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Health Benefits of Physical Exercise for Children and Adolescents

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Abstract

Several manifestations of physical exercise providing health benefits for children and adolescents are evident in healthy and functional muscles and bones, increased strength and endurance, angiogenesis and neurogenesis, the reduced risk for chronic disease such as overweight and diabetes, improved self-esteem and psychological well-being, and finally higher levels of subjective and psychological well-being as well as reduced stress, anxiety and depression. Since obesity and being overweight impacts adversely on happiness, psychological well-being and several important positive personal attributes, most physical activity interventions, if properly designed and maintained appear to promise a satisfying degree of improvement. Physical exercise influences cognitive, emotional, learning and neurophysiological domains, both directly and indirect, thereby rendering it essential that this noninvasive, nonpharmacological intervention ought to form a part of children's and adolescents' long-term health programs.

Keywords: Physical exercise; Health; Physical; Psychological; Well-being

Several factors facilitate health and happiness in children and adolescents: some of these factors are non-modifiable, including age, gender, genetic characteristics and macro-socioeconomy, whereas others are more-or-less modifiable, including education, income, leisure activity, social status, affective profiles and role models [1-3], while physical exercise as a promoter of health and well-being is invariably available [4]. It seems remarkable that the benefits of physical exercise upon psychological and physical health parameters have received a paucity of attention compared with those presenting on adult health [5]. The utility and feasibility of physical exercise training programs in several pediatric disease settings and nursing educational facilities has been explored with some success [6,7]. In a 'review of reviews', Biddle and Asare [8] have concluded that, despite shortcomings in research design, there is a real association between physical activity and mental (psychological) health, as well as a consistent link between sedentary screen time and poorer mental health. In the present review, several health-promoting and affective status improving aspects of physical exercise are examined and discussed as contributors towards an elevated level of well-being among children and adolescents; these aspects include overweight and obesity which pose worldwide dangers for health, function, well-being and happiness, anxiety and stress that may disturb both the developmental trajectory and academic outcome, and neuroimmune functioning complications.

Exercise and Obesity

Excess weight among children and adolescents is linked to emerging health hazards that include respiratory complications [9], cardiovascular risks [10], diabetes Type 2 [11], sleep problems (Daniels et al.) metabolic disorders [12], psychological health risks [13] and incapacity to exercise [14]. Nevertheless, even relatively modest and straightforward dietary improvements (i.e. fruit and vegetables) combined with exercise programs were discovered to induce marked and long-lasting effects [15]; certainly, parental support, modeling and encouragement, after-school and weekends, were important factors that provided for the notable progressions observed in physical activity [16]. In a Spanish study of 2,330 children aged 6-17 years, Gulias-Gonzalez et al. [17] found that being overweight and obesity were related to lower levels of physical fitness but those individuals in the underweight category did not perform worse than their normal weight peers on physical fitness. These observations imply that being overweight and obesity in children/adolescents pose a greater danger than being underweight, hence the importance of the study. In a cross-sectional study of 11,743 pupils (4th grade to 8th grade, i.e. middle school), Rauner et al. [18] showed that weight status, as indexed by Body Mass Index (BMI) percentile was not a significant predictor of passing the Nebraska state accountability mathematics and reading test after including free/reduced lunch status. Aerobic fitness, nevertheless, was a significant predictor of academic performance. Reducing BMI held undoubted health benefits but only aerobic fitness endowered any real advantages with regard to academic prowess. Here, too the health benefits of exercise ought not necessarily to be equated with direct benefits in academic prowess despite the intrinsically-motivating utility of exercise in the cognitive, affective and behavioral domains Sebire et al. [19]. Similar observations were reported earlier [20].

It seems the case that obesity impacts adversely on happiness and psychological well-being. Nevertheless, after adjustment for health the obesity-unhappiness link is abolished although being overweight female participants were more likely to be unhappy [21]. Strong associations exist too between happiness and weight, regular physical exercise, exposure to 2nd-hand cigarette smoke, lower BMI, daily fruit/vegetables and how adolescents spend their leisure time [22,23] in a study of 8159 adolescent Iranian girls, observed that the adoption of regular physical exercise and other healthy behaviors promoted both better health and happiness. Wittberg et al. [24] studied the potential differences between children (N=1,725, 50.1% males) in academic achievement as a function of aerobic fitness over a 2-year, semi-longitudinal period. They reported that pupils who maintained themselves in the Healthy Fitness zone showed significantly higher scores in the WESTEST, a criterion-based academic performance assessment, than those pupils who stayed in the Needs Improvement zone. In a cross-sectional (at age 11) and longitudinal study that examined objectively-measured free-living physical activity and academic attainment in a cohort

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(United Kingdom) of 4,755 children and adolescents, Booth et al. [25] obtained a positive, long-term impact of moderate-vigorous intensity physical exercise on academic attainment; increased performance by both boys and girls was indicated at 16 years-of-age and increased science performance at 11 and 16 years. Thus, being obese and/or being overweight are very much a negative self-perception and exercise not only provides improvement but ensures a variety of other 'bonuses'.

