Analele Universităţii din Oradea
Facicula Educaţie Fizică şi Sport
ISSN **2286-2870**, E-ISSN **1224-5100**

Rev. noXXXI **/2021** pp.19-27
Article no. 31103-867

THE BENEFITS AND IMPORTANCE OF PHYSICAL ACTIVITY IN COMBATING OBESITY AMONG CHILDREN—A LITERATURE REVIEW

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Abstract: The development of boyhood overweight is usually related to maintaining the pathophysiological state in adulthood. Childhood overweight is characterized as the abnormal buildup of body weight in adipose tissue during childhood, which harms health. Increased physical behavior appeared linked to various health benefits, ranging from improved lipid and glucose homeostasis to endothelial function. Such health outcomes are usually independent of BMI changes. The prevention of boyhood adiposity is a global health priority. Because obesity is a complex condition, effective obesity prevention strategies must consider various factors (personal, environmental, and socio-economic). This article aims to review the benefits, importance, and advertising of physical behavior to children and emphasize the prevention and treatment of childhood obesity.

Key words: physical activity, obesity, children, benefits.

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INTRODUCTION

Most children's daily physical activities have been removed from their daily lives by modern society and culture, making high-energy, low-nutrient foods and beverages more affordable and accessible, making them healthier than similar products. Attractive. Obesity can be reduced mainly through changes in behavior and lifestyle. If the environment encourages unhealthy eating habits and sedentary lifestyles, relying only on personal *self-control* strategies and interventions will be ineffective. Children cannot produce knowledgeable outcomes speaking of health, and unhealthy, so paying attention to environmental changes is more important. This shall supply youngsters through healthier food choices while expanding their physical movement levels and decreasing the threat of overweight (Must et al., 1992; Pandita et al., 2016).

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Obesity development in the early stages of life is commonly related to maintaining the pathophysiological state after adulthood. Childhood overweight is characterized as the abnormal buildup of body grease in adipose tissue during childhood, harming health (Guinhouya, 2012). In modern decades, the global incidence of overweight youth has increased rapidly and is currently regarded a global epidemic (Guinhouya, 2012). In recent decades, children have become less active due to technological progress and socio-economic factors (Landry & Driscoll, 2012). Childhood obesity is the most important known risk factor for cardiovascular disease in adulthood. When these factors appear in childhood, they will increase in later life. Therefore, it is necessary to fight against them from the beginning, especially during this period—observed lifestyle habits (Brambilla et al., 2011; Paes et al., 2015).

Obesity is a significant risk factor for various bodily and psychological health problems, including metabolic disorders, type 2 diabetes, colon cancer, cardiovascular disease, mortality, and depression (Faith et al., 2002; ***. WHOMC, 2015). It appears quantified that the therapeutic expense of overweight in 2009 was 147 billion U.S. $, accounting for more than 46% of the increase in hospitalization costs (Finkelstein et al., 2009). Preventing childhood obesity is important because it is significantly associated with adult obesity (hazard ratio = 2.27-5.91). (Bris et al., 2012). Child obesity affects motor function, leading to delayed motor development and boosted threat of disability (Kantomaa et al., 2013; De et al., 2008). In addition, obese children may face social stigma and discrimination (Kuczmarski et al., 2010; Pizzi, 2010; ***. U.S. DHHS, 2010), and have fewer opportunities to participate in social activities and play at residence and schooling (Pizzi et al., 2010; Pizzi, 2010; ***. U.S. DHHS, 2010; Lane & Bundy, 2011; Pizzi & Vroman, 2013; Hong et al., 2016).

Research on children's functional limitations, factors related to children's occupations, and participation patterns are essential to understand childhood obesity better and provide interventions for obese children (Lollar & Simeonsson, 2005). In addition, motivational strategies, such as activities chosen by students, appeared recognized as an essential part of increasing physical exercise to treat obesity (Salmon et al., 2007). Occupational therapy researchers propose to develop personalized interventions to allow children to participate in exciting and enjoyable activities consistent with motivational strategies (Bazyk & Winne, 2013). Therefore, it is crucial to determine whether or not there appears a difference between healthy strength and overweight children enjoying physical activities (Hong et al., 2016).

