Exploring the Associations Between Physical Activity and Happiness in Children with Autism: The Mediating Role of Mental Health

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Abstract

Background: The connections between physical activity and happiness in children with autism are relatively unexplored. The aim of this study was to scrutinize the relationships between objective physical activity and happiness in children with autism, considering mental health as a potential mediator.

Methods: The present study employed a cross-sectional descriptive-correlational approach. A sample of 68 children with autism (average age 11.28 years) from Gorgan, Iran, was selected in 2022 through convenience sampling. The ActiGraph wGT3X-BT accelerometer was used to objectively measure physical activity. The Oxford Happiness Inventory (OHI) and the Depression, Anxiety, and Stress Scale (DASS-21) were employed to assess happiness and mental health, respectively. The Pearson correlation test and structural equation modeling was utilized for data analysis.

Results: The children did not adhere to the recommended guidelines of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day. Sedentary time was found to have a significant negative correlation with happiness (r=-0.561, P<0.001). Conversely, MVPA showed a significant positive correlation with happiness (r=0.851, P<0.001). In addition, MVPA exhibited a significant negative correlation with mental health issues, including depression, anxiety, and stress (r=-0.729, P<0.001). Lastly, mental health was found to significantly mediate the relationship between MVPA and happiness (z=8.148, P<0.001).

Conclusion: High-intensity physical activity is positively associated with the happiness and mental health of children with autism. Therefore, physical education teachers and sports coaches are encouraged to incorporate high-intensity physical activities into their lesson plans to promote the well-being of children with autism.

Keywords: Physical activity, Happiness, Autism, Accelerometer, Mental health

How to Cite: Baniasadi T, Ranjbari S, Khajeaflatoon Mofrad S, Ghorbani S. Exploring the Associations Between Physical Activity and Happiness in Children with Autism: The Mediating Role of Mental Health. Int. J. School. Health. 2023;10(4):181-188. doi: 10.30476/INTJSH.2023.98615.1305.

1. Introduction

One of the primary indicators of societal health and well-being lies in the happiness and vitality prevalent among its diverse groups. Over time, the significance of happiness has grown to such an extent that it is now regarded as a fundamental principle of human life (1, 2). Consequently, happiness, given its profound impact on personality, has always been valued as an essential psychological need. Happiness is a mental state where an individual experiences emotion such as love, pleasure, joy, or contentment. Various factors, including biological, psychological, and religious, have been explored to define and understand satisfaction (1, 3). Numerous studies investigating the relationship between happiness and health have found that happiness plays a vital role in both mental and physical health (3-8). As an integral part of society, children with physical and mental disabilities need careful attention, because the factors affecting their personality development can have a significant impact on the future society.

One of the most prevalent disabilities in children is Autism Spectrum Disorder (ASD). ASD is a pervasive developmental-neural disorder that impairs social communication skills, gross and fine motor skills, social interaction, and it often leads to limited and repetitive behaviors. In some cases, it can also affect cognitive abilities (9, 10). The symptoms of autism are typically identified in early childhood. The spectrum of autism ranges from Asperger's Syndrome (high-functioning autism spectrum disorder) to classic autism, often accompanied by cognitive impairment (10). Boys are five times more likely to be diagnosed with autism than girls (11, 12). Several studies have

revealed that children with autism tend to have a lower quality of life, particularly a diminished sense of happiness, compared to their typically developing peers. It is thus crucial to identify factors that can enhance the happiness of children with autism (13, 14). Physical activity (PA) is one of the factors that has been insufficiently examined in the previous research.

PA is any physical endeavor that enhances physical fitness and overall health (15, 16). Past studies have indicated that regular PA improves muscular strength, cardiovascular health, movement skills, and weight management. It also boosts the immune system and helps prevent various diseases such as heart failure, diabetes, and obesity (17-20). Furthermore, PA enhances mental health, reduces the incidence of depression, boosts or maintains self-confidence, and even fosters positive body image and sexual attractiveness (21-23). Additionally, a low level of PA is associated with an increased risk of several chronic diseases, including type 2 diabetes, coronary artery disease, stroke, hypertension, osteoporosis, certain cancers, and especially obesity (20-21, 24-26). It is also believed that PA during childhood and adolescence can have direct effects on health and well-being in adulthood (20, 21). Therefore, it is plausible to assume that PA can influence a child's sense of happiness. As previously mentioned, the relationships between PA and happiness among children with autism have been insufficiently studied. Hence, the objective of the current research was to examine the relationship between PA and happiness in children with autism, with a particular focus on the mediating role of mental health. The study hypothesized that higher levels of PA correlate with increased happiness in children with autism and that mental health mediates the relationship between PA and happiness.

