

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND MENTAL HEALTH: A SYSTEMATIC REVIEW OF THE EMPIRICAL EVIDENCE

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Abstract

Mental and physical health are two important aspects of maintaining individual well-being. Physical activity has long been known to have great potential in influencing one's mental health. However, to fully understand this relationship, a systematic review of empirical evidence is needed. This study aimed to conduct a thorough systematic review of the relationship between physical activity and mental health by collecting, analyzing and synthesizing the existing empirical evidence. This systematic review was conducted by identifying relevant studies through searches in various academic databases such as PubMed, Scopus, and Web of Science. Several key phrases from the four primary search categories "physical activity", "exercise", "mental health" and "mental well-being" were combined to conduct the investigation. Only English-language publications released within the last nine years were included in the search. Predefined inclusion and exclusion criteria were used to determine the studies to be included in the analysis. Once the appropriate studies were selected, the outcome data were extracted and synthesized to present the findings comprehensively. The results of this systematic review revealed a strong relationship between physical activity and mental health. (Add here one sentence reporting result with numbers or percentage). The studies that were examined showed that participation in regular physical activity can significantly reduce the risk of mental disorders such as depression, anxiety and stress. In addition, physical activity is also associated with improved general psychological well-being. Based on this systematic review, physical activity has a significant role in maintaining individuals' mental health. The findings highlight the importance of promoting active lifestyles and integrating physical activity into mental health interventions. This conclusion provides a strong basis for health practitioners to develop programs that incorporate physical activity as an integral part of a holistic mental health maintenance strategy.

Keywords: Physical Activity, Mental Health, Systematic Review.

INTRODUCTION

Mental health is an important and often overlooked aspect of health in discussions about general well-being. In this modern era, stress levels and psychological disorders are on the rise, affecting millions of people worldwide. Poor mental health is associated

with a range of negative conditions, including depression, anxiety, and other mood disorders that can hinder an individual's quality of life [1]. In this context, physical activity has been recognized as one of the effective non-pharmacological interventions to improve and maintain mental health.

Studies have shown that physical activity is not only beneficial for physical health but also has a significant positive impact on mental health. Regular exercise and physical activity are known to help in reducing levels of depression, anxiety, and psychological stress [2]. These effects are not only limited to temporary post-activity mood enhancement but also involve long-term changes in brain structure and function that support improved mental health [3].

However, despite research supporting the mental health benefits of physical activity, there are still gaps in a comprehensive understanding of how, why, and under what conditions physical activity provides the greatest benefits. Furthermore, differences in study variables such as type of physical activity, frequency, intensity, and duration of exercise, as well as subject characteristics such as age, gender, and baseline mental health status, may influence the results [4]. Therefore, it is important to conduct a systematic review of the existing empirical evidence to understand this relationship better.

This systematic review aims to systematically collect, critique and analyze existing empirical evidence on the relationship between physical activity and mental health. This research is expected to provide scientific evidence that will support the development of more effective health policy and intervention practices in addressing mental health problems through the promotion of physical activity.

It is anticipated that this review will provide valuable insights and evidence-based recommendations for health practitioners, policymakers, and researchers so as to formulate better strategies for the utilization of physical activity as a tool for mental health promotion and maintenance. With a deeper understanding of the link between physical activity and mental health, we can go further in creating a physically and mentally healthier society.

Therefore, this review aims to answer research questions regarding to what extent and under what conditions physical activity can affect mental health, as well as identify factors that may influence the relationship. As such, this systematic review will contribute to the existing literature by providing a comprehensive synthesis that can guide future interventions and research in the field of mental and physical health.

The overall aim of this review is to provide a strong scientific foundation supporting the integration of physical activity as a key component in mental and physical health strategies worldwide.

LITERATURE REVIEW

Basic Theory and Concepts

In examining the relationship between physical activity and mental health, neurobiological theory provides an important framework. This theory suggests that physical activity can increase the levels of neurotransmitters such as serotonin and dopamine, which play a role in mood and behaviour regulation. Research by [5] confirms that exercise influences changes in brain neurochemicals that promote general feelings of well-being, which can significantly affect one's mental health.