According to another research, lack of physical exercise is inversely proportional to the threat of overweight. (Spear et al., 2007; ***. HALCA, 2002) Intuitively, the increasing physical practice appears to have the opposite effect. The occurrence of overweight should be reduced. Although many studies have been conducted on this critical issue, physical activity intervention has not significantly impacted BMI. (Harris et al., 2009; Oude Luttikhuis et al., 2009) These negative findings highlight some of the difficulties in obesity research. First, lifestyle changes are rarely isolated. For example, increasing physical activity might be corresponded to increase caloric intake. Second, people do not know much about compensatory behavior—school-based interventions increase physical activity and may compensate for reduced activity later in the day. Finally, it is often difficult to assess compliance with physical activity interventions (Pradinuk et al., 2011).

PHYSICAL ACTIVITY BENEFITS, IMPORTANCE, AND PROMOTION

Increased physical behavior is correlated for different health benefits, from improving lipid and glucose homeostasis to improving endothelial function. Such health outcomes usually occur independently of changes in BMI. The higher the level of physical behavior in childhood, the lower the threat of cardiovascular disease and type 2 diabetes, and the longer the life expectancy of adults. The implication of physical behavior on cardiovascular risk is related to body fat

(especially abdominal fat) and insulin action. Exercise training improves capillarity and insulin sensitivity in this way (Cesa et al., 2014). Moderate physical practice might improve to purchase considerable well-being advantages (Figure 1). High-intensity activities are required to obtain more beneficial health effects, and aerobic exercise is conducive to more significant health benefits (Janssen & Leblanc, 2010). Maintaining high degrees of physical behavior is also associated through a spectrum of other physical health benefits, such as improving body composition, blood pressure, metabolic status, muscle growth, and bone mineral density, greater self-esteem, improved coordination, balance (Sopa & Pomohaci, 2021; Szabo et al., 2021), and motor skills (Szabo et al., 2020a; Szabo et al., 2020b; Szabo et al., 2020c; Tulbure et al., 2020; Janssen & Leblanc, 2010; Fritz et al., 2016; Wyszyska et al. People, 2020) (Figure 1).

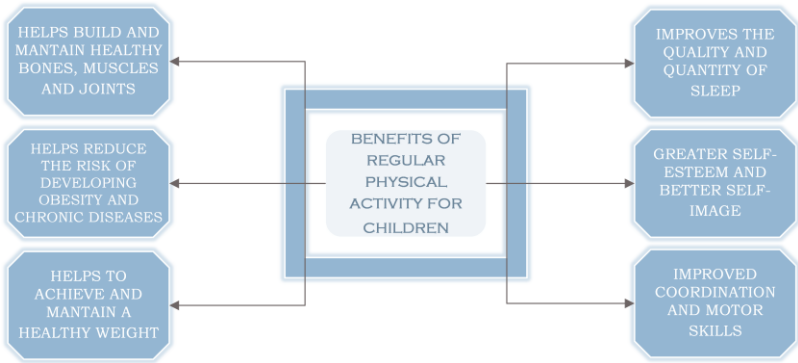

Figure 1. The benefits of regular physical activity for children

Traditional methods of combating the lack of physical activity have focused on raising personal awareness and encouraging behavior change. However, it gets progressively obvious that a person's social, physical, and cultural environment are potent predictors of their activity level (Colley et al., 2012; Pradinuk et al., 2011). In a recent questionnaire of principal health care physicians (family doctors and community pediatricians, 46% to 48% response rate), more than 70% of the respondents identified an obese environment (defined as a lifestyle that encourages consumption energy and prevents energy expenditure), and children living in childhood obesity management is a significant obstacle (Pradinuk et al., 2011; He et al., 2010).

The physical practice is considered a basic health-related behavior related to obesity (Jiménez-Pavón et al., 2010). More elevated degrees of physical practice and longer life span (Arem et al., 2015), the more serious danger of cardiovascular disorder (Swift et al., 2018), deeper concentrations of many cancers, stroke and diabetes, and quality Higher life, better mental health, higher cognitive function, and various other positive health outcomes (Brown et al., 2012; Middleton et al., 2013; Vagetti et al., 2014; Lubans et al., 2016; Bidzan-Bluma and Lipowska, 2018; Baranowski, 2019). Therefore, if citizens of all countries participate in the optimal level of physical activity throughout their adulthood, they will live older, healthier, happier, more conscious, less demanding health care systems, and possibly more productivity, the state of affairs that many citizens, employers, and governments expect (Baranowski, 2019; White et al., 2016).

Physical exercise has been proven to improve children's cardiorespiratory health, physical composition, and social and mental health. Physical exercise has been used as an essential tool for preventing and treating obesity (Kelley & Kelley, 2013). It can cultivate physical fitness that actively changes body composition and metabolic activity and reduces obesity-related complications (Alberga et al., 2013; Paes et al., 2015).

