

# Quality of life and their relationships with depression, anxiety, and stress mediated by physical activity in adolescents: A systematic review

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## Abstract:

**Background:** Despite the scientific evidence on the benefits of physical activity (PA), the relationships between PA, Quality of life (QoL), depression, anxiety and stress in adolescents are still inconclusive. **Objectives:** The aim of this study was to present the benefits of PA and its relationship with QoL, depression, anxiety and stress in adolescents. **Methods:** This is a literature review for the years 2013 to 2023, with articles in English, Spanish and Portuguese, from three databases: PubMed, SciELO and Web of Science. **Results:** 55 articles were selected for this review, of which 08 were about QoL, 14 about depression, 05 about anxiety, 05 about stress and 23 about PA. **Conclusion:** In general, adolescents who practice PA with moderate to vigorous intensity on a daily basis have a better quality of life and have fewer symptoms of mental disorders such as depression, anxiety and stress. In this study, factors related to QoL, anxiety and stress were applied. In relation to depression and PA, despite the increase in research, studies on these topics related to adolescents are still incipient.

**Keywords:** Physical activity; teenagers; quality of life; depression; anxiety.

## BACKGROUND

In this literature review focused on adolescence, we sought to present the benefits of physical activity (PA) and its relationship with quality of life, depression, anxiety and stress in adolescents. Thus, we conducted the analysis of the articles, identifying and presenting the association between these four aspects of our study and comparing them with the levels of PA.

### Quality of Life

Quality of life (QoL) has properties that cover a variety of aspects that can be analyzed and related within a given context that are complex to conceptualize, as they have been interpreted and defined in different ways, with no single definition<sup>(1)</sup>. From this perspective, QoL is often similar to self-perceived health, which are useful indicators for children and adolescents, as they are related to objective and subjective health, including physical, cognitive, social, emotional and environmental aspects<sup>(2, 3)</sup>. health-related quality of life (HRQoL) is defined as the level of well-being that an individual achieves when evaluating different areas of life considering their impacts on their health status<sup>(4)</sup>.

Thus, the concepts of health and disease are related to the social, political and economic aspects of the cultural context of each era and can evolve according to the stories of human experiences<sup>(5)</sup>. QoL in adolescence is a multifactorial structure and is related to individual characteristics, lifestyle, family relationship, satisfaction with sleep, regular practice of PA, satisfactory body weight are the main predictors<sup>(6, 7)</sup>.

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## Depression

Depression is a serious and widespread mental illness in our society and affects many people<sup>(8)</sup>. The first episode of depression usually occurs during adolescence<sup>(9)</sup>. Depression is one of the main mental health problems today and it is important to identify it to be properly evaluated<sup>(8)</sup>. In adolescents, the most common symptoms are depressed mood, sadness, irritability, loss of interest or pleasure in daily activities, weight changes, insomnia or hypersomnia, substance abuse, and an increased risk of self-destructive behavior that can lead to suicide<sup>(10-12)</sup>. Like silent killers that strike teenagers, the rate of depression has increased in recent years and has become a major public health problem<sup>(13)</sup>. Thus, the importance of identifying characteristics that increase or decrease the likelihood of developing depressive and anxiety disorders in adolescence and their risk and protective factors is emphasized<sup>(14,15)</sup>. Depression is a mood disorder with a high prevalence of psychological problems in adolescence, and its main clinical manifestation is severe and persistent depression<sup>(16)</sup>. Furthermore, the incidence of depression and treatment failure in adolescence often leads to the recurrence of depressive episodes and chronic symptoms in adulthood<sup>(17, 18)</sup>.

## Anxiety

Anxiety is part of every human being's life, but when these symptoms become harmful, they turn into illnesses in which, depending on the circumstances and intensity, they can affect the functioning of the organism. Anxiety disorders vary in the types of objects and situations, which are characterized by excessive fear and anxiety, in addition to the behavioral problems associated with their diagnosis<sup>(10)</sup>.