2. Methods

The present research employed a cross-sectional descriptive-correlational method. The study was conducted following the ethical guidelines stipulated in the Declaration of Helsinki, and written informed consent was obtained from the parents of the children.

2.1. Participants

The statistical population consisted of children diagnosed with autism spectrum disorder, referred to autism centers in Gorgan, Iran, in 2022. The inclusion criteria were confirmed diagnosis of autism at Gorgan autism center, Gorgan, Iran. Exclusion criteria included the inability to complete the physical activity measurement protocol and associated questionnaires relating to happiness and mental health. The total number of children officially undergoing treatment at these centers was 72. Given the relatively small size of this group, all participants were included in the study. Of these, 68 children with autism (including 12 girls), with a mean age of 11.28 years, successfully completed the physical activity protocol and filled out the questionnaires related to happiness and mental health.

2.2. Measures

2.2.1. Physical Activity: Physical activity (PA) was evaluated using an accelerometer operating at a frequency of 30 Hz. Accelerometers measure both the sedentary time and the intensity of PA (e.g., light, moderate, and vigorous PA). Previous studies have demonstrated the reliability of accelerometers (27-29). Participants wore the device on their right thigh for one week. The accelerometer data were analyzed using ActiLife v6.13.4 software. Scoring for the PA tool was as follows: light PA (100–1951 counts/min), moderate PA (≥1952–5724 counts/min), and vigorous PA (≥5725 counts/min). Moderate and vigorous PA were combined to form moderate-to-vigorous PA (MVPA).

2.2.2. Happiness: The Oxford Happiness Questionnaire (OHI) was used to gauge happiness in this study. The OHI, developed by Hills and Argyle (30), comprises 29 items scored on a four-point Likert scale, ranging from 'never' (1) to 'high' (4). The total score ranges from 29 to 116, with higher scores indicating higher levels of happiness. Hills and Argyle (30) obtained a 0.90 alpha coefficient for the OHI with 347 participants. In this study, the Cronbach's alpha of the OHI was 0.94, and its validity was affirmed by nine experts (CVI=0.90, CVR=0.90).

2.2.3. Mental Health: The Depression, Anxiety, Stress Scale-21 (DASS-21) was utilized to assess mental health (31). The DASS-21 is a self-measurement tool divided into three subscales designed to measure the negative emotional states of depression, anxiety, and stress. Each subscale

contains seven items, all referring to the preceding week and rated on a four-point Likert scale, from 'nothing' (0) to 'most of the time' (3). Higher scores suggest the higher levels of symptoms. In this study, the Cronbach's alpha of the DASS-21 was 0.89, and its validity was confirmed by nine experts (CVI=0.88, CVR=0.90).

2.3. Data Analysis

Mean and standard deviation were utilized to describe PA, happiness, and mental health. Data normality was assessed using the Kolmogorov-Smirnov test. The Pearson correlation test was employed to evaluate the relationships between physical activity, happiness, and mental health. Lastly, structural equation modeling using SmartPLS was applied to assess the structural associations between PA, happiness, and mental health. The level of significance was set at P<0.05.

3. Results

The participant pool consisted of 68 children diagnosed with autism, comprising 12 girls. The average age was 11.28 years old. Demographic information, such as age, weight, height, and Body Mass Index (BMI), is presented in Table 1. The average BMI of the participants was 16.75, which falls within the normal range.

3.1. Correlation among Physical Activity, Happiness, and Mental Health

Table 2 provides descriptive data on sedentary time, light physical activity (LPA), moderate-to-vigorous physical activity (MVPA), happiness, and mental health, along with the results from Pearson correlation tests. Notably, the data was normally distributed, as evidenced by the results of the Kolmogorov-Smirnov tests (all P>0.05). The Pearson correlation tests indicated that sedentary time was inversely and significantly associated with happiness (P<0.001), and directly and significantly associated with mental health (P<0.001). LPA; on the other hand, did not show a significant association with either happiness (P=0.469) or mental health (P=0.593). MVPA was found to have a direct and significant association with happiness (P<0.001), and an inverse and significant association with mental health (P<0.001). Lastly, mental health was inversely and significantly associated with happiness (P<0.001).