It is suggested that youngsters and adolescents among the periods of 6–17 take sixty minutes of physical practice every day (Piercy et al., 2018). Starting from the age of two, the

2015–2020 Dietary Guidelines for Americans propose eating various products and veggies, entire seeds, protein, low-fat creamery merchandise, and limiting sodium, solid fats, and added sugars (DeSalvo et al., 2016). Disappointingly, merely 21.6% of youngsters among the ages of 6 and 19 take 60 minutes of recommended physical activity five days a week (***. Alliance NPAP, 2016). Diet quality affects weight gain, and it is quantified that the overweight outbreak played an essential role in the decline in life expectancy for the first time in 30 years in 2015 (Ludwig, 2016; Smith et al., 2020).

The frequent physical practice is essential for regulating body composition during growth. However, it would be suggested that the physical changes of children in the process of growing up will affect exercise intensity and performance. Therefore, exercise should be planned according to the child's unique characteristics, age, and gender (Bülbül, 2020; Taşkn et al., 2018) (Figure 2).

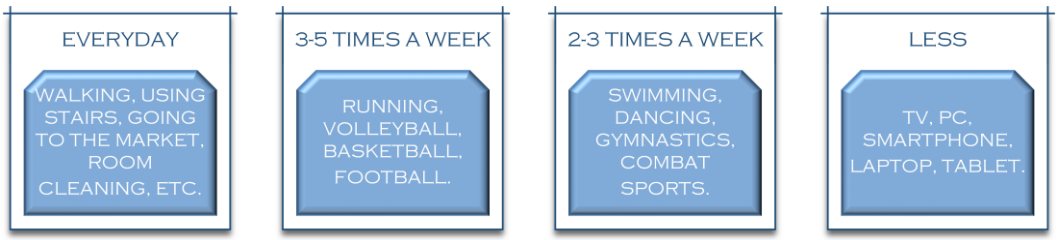

Figure 2. The weekly activity of children
(Source: Bülbül, 2020)

PREVENTING AND TREATMENT OF CHILDHOOD OBESITY

Preventing the emergence of youth obesity is a worldwide health priority. Because obesity is a complicated condition, effective obesity prevention strategies must address various factors (personal, environmental, and socio-economic). The leading couple periods of life are essential to initiate preventive measures that may affect lifestyle and overweight or obesity. Prevention strategies for young children should include parents, primary caregivers, schools, social networks, media, and the larger community (Han et al., 2010). These organizations should encourage a healthful way of life and appropriate physical activity and diet levels by establishing an excellent illustration or providing/supporting a supportive environment. The prevention plan should mainly focus on the child's family. Parents should establish an excellent exemplar in favor of their youngsters and develop a healthy lifestyle. Due to the difficulty of this parental approach, parents require social support to understand the significance of shifting lifestyle habits and their role in the psychophysiological development of their children (Watson et al., 2011; Wyszyska et al., 2020).

Obesity control needs to be prevented because many (but not all) obese children will grow up to become obese adults. The likelihood of follow-up or childhood obesity continuing into adulthood is related to age. Adult overweight supervision is challenging and often unsuccessful, especially with no known organic cause (e.g., leptin deficiency or other hormonal abnormalities). Regarding the opposite script, preventing childhood obesity may be more valuable and likely to reduce long-term complications. When dealing with childhood obesity, there are three degrees of prevention (Guo et al., 1994; Parsons et al., 1999; Pandita et al., 2016) (Figure 3).

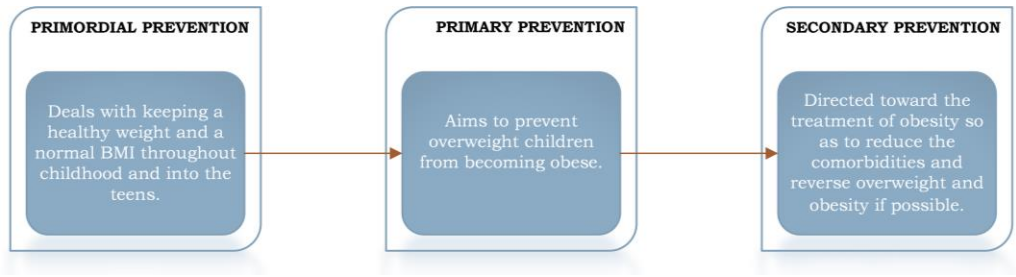

Figure 3. The levels of prevention

The treatment of youth overweight is very complicated. Poor patient motivation and parents' inability to devote time to their children possess appeared recognized as the most critical factors leading to inefficiency during the therapy of children and adolescents (Befort et al., 2006). Children who are trapped between courses/courses in an exam marathon due to occupational anxiety cannot spare time for physical exercise and are even referred to medical institutions due to these problems. Therefore, the most common problem is non-compliance with childhood obesity treatment. When comparing the two studies, it was found that children are more likely to be non-adherent to treatment (Bülbül, 2020).

