

REVIEW ARTICLES

CHILDREN AND TEENS MOVING TOWARDS MENTAL HEALTH

CRIANÇAS E ADOLESCENTES CAMINHANDO NA DIREÇÃO DA SAÚDE MENTAL

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ABSTRACT

Childhood and adolescence are periods of rapid growth when several structural and behavioral transformations take place. It is important to identify positive environmental exposures during these years and establish behavioral patterns that may have a positive effect on the development of these populations. There is an increasing body of evidence showing that regular exercise has unquestionable physical, social, and psychological benefits, contributing to general health and wellbeing.

The aim of this study was to review the available literature regarding the impact of regular physical activity on the mental health of children and adolescents and to highlight possible mechanisms involved in this association.

Study findings suggest that there is a global positive impact of physical activity on mental health, with the strongest effect related to the decrease of depressive symptoms. Other benefits include improvement in self-esteem, cognitive function, and sleep quality and a reduction of externalizing behaviors and anxiety symptoms. Competitive and esthetical sports were an exception.

Overall, the current evidence allows recommending regular physical activity in children and adolescents, not only for its organic but also mental health benefits.

Keywords: adolescent; child; exercise; mental health

RESUMO

A infância e adolescência são períodos de rápido crescimento, durante os quais é fundamental identificar exposições ambientais que possam ter um efeito positivo no desenvolvimento.

O objetivo deste estudo foi efetuar uma revisão da literatura sobre o impacto da atividade física regular na saúde mental de crianças e adolescentes e destacar possíveis mecanismos envolvidos nesta relação.

Os dados atualmente disponíveis na literatura sugerem que existe um impacto global positivo da atividade física regular, sendo a diminuição da sintomatologia depressiva o efeito mais significativo. Foi igualmente identificada uma melhoria da autoestima, função cognitiva e qualidade do sono, bem como uma diminuição de comportamentos externalizantes e de ansiedade. Os desportos competitivos e estéticos constituíram uma exceção.

A evidência atual permite recomendar a prática regular de atividade física em crianças e adolescentes, não só pelos seus benefícios orgânicos mas também de saúde mental.

Palavras-chave: adolescente; criança; exercício; saúde mental

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INTRODUCTION

The burden of mental disorders is continuously increasing, with a significant impact on the health of populations worldwide. Mental disorders are expected to be one of the main causes of disability in developed countries in upcoming years.^{1,2} Estimates indicate that nearly 10–20% of adolescents worldwide experience mental health problems, which remain largely underdiagnosed and undertreated.³

Childhood and adolescence are periods of rapid growth when several psychological, physical, biological, and social transformations take place. The brain in particular undergoes many neurochemistry and neurotransmission changes. New neuronal connections are established and maturation of the prefrontal cortex occurs. Several concerns may arise during this period, often related to self-control and self-regulation. Anxiety, mood, or eating disorders are among the most common, but mental disorders may also potentially develop. Other less common problems are related to motivation, concentration, self-confidence, and self-esteem.^{2,4} Therefore, it is important to identify positive environmental exposures during these years and establish behavioral patterns that may have a positive impact on mental health. This is even more important as healthy habits acquired in childhood and adolescence are more likely to remain in adulthood.^{2,5}

There is an increasing amount of evidence showing that regular exercise has unquestionable benefits on physical and psychological health, contributing to general wellbeing at all ages.⁶⁻⁸ The interest in the connection between body and mind is not recent and the old expression "*mens sana in corpore sano*" can symbolically reflect the benefits that an active body brings to mental health.^{6,7,9,10} Some authors suggest that exercise can be used in the treatment of certain mental disorders, decreasing the need for psychotropic medications.^{8,11} However, the underlying mechanisms explaining how physical exercise can positively influence mental health remain globally unclear, with only a few studies providing possible explanations.²

The concepts of physical activity (PA), physical exercise (PE), and sport are often used interchangeably, but it is important to understand the definition of each one. PA refers to all movements performed by skeletal muscles in the daily routine, resulting in an increase of energy consumption beyond resting levels. PE is a subgroup of PA, defined as planned, structured, and repetitive body movement, performed to improve or maintain one or more physical condition components.¹² Finally, sport is defined as an even more specific form of PA: structured, subjected to rules, and sometimes competitive.¹³

Sedentary behavior is defined as any type of waking activity characterized by an energy expenditure less than or equal to 1.5 metabolic equivalents of task (METs)* while in a sitting or reclining posture.² Besides having a negative physical health impact, a sedentary lifestyle also appears to interfere with emotional stability.¹⁴

*. One metabolic equivalent of task (MET) is defined as the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O₂/kg body weight x min. The MET concept represents a simple, practical, and easily understood procedure for expressing the energy cost of physical activities as a multiple of the resting metabolic rate. The energy cost of an activity can be determined by dividing the relative oxygen cost of the activity (ml O₂/kg/min) x by 3.5.

