

Mediating Role of Resilience in the Relationship between Physical Activity and Mental Health among Children with ADHD

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ABSTRACT: Background and Aim: This study was designed to explore the mediating role of resilience in the relationship between physical activity and mental health among children with ADHD.

Methods: A descriptive-correlation methodology was utilized in this study, incorporating structural equation modeling. The study comprised 112 children diagnosed with ADHD, of whom 35 were female, sourced from different special education institutions. The ages of the participants ranged from 7 to 10 years, with a mean age of 8.29 ± 0.50 years. Participants were selected through a convenience sampling method. Standard questionnaires were used to collect data. Pearson correlation test and the structural equation modeling were used for data analysis.

Results: Results revealed that physical activity significantly affected mental health ($T=6.957$). Moreover, physical activity significantly affected resilience ($T=8.479$). Furthermore, resilience affected mental health ($T=5.527$). Finally, resilience has significantly mediated the relationship between physical activity and mental health ($P<0.001$). Results of model fit indicated that the research model has good fit.

Conclusion: This research represents the inaugural investigation into the connection between physical activity (PA), resilience, and mental health. The results indicated a positive correlation between PA and favorable mental health indicators, while demonstrating a negative correlation with adverse mental health indicators. Furthermore, the study revealed that PA may enhance mental health by exerting a positive influence through the mediating factor of resilience.

Keywords: Physical activity, mental health, resilience, child, ADHD

INTRODUCTION

As civilization progresses and the pace of life accelerates, mental health has increasingly garnered societal attention and has become a significant focus of research across multiple disciplines, including psychology, preventive medicine, and epidemiology. Scholars have introduced a two-factor model of mental health, drawing from the tenets of positive psychology (Baniyadi et al. 2022). This model posits that mental health transcends the mere absence of mental disorders; it is characterized by the presence of positive attributes, such as life satisfaction, alongside the absence of negative factors, such as depression (Feng et al. 2024). Various instruments have been employed to assess positive mental health indicators, including the Positive Mental Health Scale (PMH-scale), the WHO Happiness Index, the Psychological General Well-Being Index (PGWBI), and the Life Satisfaction Scale. Conversely, negative indicators have been evaluated using tools such as the Center for Epidemiologic Studies Depression Scale (CES-D), the Depression Anxiety Stress Scale (DASS-21),

the GAD-7 Anxiety Disorder Scale, and the SAS-2 Anxiety Questionnaire. Although there may be differences among these assessment tools, they collectively capture the positive and negative dimensions of mental health. Consequently, the introduction and implementation of the two-factor model provide a robust framework for a more nuanced and precise evaluation of an individual's mental health status (Chaharbaghi et al. 2022; Seyedi Asl et al. 2016).

Physical activity (PA) has emerged as a significant determinant of mental health among various influencing factors. Intervention studies have shown that PA is effective in the treatment of depression and anxiety. Additionally, observational studies indicate a negative correlation between PA and adverse mental health indicators, including depression, anxiety, and stress symptoms. Participation in PA that provides self-entertainment for psychological satisfaction may help mitigate negative emotions and enhance overall health or subjective well-being (Mastoras et al. 2018; Shafaei et al. 2024). Epidemiological research suggests that PA is linked to specific measures of subjective well-being, with moderate-intensity physical activity having a beneficial effect on mood. Consequently, the majority of studies indicate that PA can directly impact mental health by improving individuals' mental states and diminishing negative feelings. However, research by Hearon et al. identified a positive correlation between anxiety sensitivity and PA among adults. Established meta-analyses have primarily focused on the effects of PA on mental health through pooled intervention studies (Najafzadeh et al. 2024). In contrast, correlational meta-analyses have typically examined the relationship between PA and individual mental health indicators. The validity and applicability of a two-factor model in meta-analyses of mental health were confirmed in a study by Hu et al. Thus, conducting a meta-analysis on the correlation between PA and mental health utilizing the two-factor model would yield more comprehensive insights (Omidvar et al. 2018; Taghva et al. 2020).

