res Public Health.* 2019;16:2397-2408.
49. Aliyas Z, Jafari K. Observational physical activity in public open spaces: Environmental determinants of physical activity intensity levels in Iran. *Glob Health Prom.* 2019;1:1757-1765.
50. Blanco M, Veiga OL, Sepúlveda AR, Izquierdo-Gomez R, Román FJ, López S et al. Family environment, physical activity and sedentarism in pre-adolescents with childhood obesity: ANOBAS case-control study. *Aten Primaria;* 2019.  
pii: S0212-6567(17)30672-8.  
DOI: 10.1016/j.aprim.2018.05.013  
[Epub ahead of print]
51. Hayes G, Dowd KP, MacDonncha C, Donnelly AE. Tracking of physical activity and sedentary behavior from adolescence to young adulthood: A systematic literature review. *J Adolesc Health.* 2019;65:446-454.
52. Konrad K, Firk C, Uhlhaas PJ. Brain development during adolescence. *Dtsch Arztebl Int.* 2013;110:425–431.
53. Kahan D, McKenzie TL. School websites: A physical education and physical activity content analysis. *J Sch Health;* 2019.  
DOI: 10.1111/josh.12851  
[Epub ahead of print]
54. Valkenborghs SR, Noetel M, Hillman C, Nilsson M, Smith J, Ortega F, et al. The Impact of physical activity on brain structure and function in youth: A systematic review. *Pediatrics;* 2019.  
pii: e20184032  
DOI: 10.1542/peds.2018-4032  
[Epub ahead of print]
55. Sturm R, Cohen DA. Free time and physical activity among americans 15 years or older: Cross-sectional analysis of the american time use survey. *Prev Chronic Dis.* 2019;16:E133.  
DOI: 10.5888/pcd16.190017
56. Nordbo ECA, Nordh H, Raanaas RK, Aamodt G. Promoting activity participation and well-being among children and adolescents: A systematic review of neighborhood built-environment determinants. *JBIS Database System Rev Implement Rep;* 2019.  
DOI: 10.11124/JBISRIR-D-19-00051  
[Epub ahead of print]

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