OBJECTIVES

The aim of this study was to review the available literature regarding the impact of regular PA on the mental health of children and adolescents and highlight possible mechanisms involved in this association.

METHODS

A non-systematic literature search was conducted in January, February, and March 2020 in PubMed, Scielo, PsychINFO, Web of Science, and ResearchGate using the terms "physical activity", "physical exercise", "sports", "children", "adolescents", "mental health", and "psychopathology". Initial article selection was carried out by reading their titles and abstracts and selecting those with relevant content for this review. Only Portuguese, Spanish, and English-language articles were considered. There were no restrictions regarding publication date or country of origin. Duplicated articles were excluded, as well as articles focusing exclusively on the adult population.

For the purpose of this review, the term PA will be used to refer to any type of exercise, including PE and sport. The last two terms will be used when more specific designations are required.

RESULTS

Positive effects of physical activity on mental health

The criteria allowed to select and include a total of 34 articles.

The amount of research focusing on children and adolescents is considerably lower than in the adult population.^{5,15,16} Available studies suggest a positive association between regular PA during this developmental period and mental health.^{2,5,17-19} Most of the studies retrieved focused on anxiety and depression, with the latter accounting for 80% of the literature search output.^{2,17,19}

A statistically significant association was found between regular PA and reduction of depressive symptoms in adolescence,^{2,16,19-21} with some articles suggesting that such effect is stronger in individuals with poor mental health at baseline.⁵ Based on these findings, some authors defend the integration of PA in the therapeutic interventions for depression.^{17,19} Studies in children and adolescents also suggest that practicing regular PA in this period of life can be a protective factor against the development of depression in adult age.^{5,17} Other authors report that children and adolescents who never practiced any type of sport have an increased prevalence of internalizing problems, like depression and anxiety, compared to those who engage in sports activities.^{6,18}

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like depression and anxiety, compared to those who engage in sports activities.^{6,18}

Among the psychological components of wellbeing studied, self-esteem particularly seems to be positively and statistically significantly affected by PA. An example is the improvement in body image perception shortly after practicing exercise.^{5,17,19,22,23} A similar positive trend was found regarding global satisfaction with life. On the other hand, negative emotions, like sadness or anger, and psychological distress seem to be inversely associated with regular PA.^{2,19}

Anxiety problems in children and adolescents were not significantly associated with PA in the studies assessed, although some reported a slight trend towards a decrease in these symptoms.^{5,6,18,19}

Some authors found a low prevalence of externalizing symptoms, such as aggressiveness and hyperactivity, in children who participated in an intervention program of organized sports, hypothesizing that PA can help to improve behavior problems.²⁴

Engaging in regular PA also seems to be associated with increased concentration and attention capacity and better global classroom behavior and school life satisfaction. Additionally, one randomized control trial that recruited 30 children with major depressive disorder to a 12-week aerobic exercise program demonstrated an improvement in school performance.¹⁷ The positive effects on cognitive function seem to be particularly associated with cardiovascular exercise.^{5,17} The mechanisms underlying this relation potentially include increased blood flow and brain activation with stimulation of learning areas during exercise.²⁵

There is also evidence that PA improves sleep quality. Some studies have sought to investigate this association putting forward three main hypotheses. The first, known as *thermoregulatory*, states that the increase in body temperature due to physical exercise facilitates triggering sleep onset, due to activation of heat dissipation and sleep induction mechanisms, which are controlled by the hypothalamus. The second hypothesis, known as *energy conservation*, suggests that the increased energy expenditure promoted by exercise during wakefulness increases the need for sleep in order to achieve a positive energy balance, reestablishing an adequate condition for a new wake cycle. Similarly to this, the third hypothesis, known as *restorative or compensatory*, suggests that high catabolic activity during wakefulness reduces body energy reserves, increasing the need for sleep in favor of the anabolic activity.^{6,26,27}

In contrast with the positive effects associated with regular PA, high levels of sedentary time seem to be linked to poor mental health in children and adolescents.^{17,20,28} More specifically, studies suggest that more than 2-3 hours of sedentary time per day (e.g. screen time) increases the risk of depressive symptoms, levels of anxiety, school life dissatisfaction, and social exclusion.^{5,17} Some studies show that a sedentary lifestyle has a negative association with self-image and global life satisfaction, leading to a higher prevalence of physical aggression and lower levels of socialization.^{20,29}