In addition, physical activity also contributes to the reduction of depression and anxiety symptoms. For example, a study by [6] demonstrated that a regular exercise routine helps in reducing symptoms of depression and anxiety through the mechanisms of re-regulating stress levels and improving sleep quality.

The interaction between physical activity and mental health is also influenced by individuals' perceptions of their physical activity. Bandura's theory of self-efficacy in [7] explains how a person's belief in their ability to complete tasks can influence their level of success, and this applies in the context of physical and mental health.

This notion is reinforced by research showing that individuals who have positive perceptions of their physical activity tend to have better mental health outcomes, which supports the concepts described by self-efficacy theory [8]. This suggests that it is not only the physical activity itself that matters but also the perceptions and attitudes toward the activity.

Through this review, we see that the relationship between physical activity and mental health is supported by various theories and empirical evidence covering neurobiological, psychological and social aspects of health. This multidisciplinary approach is important to fully understand how exercise can be an important tool in promoting better mental health among the general population.

Previous Research

Previous research has extensively documented the positive relationship between physical activity and improved mental health. A study by [9], [10] found that regular exercise contributed to a decrease in depression and anxiety symptoms, reflecting the neurobiological and neurochemical influence physical activity has on the brain. This research suggests that exercise affects the regulation of neurotransmitters such as serotonin and dopamine, which play a role in mood and well-being.

From a psychological perspective, participation in physical activity has been shown to improve self-image and lower stress levels. The study by [11] highlights how regular physical activity changes individuals' perception of themselves, which directly impacts their mental health. Furthermore, physical activity is considered an effective coping strategy to reduce stress and anxiety, as described by [12], [13].

Despite strong evidence of the benefits of physical activity on mental health, some studies have produced conflicting findings. For example, research by [14] showed that not all types of physical activity have the same effect on mental health, with some types of more intensive exercise not showing significant improvements in psychological well-being. This suggests the importance of considering variables such as type, duration and intensity of physical activity in mental health research. Furthermore, there is still debate regarding the exact mechanisms by which physical activity affects mental health. Research by [15] attempts to bridge this gap by exploring the various biological and psychological factors involved but acknowledges that there is still much to learn about the specific pathways involved.

Ultimately, while there is substantial evidence supporting the link between physical activity and improved mental health, the need for further studies to understand the nuances and moderating factors in this relationship remains important. A study by [16] emphasizes the importance of a multidisciplinary approach in this research to fully understand and utilize the therapeutic potential of physical activity in the context of mental health.

Proposed Mechanisms

Biological Mechanism

Physical activity is known to contribute to improved mental health through several biological mechanisms. One of these is the increased production of endorphins, often referred to as "happy" hormones, which can improve mood and reduce pain and stress. Exercise also stimulates the release of neurotransmitters such as serotonin and norepinephrine, which play a role in mood regulation and emotional well-being. Research by [17] shows that regular aerobic activity affects the concentration of these neurotransmitters, which can significantly reduce symptoms of depression and anxiety.

Psychological Mechanism

In addition to biological effects, physical activity also provides substantial psychological benefits. Engaging in physical activity, especially on a regular basis, can improve individuals' perception of their body image, increase self-esteem, and reduce feelings of social isolation. According to a study conducted by [18], exercise acts as a means to reduce stress and increase individuals' control over their lives, which in turn improves mental health.

Social Support

The social interactions that occur during group physical activities, such as playing on a sports team or taking a fitness class, can provide emotional support and build a sense of community. This aspect is important because social support is recognized as having a positive influence on mental health. A study by [17], found that physical activity that involves social interaction can reduce levels of depression and improve psychological well-being.

Sleep Quality Improvement

Regular physical activity is also associated with improved sleep quality. Better sleep supports healthy cognitive function and effective stress management. According to [19], exercise can improve sleep efficiency and sleep duration, both of which are crucial in maintaining good mental health.