3.2. Path Analysis

Results from the structural equation modeling, as shown in Table 3 and Figure 1, revealed that sedentary time had an inverse and significant effect on happiness (T=-5.293), and a direct and significant effect on mental health (T=7.209). LPA did not have a significant impact on either happiness (T=0.718) or mental health (T=0.694). Conversely, MVPA showed a direct and significant impact on happiness (T=9.647), and an inverse and significant effect on mental health (T=-8.341). Furthermore, mental health was found to have an inverse and significant effect on happiness (T=-6.208). Mental health significantly mediated the associations between both sedentary time and MVPA with happiness (P<0.001). However, it did not significantly mediate the association between

Table 1: Demographic data of the participants

	Age	Weight	Height	BMI
Mean±SD	11.28±2.51	35.12±3.19	140.11±6.82	16.75±1.40

BMI: Body Mass Index

**Table 2:** Results of correlation between physical activity with happiness and mental health

	Mean±SD	1	2	3	4	5
1. Sedentary time (minutes)	893.17±217.85	-				
2. LPA (minutes)	127.97±24.64	r=0.028 P=0.967	-			
3. MVPA (minutes)	22.14±12.90	r=0.051 P=0.759	r=0.019 P=0.983	-		
4. Happiness	52.71±17.84	r=-0.561 P<0.001	r=0.102 P=0.418	r=0.854 P<0.001	-	
5. Mental health	1.96±0.84	r=0.605 P<0.001	r=0.096 P=0.534	r=-0.729 P<0.001	r=-0.552 P<0.001	-

LPA: Light physical activity; MVPA: Moderate-to-vigorous physical activity

Table 3: Results of structural equation modelling

	Path	β	T value
1	Sedentary time=>Happiness	0.493	-5.293
2	LPA=>Happiness	0.707	0.718
3	MVPA=>Happiness	0.935	9.647
4	Mental health=>Happiness	0.610	-6.208
5	Sedentary time=>Mental health	0.689	7.209
6	LPA=>Mental health	0.641	0.694
7	MVPA=>Mental health	0.803	-8.341
		Z	P value
8	Sedentary time=>Mental health=>Happiness	5.694	P<0.001
9	LPA=>Mental health=>Happiness	0.632	P=0.597
10	MVPA=>Mental health=>Happiness	8.148	P<0.001

LPA: Light physical activity, MVPA: Moderate-to-vigorous physical activity
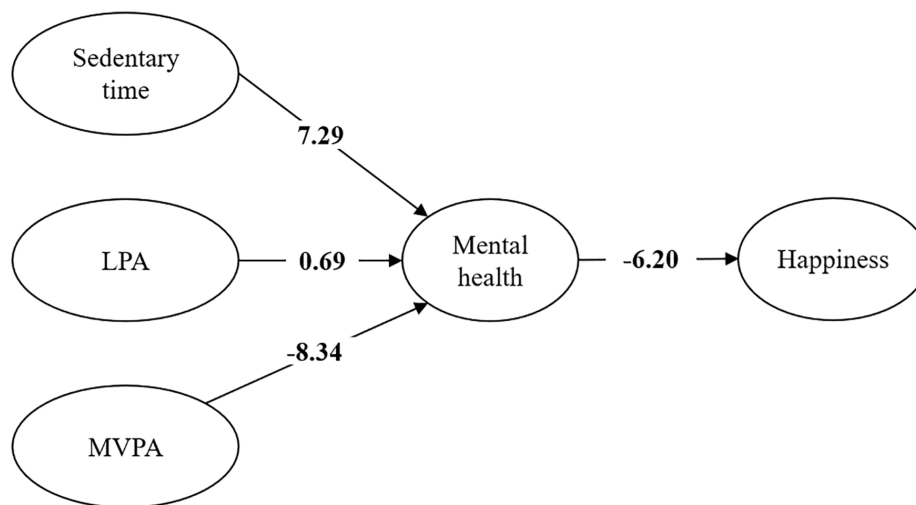
Figure 1: The figure shows the conceptual model of the study. LPA: Light physical activity; MVPA: Moderate-to-vigorous physical activity

LPA and happiness (P=0.597). The model fit results indicated that the conceptual model of this study exhibits good fit (GOF=0.593; RMSEA=0.064; CFI=0.951; GFI=0.914).