Currently, anxiety is a prevalent mental disorder in the adolescent population that is going through a period of self-exploration and development, in which the transition between childhood and adulthood can lead to the development of anxiety disorders that are associated with a decrease in neuropsychological performance, attention and memory<sup>(19, 20)</sup>. In adolescence, the pressures of the external environment, the hormonal changes of puberty, restructure the central neural system, which may trigger developmental abnormalities and may mediate the onset and progression of anxiety disorders<sup>(21)</sup>. In adolescents, the most common disorders are generalized anxiety disorders (GAD), separation anxiety and social anxiety disorder (SAD), seen by primary care professionals (PCP's)<sup>(21)</sup>.

In generalized anxiety disorder, the person has excessive worries, but more focused on the nature of existing relationships than on fear of negative evaluation. Separation anxiety disorder, coincidentally, people with separation anxiety may avoid social situations (including truancy) because they fear being separated from their attachment figures. In social anxiety disorder, concerns focus on social performance and evaluation of others<sup>(10)</sup>. The immaturity of neural networks underlying emotional regulation in this population in which brain vulnerability to anxiety in adolescence is associated with the asynchronous development of functional brain systems related to anxiety<sup>(20)</sup>. Psychic distress and its risk factors that permeate the psychological distress experienced in adolescence tend to have negative repercussions in adulthood<sup>(22)</sup>.

Information from approaches to brain functioning in adolescence suggests that the emotional control system tends to be underactive, the fear conditioning system is immature, and the reward and stress response systems are hypersensitive. Thus the functional connectivity between the striatum, the amygdala and the prefrontal cortex is strengthened, while the connectivity between the prefrontal cortex and the amygdala weakens<sup>(21)</sup>. It was noted that adolescents have impaired planning skills, also indicating that all cognitive functions related to planning are impaired in the presence of fear<sup>(19)</sup>. In a phase of several changes, the adolescent who tries to manage his emotions and appreciate life in the face of duties and biopsychosocial constructions has his mental health challenged on a daily basis<sup>(23)</sup>. Therefore, it should be noted that the mental health

of adolescents is challenged when they try to control their emotions and appreciate life in the face of all the structures that complete their existence.

### **Stress**

In today's society, stress and its debilitating effects can occur for many reasons, including everyday life, which can affect people's physical and mental health. Based on the concept of homeostasis of the organism, stress can be defined as a non-specific response of the organism against agents that threaten its integrity<sup>(24)</sup>. In adolescence, the development of stress is associated with major changes, standardization of intellectual, cultural, physical models and rapid technological advances that need to be adapted can generate imbalances that are called stress<sup>(24)</sup>.

Studies have shown distinct associations between the perceived stress "feeling stressed about schoolwork" and the psychiatric symptoms "feeling irritable", "feeling low" and "feeling anxious", suggesting that the reported increase in psychiatric and somatic symptoms over time, in both boys and girls, may be due to an increase in perceived stress<sup>(25)</sup>.

Pubertal morphological changes in the cortical and limbic regions of the brain have been hypothesized to contribute to the significant changes in cognitive performance and emotional regulation observed during puberty<sup>(26)</sup>. The structural components of the adolescent amygdala, the formation of the hippocampus and the prefrontal cortex are markedly affected by exposure to chronic stress<sup>(27)</sup>. To adapt to a stressful situation, the body triggers responses that activate hormone production adrenaline and cortisol, which alert and make the person react<sup>(24, 25)</sup>.

Regarding academic performance, executive function scores are negatively correlated with salivary cortisol in adolescent students<sup>(26)</sup>. However, the stress perceived by students related to academic activities are more relevant factors for increasing the stress indicators of high school students, and in greater numbers, females<sup>(24)</sup>.

Although increased stress can negatively affect life satisfaction, there is evidence that PA acts to mitigate stress<sup>(28)</sup>. In addition, optimal PA and the release of stress-related hormones may be factors that determine performance in school and other activities<sup>(26)</sup>. In this logic, studying adolescents who have different levels of stress and the possible impact on the formation and development of this population are important to define efficient strategies. Knowing their stressors is essential to analyze the psychological vulnerability of this population<sup>(24)</sup>.