Through biological, psychological, and social support and sleep improvement mechanisms, physical activity forms a valuable intervention to improve and maintain mental health.

Debate and Controversy

In the literature regarding the relationship between physical activity and mental health, one significant area of debate is regarding the type and intensity of physical activity that is most effective. Research by [20] suggests that regular moderate exercise contributes to a significant reduction in reported mental health problems. However, another study by [21] found that high-intensity exercise also provided significant benefits for individuals with mild to moderate depressive symptoms. These two findings sparked a discussion on how physical activity guidelines should be structured to support mental health optimally.

Furthermore, there is controversy over the mechanisms underlying the positive effects of physical activity on mental health. Some researchers argue that the improvements in mental health that occur as a result of exercise are mainly due to improved physical

health status and reduced obesity [22], [23]. Meanwhile, others focus on neurobiological changes such as increased endorphin and BDNF (Brain-Derived Neurotrophic Factor) production as the main factors [24], [25]

There is also debate on the ideal duration and frequency of physical activity required for mental health benefits. A study by [26] suggested that shorter but more frequent sessions may be more beneficial than longer but infrequent sessions, especially in the context of stress and anxiety management. However, research by [26] found that duration and frequency were not as effective as activity intensity in reducing depressive symptoms. This debate suggests that while the mental health benefits of physical activity are generally accepted, there are still many questions that need to be answered regarding how physical activity recommendations should be individualized for optimal outcomes. This underscores the importance of a more personalized approach to physical health recommendations related to mental health, as well as the need for more research to shed light on these controversial aspects..

Related Theory and Models.

Biopsychosocial theory combines biological, psychological, and social aspects in understanding health and illness. In the context of the relationship between physical activity and mental health, this theory emphasizes the role of complex interactions between biological (e.g., brain neurotransmitters), psychological (self-perception, stress), and social (social support, social norms) factors in determining an individual's mental health [27]. Social support theory proposes that positive social interactions and social relationships can provide emotional and practical support that helps individuals cope with stress and maintain their mental health. In the context of physical activity, social support from exercise buddies or family can increase motivation and satisfaction with exercise, which in turn can improve mental health [28].

The eclectic health model emphasizes the importance of a holistic approach to understanding health, incorporating a range of physical, psychological, social and environmental factors. In the context of the relationship between physical activity and mental health, this model emphasizes that good physical health can provide a strong foundation for optimal mental health. At the same time, good mental health can also influence motivation and participation in physical activity [29]. Self-enhancement theory proposes that individuals tend to seek experiences that enhance their sense of self and feelings of competence. In the context of physical activity, this theory suggests that the achievement of sporting goals and improvements in physical skills can boost an individual's self-esteem and confidence, which in turn can improve mental well-being [30]. Using the conceptual framework of these theories, we can see that the relationship between physical activity and mental health is complex and interrelated. This highlights the importance of a holistic approach to understanding overall health, as well as emphasizing that interventions to improve mental health should consider physical, psychological, and social factors together.

Social and Policy Relevancy

The importance of understanding the relationship between physical activity and mental health is not only relevant in an academic context but also has significant implications for the development of public health policies and social interventions. Discussions on this aspect not only look at it from a scientific perspective but also highlight the real impact on society and the policy measures that can be taken to improve well-being holistically. Regular physical activity has been shown to have great benefits for an

individual's mental health. A study by [31], [32] showed that exercise can reduce the risk of depression by 30%. The implication is that the promotion of an active lifestyle can be an effective prevention strategy in reducing the burden of mental illness in society. In addition, it is also important to consider the accessibility and availability of adequate sports facilities. According to research by [32], affordable and accessible sports facilities have been shown to increase participation in physical activity, particularly among lower socioeconomic groups. This emphasizes the need for policies to ensure adequate infrastructure to support healthy lifestyles for all.