4. Discussion

The aim of the current research was to investigate the effects of physical activity (PA) on the happiness of children with autism, focusing on the mediating role of mental health. Initially, the findings showed that the children in this study had significantly lower levels of health-related PA, specifically moderate to vigorous physical activity (MVPA), than what is typically recommended. International guidelines suggested that children should engage in at least 60 minutes of MVPA daily throughout the week (32). However, our participants were found to only spend an average of 22.14 minutes per day on MVPA, which is markedly below the guidelines. These results are consistent with previous studies (15, 16, 18, 20, 22), highlighting that children are

not dedicating enough time to health-related PA. Given the multitude of benefits associated with regular health-related PA for children (17, 18, 19, 22, 24, 25), it is highly recommended that the PA behavior of children, particularly those with autism, should receive special attention from health practitioners. Consequently, identifying interventions and strategies to increase MVPA levels in children with autism is essential.

Regarding happiness, the results showed that sedentary time had a significant inverse effect on happiness. Moreover, while light physical activity (LPA) did not significantly affect happiness, MVPA exhibited direct and significant effects on happiness. These results corroborated past studies utilizing self-reported instruments (33-37), illustrating that PA has positive effects on the happiness of children with autism. However, a more detailed examination of PA patterns reveals that not all types of PA contribute to happiness. We discovered that LPA had no impact on the happiness

of children with autism, whereas MVPA positively influenced their happiness. This indicates that the intensity of PA is a critical factor for happiness; the greater the intensity of PA, the more significant its impact on children's happiness. Sedentary time; on the other hand, was found to be detrimental to happiness. The more sedentary children were, the less happy they seemed to be. Therefore, it is suggested that children with autism engage more in high-intensity PA and reduce sedentary time. Concerning the mechanisms behind the impact of PA on happiness and mood, some studies have demonstrated that exercise and PA increase plasma endorphins, which are associated with feelings of happiness, and also elevate the levels of the mood-regulating hormone serotonin (33, 35, 37).

These results are further supported by findings related to mental health. The present study showed that, similar to its effect on happiness, high-intensity PA (MVPA) also positively impacts mental health, reducing symptoms of depression, anxiety, and stress in children with autism. Conversely, low-intensity PA (LPA) had no significant effect on mental health, and sedentary time was found to negatively impact the mental health of children with autism. These findings aligned with previous studies (34, 35), indicating that to improve mental health, children should participate more in high-intensity PA and spend less time being sedentary. Additionally, the results of this study showed that mental health can act as a mediator between PA and happiness, suggesting that mental health is a key influencer of happiness. In other words, lower levels of depression, anxiety, and stress correspond with higher levels of happiness, and in this context, high-intensity PA can be viewed as a positive influencing factor (38-40).

4.1. Limitation

One significant limitation of this study is the relatively small sample size. To build upon and validate the results of this investigation, larger-scale studies are recommended. Nonetheless, a key strength of our research lies in the utilization of contemporary instruments to measure physical activity (PA), enabling us to ascertain accurate levels of PA.

5. Conclusion

The findings of the study revealed a notably low level of PA among children with autism, emphasizing an urgent need for interventions and policies aimed at enhancing health-related PA in this group. In addition, it was observed that high-intensity PA was correlated with happiness, and here mental health played a mediating role. This suggests that children with autism would greatly benefit from more frequent participation in high-intensity PA and a reduction in sedentary behaviors. Therefore, we fervently recommend that physical education teachers and sports coaches incorporate strategies within their programs to boost levels of high-intensity PA among children with autism.

Ethical Approval

Acknowledgement

Authors' Contribution

TB: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work, drafting the work. ShR: Contribution to the design of the work, drafting the work and reviewing it critically for important intellectual content. SKhM: Contribution to the design of the work, drafting the work and reviewing it critically for important intellectual content. SGh: Acquisition, analysis, and interpretation of data for the work, drafting the work. All authors approved of the final version to be published, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest: None declared.

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