### **Physical Activity and its effects on depression, anxiety and stress in adolescents**

PA is all activity produced by skeletal muscle that requires energy expenditure, including activity at work, leisure, household chores, travel and leisure activities<sup>(29)</sup>. In this context, we highlight the numerous benefits of regular PA, covering all philological, psychological, cultural, social and QoL aspects<sup>(7, 30, 31)</sup>. However, international data indicate that 81.0% of adolescents are insufficiently active<sup>(31, 32)</sup>. The risk of depression is greater in adolescents with less frequent and less intense PA than in those with more frequent and prolonged PA<sup>(33)</sup>.

However, the lack of PA is associated with an increase in moderate and severe symptoms of depression and anxiety, in addition to other physiological diseases<sup>(18, 34)</sup>. The problem may be even more substantial in low- and middle-income countries, where up to 28% of adolescents report having depression<sup>(35)</sup>. In addition, adolescence is a critical time for the development of healthy habits that become part of the way of life and extend into adulthood<sup>(36, 37)</sup>. Access to mental health care is critical to your health and well-being during adolescence and adulthood<sup>(38)</sup>. Prevention measures require greater attention focused on the practice of PA, as an essential role in reducing stress and treating depressive symptoms<sup>(9, 36, 39)</sup>. PA favors the functionality of monoamine through

neurotransmitters, stimulating the action of endorphins, which regulate mood, promote well-being and help control stress, maintaining the balance of some hormones, such as cortisol<sup>(40, 41, 42, 43)</sup>.

Current evidence suggests that increased PA reduces the prevalence of mental disorders, particularly mental disorders such as depression and anxiety<sup>(39, 44, 45)</sup>. This reality confirms that PA has beneficial effects on mental health and mood can be improved through a variety of psychological and neurophysiological mechanisms<sup>(46)</sup>. A high level of daily PA was associated with a 22% lower likelihood of experiencing anxiety<sup>(31)</sup>. Salivary cortisol levels are lower and serum serotonin levels are higher in active people with moderate activities compared to light activity practitioners<sup>(26)</sup>. In addition, exercise and muscle secretion improve various brain functions related to blood vessels, neuroplasticity, memory, sleep and mood<sup>(47)</sup>. PA recommendations for children and adolescents are 60 minutes or more of moderate to vigorous PA daily<sup>(29)</sup>. The frequency, duration of PA and its daily variability can help reduce depression in adolescents, improving mental and physical health and quality of life<sup>(7, 26, 48, 49)</sup>. The effectiveness of PA is the subject of scientific debate, and some of its benefits are controversial in the scientific community<sup>(33)</sup>. These findings imply that current behavioral theories must recognize that PA is not a definitive outcome, but part of an interactive process<sup>(43)</sup>.

## METHODS

A qualitative and descriptive study was developed to meet the research objectives. Qualitative, as statistical methods were not used to process the data. Descriptive because it explains the phenomenon based on previously published research<sup>(50)</sup>. This methodology consists of research tools whose objective is to present the benefits of PA and its relationship with QoL, depression, anxiety and stress in adolescents. To ensure scientific rigor, the systematic procedures adopted were performed using the PRISMA methodology<sup>(51)</sup>. Exclusion criteria included retrospective studies and other forms of research that did not address the objectives proposed by the research. The eligibility criteria of the included studies were: i) publication in scientific journals, ii) being related to PA and QoL, iii) being related to PA for adolescents with symptoms of depression, anxiety or stress, iii) publication of 2013 to 2023, iiiii) articles in English, Spanish and Portuguese iiiii) all types of study that met the proposed objectives.

In this review, we used three electronic databases: PubMed, SciELO and Web of Science. In the Search Strategies we applied the title and abstract of the articles that addressed the target subject of this review. Thus, Boolean operators "AND" and "OR" were used to combine the terms for the literature review: (adolescents and PA); (adolescents and quality of life);(adolescents and depression); (adolescents and anxiety); (adolescent and stress) OR (PA AND quality of life OR depression or anxiety AND stress AND adolescents. After this search, an analysis of the titles and abstracts of the works was carried out, and those that did not address adolescents in the defined axis were excluded. Thus, the selected articles were read in full, where citations of works that were not presented in our databases were observed. In this way, we searched for articles that were presented in the bibliographic references of the selected articles and that had not yet been collected through the main search. Of these, also after being analyzed, they were included in the studies because they met the objective proposed in the review. The works analyzed were characterized, including main author, year of publication, journal and primary approach (qualitative or quantitative). Finally, an overview of the objectives and results of the work analyzed was produced.