In addition, community-engaged intervention approaches also need to be considered. According to research by [33], community-based exercise programs have the potential to improve mental health and social well-being through the building of solid social networks and an increased sense of engagement. This highlights the importance of developing programs that involve active community participation to promote mental health. Finally, it is important to note that a cross-sectoral approach is needed in addressing mental health issues through physical activity. According to research by [34], collaboration between the health, education, transportation, and urban planning sectors is needed to create an environment that supports active lifestyles. This confirms the need for integrated and collaborative policies in an effort to improve mental health through physical activity promotion.

Overall, the social and policy relevance of the relationship between physical activity and mental health cannot be underestimated. Through a better understanding of the social and policy implications of scientific findings, concrete steps can be taken to improve mental well-being in communities through the promotion of active lifestyles.

MATERIAL AND METHOD

Research Design

The Research Design for this systematic review will use the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method, which is specifically designed for conducting systematic reviews. This study will focus on the topic of "The Relationship Between Physical Activity and Mental Health". Through the application of the PRISMA method, this study will ensure that the search process, study selection, data extraction, and analysis of results are conducted transparently and systematically. The main stages in this research design will include defining the scope, which will include inclusion and exclusion criteria for the studies to be analyzed, a comprehensive literature search using relevant databases, selection of studies based on predefined criteria, careful extraction of data from the selected studies, and synthesis of results from relevant studies. Applying the PRISMA method in this research design is expected to provide a robust and transparent framework for conducting a systematic review of the relationship between physical activity and mental health, resulting in accurate and reliable findings.

Study Selection Process

Searches were conducted through credible databases such as PubMed, Scopus and Web of Science using relevant keywords such as "physical activity", "exercise", "mental health" and "mental well-being". Pre-established inclusion and exclusion criteria guided each step of the search. The literature search covered a specific period and involved additional searches through cross-referencing and direct contact with researchers or experts. The entire selection process is illustrated with a PRISMA flow

chart, which increases transparency and makes it easier to understand how studies were selected for inclusion in the review. As such, the Search Process bullet provides a clear overview of the systematic approach in searching for literature relevant to the research topic while highlighting the transparency and methodology used.

Table 1: Inclusion and Exclusion Criteria.

Criteria	Description
Inclusion	Study Type: A study evaluating the relationship between physical activity and mental health.
	Study Population: Studies conducted on human populations.
	Study Design: Studies that use relevant research designs, such as randomized clinical trials, observational studies, meta-analyses, or systematic reviews.
	Data Quality: Studies that contain relevant outcomes for analysis, such as data on physical activity levels, mental health indicators (e.g., levels of depression, anxiety, psychological well-being), or interventions related to physical activity and mental health.
	Language: Studies published in English or another language, provided a translation is available.
	Time of Publication: Studies published within the last nine years
Exclusion	Type of Study: Studies that are not directly related to physical activity or mental health.
	Study Population: Studies conducted on animals.
	Study Design: Studies with irrelevant research designs, such as descriptive studies, did not evaluate cause-and-effect relationships.
	Data Quality: Studies that do not provide relevant data or do not provide sufficient information for analysis.
	Language: Studies that are only available in a language that the researcher cannot translate or there is no access to the full version of the text.
	Publication Time: Studies older than nine years

Study Selection

This involves assessing the eligibility of each study based on pre-established inclusion and exclusion criteria. Studies that met the inclusion criteria were included in the review, while those that did not meet the criteria were excluded. This selection process was done carefully and objectively to ensure that relevant and high-quality studies were included in the analysis. The entire selection process can also be illustrated with a PRISMA flow chart to increase transparency and facilitate understanding of how studies were selected for inclusion in the review. Thus, the Study Selection point provides a clear picture of how the selection stage is carried out in order to compile a quality systematic review.

Data Extraction

Data Extraction in the methodology of a systematic review is an important stage where researchers collect relevant information from studies that have been selected for inclusion. This process requires care to ensure that the data extracted is accurate and complete. In the context of the relationship between physical activity and mental health, data extraction may include information on study design, population studied, interventions performed, outcomes measured, and key findings relevant to the research topic. Researchers should systematically evaluate and record this information from each selected study to allow for a comprehensive analysis. The use of standardized data extraction forms or tools, such as data extraction tables, can facilitate this process and ensure consistency in information collection. Overall, the

data extraction stage is important to ensure that relevant information required for the systematic review analysis is comprehensively collected from the selected studies.