With the progress of extensive research, contemporary scholars are increasingly directing their attention towards the mediating processes through which physical activity (PA) impacts mental health. These processes involve a range of variables, such as resilience, social support, self-efficacy, and psychological capital (Li et al. 2022; Sibbick et al. 2024). A review of the existing literature reveals that a majority of studies have primarily focused on the relationship between resilience and mental health. Resilience is defined as an individual's capacity to manage stress, frustration, and trauma, representing a vital positive psychological attribute with a complex and multifaceted connection to both PA and mental health. Research has identified a positive relationship between PA and resilience. Regular engagement in PA enhances individuals' psychological resilience, while the satisfaction of psychological needs during exercise further bolsters this resilience (Baniasadi et al. 2022; Fossati et al. 2020). Numerous empirical investigations have established that resilience is positively associated with favorable mental health outcomes and negatively associated with adverse mental health indicators. Furthermore, resilience has been shown to predict various mental health metrics, including life satisfaction, depression, and anxiety. While empirical studies have validated the mediating role of resilience in the relationship between PA and mental health, the results have been inconsistent (Ding et al. 2019; Liang et al. 2023; Seyedi Asl et al. 2020; Song et al. 2021). Some research indicates that resilience serves as a partial mediator in the influence of PA on mental health, while other studies suggest that controlling for resilience diminishes the correlation between PA and mental health indicators. Nevertheless, the application of meta-analysis to clarify the mediating function of resilience and to explore the mechanisms through which PA affects mental health has not been undertaken. This gap in the literature highlights the necessity for further investigation into this significant area of research. Hence, this study was designed to explore the mediating role of resilience in the relationship between physical activity and mental health among children with ADHD.

METHODS

A descriptive-correlation approach was employed in this research, which included the use of structural equation modeling. The study comprised 112 children diagnosed with ADHD, of whom 35 were female, sourced from different special education institutions. The ages of the participants ranged from 7 to 10 years, with a mean age of 8.29 ± 0.50 years. Participants were selected through a convenience sampling method.

The evaluation of physical activity was conducted utilizing the Rapid Assessment of Physical Activity (RAPA) scale. This scale comprises seven items that necessitate binary responses of 'Yes' or 'No'. The cumulative score on this scale can vary from 0 to 7. In the current study, the internal consistency reliability of the RAPA scale, as determined by Cronbach's alpha, was recorded at 0.92. Additionally, the validity of this instrument has been confirmed by ten experts, yielding a Content Validity Index (CVI) of 0.90 and a Content Validity Ratio (CVR) of 1.00 (Abdoshahi et al. 2022).

The Depression, Anxiety, Stress Scale-21 (DASS-21) was employed to evaluate mental health. This self-assessment instrument is segmented into three subscales, each aimed at measuring the adverse emotional states associated with depression, anxiety, and stress. Each subscale comprises seven items that pertain to the previous week and are rated on a four-point Likert scale, ranging from 'not at all' (0) to 'most of the time' (3). Elevated

scores indicate increased levels of symptoms. In this research, the DASS-21 demonstrated a Cronbach’s alpha of 0.89, and its validity was corroborated by nine experts (CVI=0.88, CVR=0.90) (Baniasadi et al. 2022).

The Connor-Davidson 25-item resilience scale was employed to assess resilience, specifically focusing on an individual's capacity to manage stress. Consequently, it is essential to prioritize the management of anxiety, depression, and stress responses, as these can pose significant challenges. Each item on this scale was evaluated using a 5-point rating system (0=not true at all to 4=almost always true), exemplified by statements such as “Adapt to change.” The authors of the scale reported a content validity ratio (CVR) of 0.85 and a content validity index (CVI) of 0.90 in their research. Additionally, they indicated a Cronbach’s alpha coefficient of 0.89. In the current study, the scale's items collectively produced a Cronbach’s alpha of 0.89 (Baniasadi, 2024; Khosravi et al. 2023).

Data analysis was conducted using SPSS-26 and Lisrel software. Descriptive statistics, including means and standard deviations, were utilized to define the characteristics of the variables. To evaluate the relationships among the variables, a Pearson correlation test was performed. Additionally, the structural equation modeling approach was employed to explore the structural relationships between the research variables. A significance level of $P < 0.05$ was established.