Traditional interventions for overweight or obesity include healthy nutrition education and lifestyle changes through increased physical exercise. In this case, interventions based on increasing physical activity are generally considered the most effective, not only because they help control weight but also because they provide health benefits such as bone and muscle strengthening, improved sleep, and strengthened psychological well-being and decrease the threat of cardiovascular disease (Janssen & Leblanc, 2010; Harris et al., 2009). In a longitudinal research of more than 6000 7-year-old children participating in regular physical activities, it was found that physical activity was related to the percentage of body fat of 11-year-old children (Griffiths et al., 2016). Similarly, research on children aged 4 to 18 shows that regular physical exercise has significant health benefits, such as increased bone density, good blood pressure, and improved metabolism or cardiorespiratory health (Janssen & Leblanc, 2010; Yuksel et al., 2020).

Experts recommend specific nutrition and physical practice behaviors (Barlow & Expert Committee, 2007). In addition to clinic-based interventions, researchers have also tried to manage obesity through family, community, school, and after-school programs. According to Cochrane's review of childhood obesity prevention programs, most well-designed interventions have produced positive results, especially in children between 6 and 12 years of age. (Summerbell et al., 2005). Children may benefit from clearly targeted interventions, while adolescents may benefit from population-based practical and cost-effective methods (Kelishadi & Azizi-Soleiman, 2014). The purpose of this article is to review (literature) the benefits, importance, and promotion of physical activity to children and to try to highlight the prevention and treatment of childhood obesity.

CONCLUSIONS

Physical behavior has appeared proven to promote active adaptation to childhood obesity and support its prevention and treatment. The size of the benefits may vary from practice to practice. The main effects of the exercise are mainly related to the restoration of blood lipids, the restoration of autonomic nerves, and the improvement of body composition.

Child obesity is now one of the particularly severe widespread health care challenges in developed and developing countries. Child overweight is a threat element for many chronic diseases, including type II diabetes, cardiovascular disease, hypertension, osteoporosis, and cancer. It also has psychosocial consequences, such as delays in academic and social functioning, low self-esteem, and depression.

Clinical health psychologists are well-suited to investigate this complex issue, but transdisciplinary teams will be required to shift the dial.

REFERENCES

Alberga, A. S., Farnesi, B. C., Lafleche, A., Legault, L., & Komorowski, J. (2013). The effects of resistance exercise training on body composition and strength in obese prepubertal children. *The Physician and sportsmedicine*, 41(3), 103–109. https://doi.org/10.3810/psm.2013.09.2028

Arem, H., Moore, S. C., Patel, A., Hartge, P., Berrington de Gonzalez, A., Visvanathan, K., Campbell, P. T., Freedman, M., Weiderpass, E., Adami, H. O., Linet, M. S., Lee, I. M., & Matthews, C. E. (2015). Leisure time physical activity and mortality: a detailed pooled analysis of the dose-response relationship. *JAMA internal medicine*, 175(6), 959–967. https://doi.org/10.1001/jamainternmed.2015.0533

Baranowski T. (2019). Increasing physical activity among children and adolescents: Innovative ideas needed. *Journal of sport and health science*, 8(1), 1–5. https://doi.org/10.1016/j.jshs.2018.09.011

Barlow, S. E., & Expert Committee (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*, 120 Suppl 4, S164–S192. https://doi.org/10.1542/peds.2007-2329C

Bazyk, S., & Winne, R. (2013). A multi-tiered approach to addressing the mental health issues surrounding obesity in children and youth. *Occupational therapy in health care*, 27(2), 84–98. https://doi.org/10.3109/07380577.2013.785643

Befort, C. A., Greiner, K. A., Hall, S., Pulvers, K. M., Nollen, N. L., Charbonneau, A., Kaur, H., & Ahluwalia, J. S. (2006). Weight-related perceptions among patients and physicians: how well do physicians judge patients' motivation to lose weight?. *Journal of general internal medicine*, 21(10), 1086–1090. https://doi.org/10.1111/j.1525-1497.2006.00567.x