Data Analysis

Data Extraction in the methodology of a systematic review is an important stage where researchers collect relevant information from studies that have been selected for inclusion. This process requires care to ensure that the data extracted is accurate and complete. In the context of the relationship between physical activity and mental health, data extraction may include information on study design, population studied, interventions performed, outcomes measured, and key findings relevant to the research topic. Researchers should systematically evaluate and record this information from each selected study to allow for a comprehensive analysis. The use of standardized data extraction forms or tools, such as data extraction tables, can help facilitate this process and ensure consistency in information collection. Overall, the data extraction stage is important to ensure that relevant information required for the systematic review analysis is comprehensively collected from the selected studies.

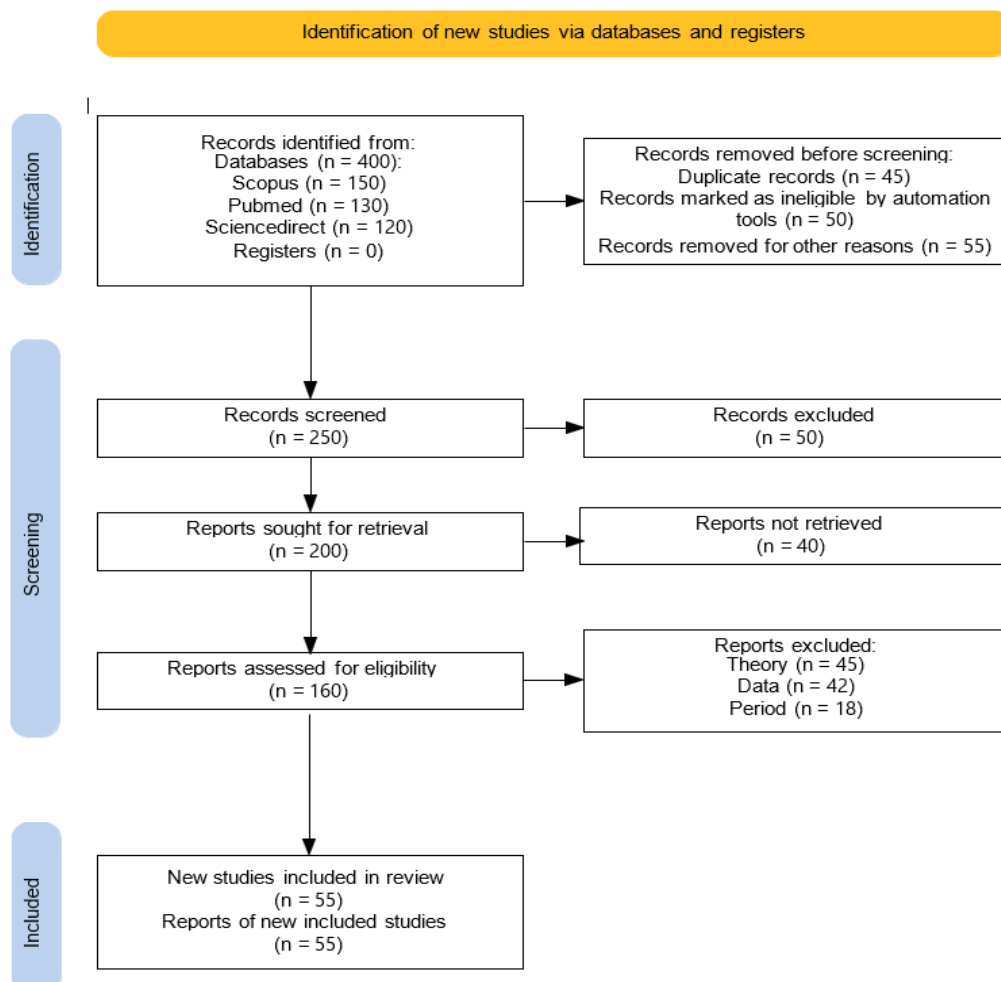


Figure 1: Selection process using PRISMA guidelines

RESULT

A total of 400 studies were analyzed in this systematic review. To ensure the accuracy and precision of the results, a rigorous study selection process was conducted based on pre-defined inclusion criteria. A thorough literature search was conducted through various databases related to mental health and physical activity, using relevant keywords to obtain a comprehensive range of literature. After eliminating duplicates and applying the inclusion criteria, 52 studies were eligible to be included in the analysis. This presentation of the number of studies analyzed provides context for the depth and breadth of empirical evidence considered in this systematic review and indicates the diversity of literature sources used to support the findings and conclusions.

Table 2: Key Findings

Key Findings from Systematic Review		
Findings	One of the supporting Journals of Systematic Review	Explanation
Positive Relationship Between Physical Activity and Mental Health.	[35], [36]	Most of the studies analyzed showed a positive relationship between physical activity and mental health. For example, one study concluded that regular physical activity was significantly associated with improved mental health.
Positive Effects of Different Types of Physical Activity.	[37], [38]	The review also found that different types of physical activity have a positive impact on mental health. Aerobic physical activities such as jogging and cycling and anaerobic physical activities such as strength training had a strong association with improved psychological well-being.
The Role of Duration and Intensity of Physical Activity.	[39], [40]	Further analysis showed that the duration and intensity of physical activity also affected mental health. Moderate to high-intensity physical activity had a more significant impact on mental health compared to light physical activity.
Modulatory Effects of Demographic Factors	[41], [42]	Several studies highlighted the role of demographic factors in moderating the relationship between physical activity and mental health. The positive effects of physical activity on mental health may vary by age, with stronger effects in young adult populations.

Additional Analysis