RESULTS

Descriptive data are presented in Table 1. Descriptive results show that in general the level of physical activity is lower than the average. However, mental health and resilience were at medium level. The results of Kolmogorov-Smirnov tests revealed that all variables were normally distributed (all $P > 0.05$). Results of Independent t tests showed that there were no significant differences between boys and girls in all variables of the study.

Table 1. Descriptive data

	physical activity	mental health	resilience
Mean	2.21	5.69	2.78
SD	0.46	1.72	0.26

Bivariate relationships between physical activity with mental health and resilience are demonstrated in Table 2. Results revealed significant direct relationship between physical activity and mental health ($P < 0.001$). Moreover, physical activity was directly and significantly associated with resilience ($P < 0.001$). Finally, resilience was directly and significantly associated with mental health ($P < 0.001$).

Table 2. Results of bivariate relationships between variables

	1	2	3
1. physical activity	-		
2. mental health	r=0.697 P<0.001	-	
3. resilience	r=0.874 P<0.001	r=0.527 P<0.001	-

Table 3 and Figure 1 show the results of structural equation modelling. Results revealed that physical activity significantly affected mental health ($T=6.957$). Moreover, physical activity significantly affected resilience ($T=8.479$). Furthermore, resilience affected mental health ($T=5.527$). Finally, resilience has significantly mediated the relationship between physical activity and mental health ($P < 0.001$). Results of model fit are presented in Table 4 and indicated that the research model has good fit.

Table 3. Results of structural equation modelling

Path	β	T-value
1 physical activity => mental health	0.695	6.957
2 physical activity => resilience	0.845	8.479
3 resilience => mental health	0.558	5.527
	Z	P-value
4 physical activity => resilience => mental health	6.547	P<0.001

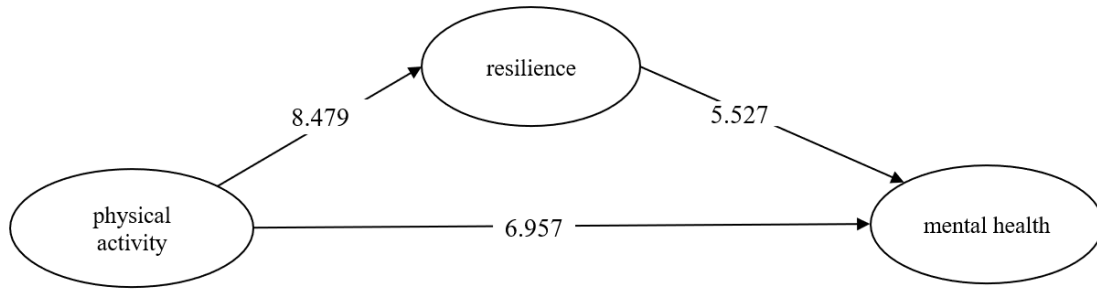


Figure 1. Structural equation modelling in the form of T-values

Table 4. Results of model fit

Index	Optimal Range	Obtained Value	Conclusion
RMSEA	< 0.08	0.06	Good fit
X ² / df	< 3	2.95	Good fit
RMR	Closer to 0	0.03	Good fit
NFI	> 0.9	0.96	Good fit
CFI	> 0.9	0.95	Good fit

DISCUSSION

This study was designed to explore the mediating role of resilience in the relationship between physical activity and mental health among children with ADHD. Results revealed that physical activity significantly affected mental health. Moreover, physical activity significantly affected resilience. Furthermore, resilience affected mental health. Finally, resilience has significantly mediated the relationship between physical activity and mental health.