Bidzan-Bluma, I., & Lipowska, M. (2018). Physical Activity and Cognitive Functioning of Children: A Systematic Review. *International journal of environmental research and public health*, 15(4), 800. https://doi.org/10.3390/ijerph15040800

Brambilla, P., Pozzobon, G., & Pietrobelli, A. (2011). Physical activity as the main therapeutic tool for metabolic syndrome in childhood. *International journal of obesity* (2005), 35(1), 16–28. https://doi.org/10.1038/ijo.2010.255

Brisbois, T. D., Farmer, A. P., & McCargar, L. J. (2012). Early markers of adult obesity: a review. Obesity reviews: an official journal of the *International Association for the Study of Obesity*, 13(4), 347–367. https://doi.org/10.1111/j.1467-789X.2011.00965.x

Brown, J. C., Winters-Stone, K., Lee, A., & Schmitz, K. H. (2012). Cancer, physical activity, and exercise. *Comprehensive Physiology*, 2(4), 2775–2809. https://doi.org/10.1002/cphy.c120005

Bülbül S, Uluğ F, Şanlı C, Kırışoğlu M. (2011). Obesite Hastalarının Tedaviye Uyum Durumlarının Değerlendirilmesi SözlüBildiri. VI. *Ulusal Ana Çocuk SağlığıKongresi*. Antalya: Kasım 16-20.

Bülbül S. (2020). Exercise in the treatment of childhood obesity. *Turk pediatri arsivi*, 55(1), 2–10. https://doi.org/10.14744/TurkPediatriArs.2019.60430

Cesa, C. C., Sbruzzi, G., Ribeiro, R. A., Barbiero, S. M., de Oliveira Petkowicz, R., Eibel, B., Machado, N. B., Marques, R. d., Tortato, G., dos Santos, T. J., Leiria, C., Schaan, B. D., & Pellanda, L. C. (2014). Physical activity and cardiovascular risk factors in children: meta-analysis of randomized clinical trials. *Preventive medicine*, 69, 54–62. https://doi.org/10.1016/j.ypmed.2014.08.014

Colley, R. C., Brownrigg, M., & Tremblay, M. S. (2012). A model of knowledge translation in health: the Active Healthy Kids Canada Report Card on physical activity for children and youth. *Health promotion practice*, 13(3), 320–330. https://doi.org/10.1177/1524839911432929

De, S., Small, J., & Baur, L. A. (2008). Overweight and obesity among children with developmental disabilities. *Journal of intellectual & developmental disability*, 33(1), 43–47. https://doi.org/10.1080/13668250701875137

DeSalvo, K. B., Olson, R., & Casavale, K. O. (2016). Dietary Guidelines for Americans. *JAMA*, 315(5), 457–458. https://doi.org/10.1001/jama.2015.18396

Faith, M. S., Matz, P. E., & Jorge, M. A. (2002). Obesity-depression associations in the population. *Journal of psychosomatic research*, 53(4), 935–942. https://doi.org/10.1016/s0022-3999(02)00308-2

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: payer-and service-specific estimates. *Health affairs (Project Hope)*, 28(5), w822–w831. https://doi.org/10.1377/hlthaff.28.5.w822

Fritz, J., Rosengren, B. E., Dencker, M., Karlsson, C., & Karlsson, M. K. (2016). A seven-year physical activity intervention for children increased gains in bone mass and muscle strength. *Acta paediatrica* (Oslo, Norway : 1992), 105(10), 1216–1224. https://doi.org/10.1111/apa.13440

Griffiths, L. J., Sera, F., Cortina-Borja, M., Law, C., Ness, A., Dezateux, C. (2016). Objectively measured physical activity and sedentary time: Cross-sectional and prospective associations with adiposity in the Millennium Cohort Study. *BMJ Open*. 6, e010366.