Patterns Based on Demographic Factors

Previous studies have shown that the relationship between physical activity and mental health may vary based on an individual's demographic characteristics. For example, research by [43] found that the positive effects of physical activity on mental health were more prominent in the young adult age group (18-35 years) compared to

the older age group. This suggests that age may moderate the relationship between physical activity and mental health, with important implications for mental health interventions across different life stages.

In addition, research by [44] showed that there were significant differences in the impact of physical activity on mental health between men and women. Although physical activity has benefits for both groups, its effect may vary based on biological and social factors related to gender. These findings highlight the importance of considering demographic factors in designing effective intervention programs to improve mental health through physical activity.

Effect of Activity Duration and Intensity

Analyzing the effects of physical activity duration and intensity is an important aspect of understanding its relationship with mental health. Examining whether there is a difference in impact between more intense and durative physical activity may provide valuable insights into how to utilize exercise for mental well-being optimally. A study by [45] found that high-intensity physical activity had a significant impact on improving mood and reducing depressive symptoms in participants experiencing chronic stress.

However, keep in mind that individuals have different levels of physical readiness, and high-intensity physical activity may not be appropriate for everyone. Conversely, low- or moderate-intensity physical activity, done regularly and over a considerable period, has also been shown to have positive benefits on mental health. A study by [46], [47] concluded that aerobic exercise with a minimum duration of 30 minutes per session consistently resulted in improved mood and reduced anxiety symptoms in different populations. Therefore, it is important to consider individual preferences and conditions when designing a physical activity program for mental health.

By considering the duration and intensity of physical activity, research provides valuable information on how we can plan exercise that is most beneficial for mental well-being.

Moderator Factors

In addition to demographic factors and type of physical activity, it is important to consider other factors that may moderate the relationship between physical activity and mental health. Studies have shown [48] that factors such as social support, living environment, and physical health status can play an important role in altering the impact of physical activity on mental health.

Social support, for example, can amplify the mental health benefits of physical activity by providing individuals with emotional and practical resources for coping with stress and psychological difficulties [49].

The living environment can also influence the relationship between physical activity and mental health. A safe and sport-friendly environment can encourage participation in physical activity, which in turn can improve an individual's mental health [50].