Physical activity (PA) holds significant importance in individuals' lives. Engaging in PA can effectively reduce stress, manage negative emotions, enhance overall life satisfaction, and promote mental well-being. From a physiological standpoint, participation in PA results in increased endorphin production, lowered adrenaline levels, and enhanced cognitive functions such as logical thinking and reasoning (Uddin et al. 2020). As a result, one of the most immediate benefits of PA is the sensation of pleasure and improved well-being. Our findings further support the notion that PA is associated with positive mental health indicators and can positively affect these indicators. Elevating positive emotions during physical activity can counteract negative feelings and alleviate symptoms of depression, anxiety, and work-related stress. Additionally, PA is vital in addressing anxiety and depression by enhancing various physiological aspects, as demonstrated by our study, which revealed a negative correlation between PA and adverse mental health indicators. However, it is important to note that the relationship between PA and mental health varies significantly across different life contexts (Najafzadeh et al. 2024). Certain populations, such as older adults and smokers, may experience negative emotions linked to the physical challenges or risks associated with exercise. Therefore, it is essential to develop a scientifically grounded exercise prescription to effectively implement exercise interventions for mental health concerns. The rise of a technology-driven society has contributed to a decrease in PA levels among individuals, which inevitably leads to mental health challenges. Research indicates that physical inactivity is a leading global cause of death, significantly influencing the prevalence of non-communicable diseases, including mental health disorders. Consequently, the effects of physical inactivity on mental health remain a pressing issue for the future (Uddin et al. 2023).

Resilience, defined as an intrinsic quality or ability to navigate challenges, is intricately connected to mental well-being. Individuals exhibiting high resilience often maintain a more optimistic perspective on cognitive issues. Our study's findings revealed a significant positive relationship between resilience and beneficial mental health indicators. Additionally, resilience demonstrated a notable negative correlation with adverse indicators (Dzhambov et al. 2023). A comprehensive meta-analysis conducted by researchers has elucidated the relationship between resilience and mental health. Those endowed with resilience are better equipped to face challenges, manage them positively, seek assistance, and resolve problems effectively. This resilience serves as a protective barrier, shielding individuals from the detrimental emotional impacts of negative experiences. The results of the current study suggest that the link between resilience and mental health is considerably stronger than that associated with physical exercise (Shafaei et al. 2024). This may be due to resilience exerting a more immediate influence on mental health compared to physical activity. Furthermore, resilience, as a personality trait, shows greater consistency and a stronger connection to an individual's mental

well-being than physical exercise, which is considered an external protective factor. This characteristic of resilience implies that it may mediate other distant variables influencing mental health. Consequently, it is essential to emphasize this aspect in the exploration of mental health issues (Ghorbani et al. 2020).

Physical activity emerged as a crucial predictor of resilience, aligning with earlier findings. Resilience in individuals is dynamic and can be shaped by both beneficial and detrimental influences. As a protective factor, physical activity can facilitate the enhancement of individual resilience. Studies indicate that consistent engagement in physical activity can significantly lower physiological stress, promote emotional stability, enhance self-regulation, and improve mental health, all of which contribute to heightened resilience. Additionally, resilience is subject to various influences, including the nature and intensity of the activity, as well as personal beliefs and habits. The relationship between physical activity, resilience, and mental health is complex (Baniasadi et al. 2022). This research represents the inaugural effort to explore the mediating role of resilience in the relationship between physical activity and mental health through a meta-analytic structural equation model. The findings revealed that physical activity not only has a direct impact on mental health but also positively influences favorable mental health indicators while negatively affecting adverse ones through the mediating effect of resilience. Notably, even after accounting for resilience, the direct relationship between physical activity and mental health remained significant, suggesting that resilience serves as a partial mediator, with the mediating effects contributing 40% and 29%, respectively (Fritz et al. 2018; Ismaeel, 2024). Our research indicated that resilience plays a more significant mediating role in enhancing positive mental health outcomes compared to negative ones. This suggests that favorable mental health results may be more closely associated with an individual's inherent resilience and can further amplify the importance of resilience within the framework of physical activity and mental health interactions. Resilience protects individuals from the repercussions of challenging situations through four main pathways: reducing the likelihood of being impacted, alleviating negative cascading effects, enhancing psychosocial skills such as self-esteem and self-efficacy, and creating opportunities for adaptive responses. Consequently, regular participation in physical activity can indirectly foster mental health by strengthening psychological resilience and elevating an individual's self-esteem and self-efficacy (Chiang et al. 2024; Sadeghi & Rahimipour, 2017).

CONCLUSION

This research represents the inaugural investigation into the connection between physical activity (PA), resilience, and mental health. The results indicated a positive correlation between PA and favorable mental health indicators, while demonstrating a negative correlation with adverse mental health indicators. Furthermore, the study revealed that PA may enhance mental health by exerting a positive influence through the mediating factor of resilience.

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