Guinhouya B. C. (2012). Physical activity in the prevention of childhood obesity. *Paediatric and perinatal epidemiology*, 26(5), 438–447. https://doi.org/10.1111/j.1365-3016.2012.01269.x

Guo, S. S., Roche, A. F., Chumlea, W. C., Gardner, J. D., & Siervogel, R. M. (1994). The predictive value of childhood body mass index values for overweight at age 35 y. *The American journal of clinical nutrition*, 59(4), 810–819. https://doi.org/10.1093/ajcn/59.4.810

Han, J. C., Lawlor, D. A., & Kimm, S. Y. (2010). Childhood obesity. *Lancet* (London, England), 375(9727), 1737–1748. https://doi.org/10.1016/S0140-6736(10)60171-7

Harris, K. C., Kuramoto, L. K., Schulzer, M., & Retallack, J. E. (2009). Effect of school-based physical activity interventions on body mass index in children: a meta-analysis. CMAJ : *Canadian Medical Association journal = journal de l'Association medicale canadienne*, 180(7), 719–726. https://doi.org/10.1503/cmaj.080966

Harris, K. C., Kuramoto, L. K., Schulzer, M., Retallack, J. E. (2009). Effect of school-based physical activity interventions on body mass index in children: A meta-analysis. Cmaj. 180, 719–726.

He, M., Piché, L., Clarson, C. L., Callaghan, C., & Harris, S. B. (2010). Childhood overweight and obesity management: A national perspective of primary health care providers' views, practices, perceived barriers and needs. *Paediatrics & child health*, 15(7), 419–426. https://doi.org/10.1093/pch/15.7.419

Healthy active living for children and youth. (2002). *Paediatrics & child health*, 7(5), 339–358.

Hong, I., Coker-Bolt, P., Anderson, K. R., Lee, D., & Velozo, C. A. (2016). Relationship Between Physical Activity and Overweight and Obesity in Children: Findings From the 2012 National Health and Nutrition Examination Survey National Youth Fitness Survey. *The American journal of occupational therapy: official publication of the American Occupational Therapy Association*, 70(5), 7005180060p1–7005180060p8. https://doi.org/10.5014/ajot.2016.021212

Janssen, I., & Leblanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *The international journal of behavioral nutrition and physical activity*, 7, 40. https://doi.org/10.1186/1479-5868-7-40

Janssen, I., Leblanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int. J. Behav. Nutr. Phys. Act*. 7, 40.

Jiménez-Pavón, D., Kelly, J., & Reilly, J. J. (2010). Associations between objectively measured habitual physical activity and adiposity in children and adolescents: Systematic review. International journal of pediatric obesity : IJPO : an official journal of the *International Association for the Study of Obesity*, 5(1), 3–18. https://doi.org/10.3109/17477160903067601

Kantomaa, M. T., Stamatakis, E., Kankaanpää, A., Kaakinen, M., Rodriguez, A., Taanila, A., Ahonen, T., Järvelin, M. R., & Tammelin, T. (2013). Physical activity and obesity mediate the association between childhood motor function and adolescents' academic achievement. *Proceedings of the National Academy of Sciences of the United States of America*, 110(5), 1917–1922. https://doi.org/10.1073/pnas.1214574110

Kelishadi, R., & Azizi-Soleiman, F. (2014). Controlling childhood obesity: A systematic review on strategies and challenges. *Journal of research in medical sciences : the official journal of Isfahan University of Medical Sciences*, 19(10), 993–1008.

Kelley, G. A., & Kelley, K. S. (2013). Effects of exercise in the treatment of overweight and obese children and adolescents: a systematic review of meta-analyses. *Journal of obesity*, 2013, 783103. https://doi.org/10.1155/2013/783103

Kuczmarski M., Reitz S. M., & Pizzi M. A. (2010). Weight management and obesity reduction. In Scaffa M. E., Reitz S. M., & Pizzi M. A. (Eds.), *Occupational therapy in the promotion of health and wellness* (pp. 253–279). Philadelphia: F. A. Davis.

Landry, B. W., & Driscoll, S. W. (2012). Physical activity in children and adolescents. *PM & R : the journal of injury, function, and rehabilitation*, 4(11), 826–832. https://doi.org/10.1016/j.pmrj.2012.09.585

Lane S. J., & Bundy A. C. (2011). *Kids can be kids: A childhood occupations approach*. Philadelphia: F. A. Davis.