## RESULTS

The results found in the research are shown in Table 1, according to the search, after reading the titles and abstracts, the selected works that were read in full, we found 64

eligible studies based on the established eligibility criteria. After the complete reading, we excluded nine duplicate studies and ended with the selection of 55 articles that met the inclusion criteria of the study.

**Table 1.** Selection of articles in the PubMed, SciELO and Web of Science databases, according to the inclusion and exclusion criteria.

	Quality of Life	Depressin	Anxiety	Stress	Physical Active
Articles by theme	08	14	05	05	23
Total			55		

Anxiety and stress were the topics with the lowest number of articles, but in some studies anxiety and depression were studied together. QoL had a significant number, but the relationship with PA was more emphasized. Depression was the second most found, we noticed that in the last five years there has been a relevant increase in the databases. In addition, most articles on PA correlate with depression than with the other aspects addressed. Regarding PA, this was also the most related in the researched articles.

## DISCUSSION

Our analyzes indicate that quality of life is most often seen from a perspective that resembles health, including physical, cognitive, social, emotional and environmental aspects<sup>(3)</sup>. These are one of the indicators that aim to promote understanding of different aspects of health conditions experienced by healthy people from all cultures, including children and adolescents<sup>(2,3)</sup>. On the other hand, the prevalence of depression among adolescents has increased in recent years and has become a public health problem worldwide, with the first episode of depression usually occurring in adolescence<sup>(9,13,33)</sup>.

In this studies, we observed that several factors unique to the adolescent population make this age group particularly vulnerable. External environmental pressures, hormonal changes during puberty that can cause developmental delays, may mediate the development and progression of anxiety disorders<sup>(20)</sup>. The most common anxiety disorders in adolescents are generalized anxiety disorders (GAD), separation anxiety and social anxiety disorder (SAD), seen by primary care professionals (PCPs)<sup>(22)</sup>. However, the development of stress in adolescence was associated with significant changes in the environment in which they live, in the standardization of intellectual, cultural and physical models and in the rapid technological progress in which they are inserted<sup>(52)</sup>. However, with regard to PA, we note several studies on its benefits and that adolescents with moderate and high levels of daily PA are less likely to present general mental health problems than adolescents with low levels of daily PA<sup>(31, 36)</sup>. There are currently new recommendations for PA practices in children and adolescents, emphasizing at least 60 minutes of moderate to vigorous PA per day<sup>(29)</sup>.

These changes represent new behaviors in relation to the practice of PA and adaptations are necessary for this age group to benefit from its usefulness. Evidence on circadian PA patterns associates low morning PA with high depression or late afternoon (evening) depressive symptoms, suggesting that future studies consider day-to-day variability as well as PA levels<sup>(49, 53)</sup>. The regular practice of PA in adolescents becomes essential to constitute a form of leisure that aims to reduce stress and improve quality of life<sup>(54, 55)</sup>.

Daily variability may be important to further explore this emerging research area<sup>(49, 55)</sup>. PA interventions focused on adolescents require specific, measurable and achievable goals with diagnosis to enable appropriate interventions for this age group<sup>(9,14,15)</sup>.

## FINAL CONSIDERATIONS

As a result of our review, we consider that, when it comes to PA, we noticed several studies on its benefits, showing that adolescents with moderate and high levels of daily PA had fewer mental health problems and better quality of life than adolescents with low levels of daily PA. We also emphasize that the analysis of the emotional state is a significant strategy, which contributes to the planning of actions as a form of prevention and intervention, in order to maintain and preserve the physical and mental health of adolescents. To this end, it is suggested that these presented properties be complemented, pointing out the characteristics of the physical activities they are performing, times (day/night), frequency, intensity and the motivational factor present in this age group, facts that interfere with mental health and which are not specified in various articles. We recommend that future studies investigate the classification of PA, time, extent, variability and characteristics. We suggest that the effects of their practice on mental health and Quality of life be studied in terms of interactions with these mentioned dimensions.

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