The benefits of regular PA have different dimensions, including

physiological, biochemical, and psychological. Besides the previously mentioned increase in body temperature and improvement in cerebral cortex oxygenation, there is an increase in the amount of circulating catecholamines and blood flow in adipocytes. These changes stimulate lipolysis and lead to a higher concentration of fatty acids in the bloodstream. Consequently, tryptophan is displaced from its binding sites in albumin and increases its free concentration in plasma. Furthermore, there is also a higher level of branched-chain amino acids uptake and oxidation by muscles, reducing their concentration in the bloodstream and brain. Altogether, these factors facilitate the crossing of the blood-brain barrier by tryptophan, leading to increased levels of serotonin synthesis and a potential change in individuals' mood. Additionally, aerobic exercise performed for at least 30 minutes at moderate intensity leads to the release of endorphins. These hormones act in the brain, preventing or reducing depressive states.¹¹ Other PA benefits include improvement of cerebral vascularization, stimulation of neurogenesis, and increase in levels of brain-derived neurotrophic factors in the hippocampus. From this perspective, PA may be a beneficial factor in children and adolescents' development and an important therapeutic tool in the treatment of mental illness.⁴

Besides physiological and biochemical changes, collective sports practice is also associated with important psychological and social components, including familiarization with principles of teamwork, feelings of group inclusion and forging of friendship bonds, achievement of common goals, and development of the sense of responsibility, as the most relevant.^{5,17,22}

Possible negative impact of physical activity on mental health

In contrast with the previous data suggesting that increased PA levels have a global positive effect on the mental health of children and adolescents, the potential impact of esthetical and/or competitive sports is not as favorable.⁵ Adolescents who participate in ballet and rhythmic gymnastics, for instance, display high levels of body image dissatisfaction.³⁰ Among other etiological factors, this feeling can be a precipitating factor for the development of eating disorders, such as anorexia nervosa and bulimia nervosa. Despite the thin body and low body fat, many dancers engage in risky behaviors to meet the required esthetic standards.³¹ One study revealed that fasting for an entire day was the most frequent compensatory strategy used by dancers (33.3%), followed by the use of purgative methods (16.7%).³²

Focusing on competitive sports practice, young athletes must cope with multiple challenges that carry a potential impact on their psychological stability. These challenges can lead to several negative consequences, such as mental and physical fatigue due to training volume, injuries, separation from family and friends, and time management issues. All these factors can cause an emotional homeostasis imbalance and subsequent development of anxiety or depression.³³

Besides these negative impacts, some authors also mention the “competitive anxiety” in adolescents, an emotional reaction frequently emerging before or during sports competition.^{33,34} This is characterized by negative cognitions, fear, somatic symptoms, or behavioral changes and tends to be particularly intense in young athletes struggling with insecurities and using less elaborated strategies for coping with pressure.³⁴

DISCUSSION

Findings from this review suggest that regular PA has a global positive impact on the mental health of children and adolescents, with the strongest effect being a decrease of depressive symptoms. Other relevant effects include the improvement of self-esteem, cognitive function, and sleep quality and the decrease of anxiety symptoms and externalizing behaviors.

On the other hand, competitive sports practice can be related to several negative aspects, as children and adolescents are exposed to increased psychological pressure caused by extensive training volume, risk of injury, and high-performance expectations from people around them or themselves in this setting. Also esthetical sports are associated with an increased risk of mental health problems and potential development of eating disorders, due to the major role that body image has in this setting.

On the opposite side of the spectrum, an increasing number of children and adolescents nowadays have a sedentary lifestyle. This is not only associated with well-known physical health problems, as obesity, but also with a large number of psychological and social issues, and can negatively impact mental health and in more severe cases influence the development of psychiatric disorders, as depression and anxiety.

Despite the growing interest in improving the understanding of the association between regular PA and mental health, studies in young populations are still scarce. Most studies focus on the adult population and have methodological issues related to using different indicators, including group size, target age, concept definitions (PA, PE, and sports), and frequency, intensity, duration, and type of activity. Furthermore, many studies are cross-sectional, which can fail to rule out reverse causality. Further research on this subject is therefore required, using uniform criteria, longitudinal observations, and larger study populations.

Nevertheless, there seems to be a global consensus on the importance of encouraging children and adolescents to be more active inside and outside school, stimulating PA (active commuting, outdoor play, non-competitive sports participation), reducing inactivity, and promoting a healthy mind. Personal and family characteristics seem to influence the determination of a physically active behavior. Therefore, it is important to provide parents, children, and adolescents with information about the mental benefits of an active life. Findings from this study may additionally be useful

to support public health projects promoting PA during childhood and adolescence.

CONCLUSIONS

Evidence retrieved in this study allows to recommend increased regular physical activity and decreased sedentary behavior in children and adolescents, with the aim of improving their mental health. These factors have a positive effect not only on physical health but also on the prevention and reduction of mental disorders.

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