Lollar, D. J., & Simeonsson, R. J. (2005). Diagnosis to function: classification for children and youths. *Journal of developmental and behavioral pediatrics : JDBP*, 26(4), 323–330. https://doi.org/10.1097/00004703-200508000-00012

Lubans, D., Richards, J., Hillman, C., Faulkner, G., Beauchamp, M., Nilsson, M., Kelly, P., Smith, J., Raine, L., & Biddle, S. (2016). Physical Activity for Cognitive and Mental Health in Youth: A Systematic Review of Mechanisms. *Pediatrics*, 138(3), e20161642. https://doi.org/10.1542/peds.2016-1642

Ludwig D. S. (2016). Lifespan Weighed Down by Diet. JAMA, 315(21), 2269–2270. https://doi.org/10.1001/jama.2016.3829

Middleton, L. E., Corbett, D., Brooks, D., Sage, M. D., Macintosh, B. J., McIlroy, W. E., & Black, S. E. (2013). Physical activity in the prevention of ischemic stroke and improvement of outcomes: a narrative review. *Neuroscience and biobehavioral reviews*, 37(2), 133–137. https://doi.org/10.1016/j.neubiorev.2012.11.011

Must, A., Jacques, P. F., Dallal, G. E., Bajema, C. J., & Dietz, W. H. (1992). Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. *The New England journal of medicine*, 327(19), 1350–1355. https://doi.org/10.1056/NEJM199211053271904

Oude Luttikhuis, H., Baur, L., Jansen, H., Shrewsbury, V. A., O'Malley, C., Stolk, R. P., & Summerbell, C. D. (2009). Interventions for treating obesity in children. *The Cochrane database of systematic reviews*, (1), CD001872. https://doi.org/10.1002/14651858.CD001872.pub2

Paes, S. T., Marins, J. C., & Andreazzi, A. E. (2015). Efeitos metabólicos do exercício físico na obesidade infantil: uma visão atual [Metabolic effects of exercise on childhood obesity: a current view]. *Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo*, 33(1), 122–129. https://doi.org/10.1016/j.rpped.2014.11.002

Pandita, A., Sharma, D., Pandita, D., Pawar, S., Tariq, M., & Kaul, A. (2016). Childhood obesity: prevention is better than cure. *Diabetes, metabolic syndrome and obesity: targets and therapy*, 9, 83–89. https://doi.org/10.2147/DMSO.S90783

Parsons, T. J., Power, C., Logan, S., & Summerbell, C. D. (1999). Childhood predictors of adult obesity: a systematic review. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*, 23 Suppl 8, S1–S107.

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., George, S. M., & Olson, R. D. (2018). *The Physical Activity Guidelines for Americans. JAMA*, 320(19), 2020–2028. https://doi.org/10.1001/jama.2018.14854

Pizzi, M. A., & Vroman, K. (2013). Childhood obesity: effects on children's participation, mental health, and psychosocial development. *Occupational therapy in health care*, 27(2), 99–112. https://doi.org/10.3109/07380577.2013.784839

Pradinuk, M., Chanoine, J. P., & Goldman, R. D. (2011). Obesity and physical activity in children. *Canadian family physician Medecin de famille canadien*, 57(7), 779–782.

Salmon, J., Booth, M. L., Phongsavan, P., Murphy, N., & Timperio, A. (2007). Promoting physical activity participation among children and adolescents. *Epidemiologic reviews*, 29, 144–159. https://doi.org/10.1093/epirev/mxm010

Smith, J. D., Fu, E., & Kobayashi, M. A. (2020). Prevention and Management of Childhood Obesity and Its Psychological and Health Comorbidities. *Annual review of clinical psychology*, 16, 351–378. https://doi.org/10.1146/annurev-clinpsy-100219-060201

Sopa I. S., Pomohaci M. Using coaching techniques in assessing and developing the static and dynamic balance level of young volleyball players. *Bulletin of the Transilvania University Brasov*. 2021; 14(63):89-100. https://doi.org/10.31926/but.shk.2021.14.63.1.12.

Spear, B. A., Barlow, S. E., Ervin, C., Ludwig, D. S., Saelens, B. E., Schetzina, K. E., & Taveras, E. M. (2007). Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics*, 120 Suppl 4, S254–S288. https://doi.org/10.1542/peds.2007-2329F

Summerbell, C. D., Waters, E., Edmunds, L. D., Kelly, S., Brown, T., & Campbell, K. J. (2005). Interventions for preventing obesity in children. *The Cochrane database of systematic reviews*, (3), CD001871. https://doi.org/10.1002/14651858.CD001871.pub2

Swift, D. L., McGee, J. E., Earnest, C. P., Carlisle, E., Nygard, M., & Johannsen, N. M. (2018). The Effects of Exercise and Physical Activity on Weight Loss and Maintenance. *Progress in cardiovascular diseases*, 61(2), 206–213. https://doi.org/10.1016/j.pcad.2018.07.014