Exercise and Affective Status

Psychological disorders and obesity threaten both adolescent health outcomes and school performance [26,27], with a marked co-existence of the two conditions [28-30]. Among the factors contributing to obesity and being overweight among children and adolescents, poor nutrition, stress/trauma, anxiety and depression, and a sedentary lifestyle should be counted [31-33]. Several lines of evidence point to the links between eating disorders and affective disorders [34,35] obtained a unidirectional, age-specific association between depressive symptoms at T1 (10-11 years) and disordered eating at T2 (12-13 years). Hartmann et al. [36] have shown that children expressing loss of control eating presented higher levels of exposure to parental problems, (e.g., under-involvement, arguments, and depression of family members), affective imbalance and dieting-related risk factors than children without loss of control eating. The strongest predictors of loss of control eating were those factors associated with parental under-involvement, and critical comments by the family and the critical life event change of school. The Depressed Adolescents Treated with Exercise (DATE) program offers a standardized aerobic exercise regime and the participating adolescents showed symptoms that met the DSM-IV-TR criteria for major depressive disorder. Hughes et al. [37] studied thirty adolescents (aged 12-18 years) divided into 2 groups, Stretch (controlled stretching) and Exercise (DATE program), who participated over a 12-week intervention period. After six weeks, depressive symptoms were reduced for both groups but more rapidly for the Exercise (DATE) group. By the 12th week, the response rate for the exercise group was 100% (with 86% remission) and the response rate for the Stretch group was 67% (with 50% remission), underlining the noninvasive utility of the exercise intervention. Constancy and regularity appear to contribute a notable adjunct in the establishment of an exercise routine; lifestyle routines, such as a habitual breakfast (frequency and quality) and school breakfast programs have a positive effect on children's academic performance with clearest effects on mathematic and arithmetic grades in undernourished children. Increased frequency of habitual breakfast was consistently positively associated with academic performance [38].

The period of development through childhood and adolescence into adulthood places intrinsic stress and burden upon the individual [39,40] have shown that the transition from childhood into the middle school and incidence of puberty exerted independent negative influences on school outcomes. Certain chronic health conditions influenced the children's functional and affective status thereby affecting their performance with poorer academic achievement. School outcomes were positively associated with the number of health assets that the children possessed: low levels of negative stress experiences together with greater physical comfort gave positive benefits for teacher-connectedness, school engagement, and academic achievement, whereas bullying behavior and bully victimization affected negatively these outcomes. Children expressing higher life satisfaction were more connected with teachers, better engaged in schoolwork, and earned higher grades than those children who were less satisfied. In view of these transitional pressures that may affect health variables adversely, the associations between personal attributes, such as self-determination, anxiety and depression, stress, exercise propensity and academic performance amongst adolescents emerges with particular impact upon developmental trajectories. Using structural equation modeling with data from 750 secondary school pupils (mean age=13.4 years), Hashim et al. [41] observed that greater levels of self-determination (intrinsic motivation) were linked positively with exercise habit behavior, with intensity of the exercise habit fostering academic performance and buffering individuals against the debilitating influences of stress, anxiety and depression in the absence of gender effects. The COPE (Creating Opportunities for Personal Empowerment), a cognitive-behavioral skills-building intervention, combined with TEEN (Thinking, Emotions, Exercise, Nutrition) program has been constructed to address public health problems affecting academic achievement in adolescents (Lusk and Melnyk). Melnyk et al. [42] studied 779 culturally-diverse adolescents in the US Southwest with COPE-TEEN+20 minutes physical exercise over 15 weeks. As a result of the intervention, they obtained significantly lower depression scores, lower mean BMI and higher health course grades both during the short-term and long-term testing.

Exercise and Multiple Domains

The advantages provided by physical exercise for both children and adolescents have been observed several health domains that include physiology, neuroimmune functioning, recovery from disease, accident and disability, increased strength and endurance, angiogenesis and neurogenesis, reduced risk for chronic disease, improved self-esteem and psychological well-being, and reduced stress, anxiety and depression [43,44]. The plethora of evidence supporting the benefits of physical exercise over multiple domains increases on at least a monthly basis. For example, the influence of exercise for higher order intrinsic motivation to promote life satisfaction and positive affectivity has emerged significantly [45,46]. Concomitantly, much emerging evidence reinforces the notion that physical exercise impacts upon academic performance too, both directly and directly through cognitive, emotional, learning and neurophysiological domains not unrelated to health issues [47-50] obtained results showing that physical exercise improved brain health and cognition in children thereby enhancing school performance and general functioning. Nevertheless, the earlier noted discrepancies in research design and methods appear to 'cast cold water' on any premature optimism since Rasberry et al. [51], in a systematic review of the literature, have reported from a total of 251 studies of associations between physical activity and academic performance: 50.5% were positive, 48% were non-significant and 1.5% was negative.

In conclusion, the present account has outlined the putatively positive outcomes associated with the establishment of physical exercise regimes available for children and adolescents presenting problems linked to obesity and being overweight, negative affective status and over multiple domains of physiological and psychological functioning. Exercise offers a nonpharmacological, noninvasive intervention which, if introduced proactively, will provide marked elements of prevention. Accumulated evidence has underlined the premise that brain neural, muscular and other physiologic systems are subject to the law of "Use-it-or-lose-it".

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