In addition, moderating factors such as physical health status, such as the presence of chronic diseases or physical disabilities, may modify the impact of physical activity on mental health. Individuals with certain health conditions may experience greater cognitive health benefits from well-measured and monitored physical activity [51], [52].

By considering these moderating factors, we can gain a more holistic understanding of how physical activity can affect an individual's mental health in various life contexts.

Trends over Time

It is important to pay attention to changes that occur over time. As suggested by [53], understanding how awareness of the importance of physical activity for mental health may evolve provides insight into changing patterns of societal behavior.

In addition, research conducted by [54], [55] suggests that changes in exercise practices, such as trends towards certain types of physical activity or increased participation in fitness programs, can significantly affect mental health". An analysis of these trends not only highlights changes in individual behavior but can also provide insight into the social, cultural, and economic factors that influence the relationship between physical activity and mental health. By looking at trends over time, we can better understand the evolution of understanding and practice in integrating physical activity as part of mental health maintenance.

DISCUSSION

The results of this systematic review show that there is consistency in study findings regarding the relationship between physical activity and mental health. In particular, the majority of studies showed a positive association between physical activity levels and mental well-being. These findings support theories that link physical activity with improved mood, reduced stress levels, and improved sleep. The practical implication of these findings is the importance of promoting an active lifestyle to improve overall mental health. Intervention programs that integrate physical activity into daily routines may be an effective strategy for reducing the risk of mental health disorders and improving people's psychological well-being.

While the results of this systematic review provide valuable insights, there are some limitations to note. Firstly, most of the studies analyzed were observational studies, which cannot establish a cause-and-effect relationship between physical activity and mental health. In addition, there were variations in methodology and measurements used among the included studies, which may affect the appropriateness and generalizability of the findings. Therefore, there is a need for further research with more robust designs, including intervention studies that allow for more robust inferences about the impact of physical activity on mental health. In addition, longitudinal studies may also provide a better understanding of the cause-and-effect relationship between physical activity and mental health over time.

Based on the findings of this systematic review, physical activity plays an important role in maintaining mental health. Theories supporting the relationship between physical activity and psychological well-being proved relevant in the context of the findings of this study. However, further research is needed to understand the mechanisms underlying this relationship in greater depth. Furthermore, it is important to note that physical activity is not the only factor that influences mental health, and other factors such as social environment and genetics also need to be considered.

Thus, a suggestion for future research is to take a holistic approach to understanding the complex relationship between physical activity and mental health. Collaborative efforts between researchers, practitioners, and policymakers are also needed to implement the results of this study in public health promotion efforts. Thus, through a

better understanding of the relationship between physical activity and mental health, we can develop more effective strategies for improving the holistic well-being of individuals and society as a whole.

CONCLUSION

This systematic review confirms the strong relationship between physical activity and mental health based on the empirical evidence that has been analyzed. Our findings show that participation in regular physical activity is consistently associated with improved mental well-being, including reduced risk of depression, anxiety, and stress. In addition, physical activity can also improve mood and enhance self-perception and sleep quality.

The clinical relevance of these findings is significant in both public health and clinical contexts. The practical implication is the need to support the promotion of physical activity as an integral part of mental health interventions. Measures such as including sports or physical activities in mental health programs and encouraging active lifestyles can improve overall mental well-being.

However, while our findings support the mental health benefits of physical activity, it should be noted that there are some limitations in the literature analyzed. Some studies may have weak methodological designs or a lack of control for confounding factors. Therefore, further research with more robust designs is needed to validate our findings and deepen the understanding of this relationship.

For future research, it is recommended to expand the scope of the study by delving deeper into the biological and psychological mechanisms underlying the relationship between physical activity and mental health. In addition, larger and longer intervention studies can help evaluate the effectiveness of intervention programs that aim to improve mental health through physical activity.

Overall, this study makes a significant contribution to our understanding of the importance of physical activity in maintaining mental health. By continuing to prioritize this relationship in public health policy and clinical practice, we can improve the quality of life and mental well-being of the population at large.

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