Szabo D. A., Neagu N., Sopa I. S. Research regarding the development and evaluation of agility (balance, coordination and speed) in children aged 9-10 years. (2020c). *Health Sports Rehabil Med*; 21(1): 33-40. https://doi.org/10.26659/pm3.2020.21.1.33

Szabo D. A., Neagu N., Teodorescu S., Panait C. M., Sopa I. S. (2021). Study on the Influence of Proprioceptive Control versus Visual Control on Reaction Speed, Hand Coordination, and Lower Limb Balance in Young Students 14–15 Years Old. *International Journal of Environmental Research and Public Health*; 18(19):10356. https://doi.org/10.3390/ijerph181910356

Szabo D. A., Neagu N., Teodorescu S., Sopa I.S. (2020a). Eye-hand relationship of proprioceptive motor control and coordination in children 10-11 years old. *Health, Sports Rehabil Med*;21(3):185-191. https://doi.org/10.26659/pm3.2020.21.3.185

Szabo D. A., Sopa I. S. (2020b). Study regarding the level of physical and functional development of children from primary school level. *J Phys Educ Sport*;20 (3):1497-1504.

Taşkın G, Şahin Özdemir FN. (2018). The importance of exercise on children. *Gazi J Physical Education and Sport Sciences*;23:131–41.

Tulbure R. E., Neagu N., Szabo D. A. (2020).Comparative study on the development of the motor skill (strength) through the circuit method versus dynamic games in physical education classes. *Health Sports Rehabil Med*; 1(4):223-230. https://doi.org/10.26659/pm3.2020.21.4.223

Vagetti, G. C., Barbosa Filho, V. C., Moreira, N. B., Oliveira, V. d., Mazzardo, O., & Campos, W. d. (2014). Association between physical activity and quality of life in the elderly: a systematic review, 2000-2012. *Revista brasileira de psiquiatria* (Sao Paulo, Brazil : 1999), 36(1), 76–88. https://doi.org/10.1590/1516-4446-2012-0895

Watson, P. M., Dugdill, L., Pickering, K., Bostock, S., Hargreaves, J., Staniford, L., & Cable, N. T. (2011). A whole family approach to childhood obesity management (GOALS): relationship between adult and child BMI change. *Annals of human biology*, 38(4), 445–452. https://doi.org/10.3109/03014460.2011.590531

White, M. I., Dionne, C. E., Wärje, O., Koehoorn, M., Wagner, S. L., Schultz, I. Z., Koehn, C., Williams-Whitt, K., Harder, H. G., Pasca, R., Hsu, V., McGuire, L., Schulz, W., Kube, D., & Wright, M. D. (2016). Physical Activity and Exercise Interventions in the Workplace Impacting Work Outcomes: A Stakeholder-Centered Best Evidence Synthesis of Systematic Reviews. *The international journal of occupational and environmental medicine*, 7(2), 61–74. https://doi.org/10.15171/ijoem.2016.739

Wyszyńska, J., Ring-Dimitriou, S., Thivel, D., Weghuber, D., Hadjipanayis, A., Grossman, Z., Ross-Russell, R., Dereń, K., & Mazur, A. (2020). Physical Activity in the Prevention of Childhood Obesity: The Position of the European Childhood Obesity Group and the European Academy of Pediatrics. *Frontiers in pediatrics*, 8, 535705. https://doi.org/10.3389/fped.2020.535705

Yuksel, H. S., Şahin, F. N., Maksimovic, N., Drid, P., & Bianco, A. (2020). School-Based Intervention Programs for Preventing Obesity and Promoting Physical Activity and Fitness: A Systematic Review. *International Journal of Environmental Research and Public Health*, *17*(1), 347. MDPI AG. Retrieved from http://dx.doi.org/10.3390/ijerph17010347

***. Alliance NPAP. 2016. *2016 U.S. report card on physical activity for children and youth.*

***. American Occupational Therapy Association. (2013). *Obesity and occupational therapy*. *American Journal of Occupational Therapy*, 67(6, Suppl), S39–S46. http://dx.doi.org/10.5014/ajot.2013.67S39

***. U.S. Department of Health and Human Services. (2010). *The Surgeon General's vision for a healthy and fit nation*. Rockville, MD: U.S. Department of Health and Human Services, Office of the Surgeon General.

***. World Health Organization Media Centre. (2015). *Obesity and overweight fact sheet (Fact Sheet No. 311)*. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/index.html

Submitted: September 12 2021

Revised: December 03, 2021

Accepted and published online October 13, 2021