



Exercise Duration and Its Association with ADHD Symptom Severity in Children and Adolescents: A Parent-Reported Survey Study

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Abstract

This study investigates the relationship between exercise duration and attention-deficit/hyperactivity disorder (ADHD) symptom severity in children and adolescents. A quantitative, quasi-experimental post-test only design was used with 199 parents of children aged 6–17 with diagnosed ADHD. Exercise duration was categorized into three groups: minimal (<60 min/day), moderate (61–120 min/day), and maximal (121–180 min/day). ADHD symptoms were measured using the ADHD Rating Scale-5. ANOVA results indicated a statistically significant difference in symptom severity across groups ($F(2,196) = 6.48$, $p = .002$), with post-hoc analysis revealing that the maximal exercise group exhibited significantly lower symptoms compared to the moderate group. Findings support incorporating structured physical activity into ADHD management strategies and contribute to the Optimal Stimulation Theory (OST) framework.

Keywords: Aerobic Exercise; Anerobic Exercise; Attention deficit hyperactivity disorder (ADHD); Exercise

Abbreviations

ADHD: Attention-Deficit/Hyperactivity Disorder; CDC: Centers for Disease Control and Prevention; ACMS: American College of Sports Medicine; OST: Optimal Stimulation Theory.

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders in childhood, affecting up to 9% of school-aged children in the United States [1]. Core symptoms include inattention, hyperactivity, and impulsivity, which impair functioning in academic, social, and home settings [1]. Traditional treatments often rely on stimulant medications and

behavioral therapy. However, these interventions may have limitations including side effects, short-term efficacy, and accessibility barriers. In light of these challenges, there is increasing interest in complementary, non-pharmacological strategies such as exercise to reduce symptom severity.

Recent research supports the beneficial effects of physical activity on cognitive and behavioral outcomes in children with ADHD [2,3]. However, a significant gap remains in identifying specific parameters of exercise, particularly duration, that are most effective. This study aims to determine the association between exercise duration and ADHD symptom severity, with a goal of informing future intervention strategies.

The American College of Sports Medicine [4] and the Centers for Disease Control and Prevention [1] recommend that children and adolescents engage in daily aerobic or cardiorespiratory activities. According to the ACSM, youth should accumulate a minimum of 60 minutes of physical activity per day, incorporating physical education, sports, active play, and active transportation. These activities should be developmentally appropriate, enjoyable, and varied. Similarly, the CDC recommends at least 60 minutes of moderate to vigorous aerobic activity daily, with inclusion of muscle- and bone-strengthening activities at least three times per week. The CDC also emphasizes the importance of providing children with opportunities and encouragement to be physically active, reinforcing that the activities should be age-appropriate and enjoyable.

In addition, the ACSM advises that children and adolescents participate in muscle-strengthening activities—such as jumping, climbing, gymnastics, or tumbling—two to three times per week. For youth with disabilities or chronic conditions, the ACSM recommends that physical activity programs be individualized to meet specific needs. In contrast, the CDC does not currently provide tailored recommendations for this population.

A growing body of literature supports the use of exercise as a non-pharmacological strategy to reduce and manage symptoms of attention-deficit/hyperactivity disorder [3,5,6]. Among the various exercise modalities, aerobic-based programs appear to offer the most consistent support for symptom improvement [7-9]. However, despite the promising evidence, the lack of standardized parameters limits the ability to prescribe exercise as a formal intervention for ADHD management [3,9-11].

Theoretical Framework

The study is guided by the Optimal Stimulation Theory (OST), which suggests that individuals seek an optimal level of arousal to maintain cognitive and behavioral functioning [12]. For individuals with ADHD, who may experience under-arousal, physical activity serves as a form of external stimulation that can aid in achieving this balance. By investigating how varying durations of exercise impact ADHD symptoms, this study seeks to expand the theoretical application of OST in pediatric mental health.

Materials and Methods

A quantitative, quasi-experimental design with a non-equivalent control, post-test-only structure was employed. Participants were recruited through online ADHD support groups on social media. Eligibility criteria included being a parent or guardian of a child aged 6 to 17 years with a formal ADHD diagnosis.

Data was collected via an online survey hosted on Qualtrics. The survey included demographic questions, daily exercise duration tracking, and the ADHD Rating Scale-5. Exercise duration was self-reported by parents based on their child's typical day and categorized into three groups: <60 minutes (minimal), 61–120 minutes (moderate), and 121–180 minutes (maximal). The dependent variable was the ADHD symptom score, encompassing domains of inattention and hyperactivity/impulsivity.

Statistical analysis was conducted using SPSS version 26. One-way analysis of variance (ANOVA) tested for differences in ADHD symptoms across exercise groups. Bonferroni post-hoc tests identified which group differences were statistically significant (Table 1).

Dependent Variable: Score			
Exercise groups	Mean	Std. Deviation	N
0-60	42.3065	17.13934	62
61-120	49.2571	22.46965	105
121-180	35.3437	18.14033	32
Total	44.8543	20.83615	199

Table 1: Descriptive Statistics: Exercise Groups.

Bonferroni post-hoc tests were used to answer further questions on the difference between the exercise groups. Specifically identifying which group of exercise duration is associated with the lowest ADHD symptoms, Bonferroni post-test was appropriate as the F score was significant, indicating that there was a difference between the exercise groups.

Results

The final sample consisted of 199 participants. Descriptive statistics showed a balanced distribution across exercise duration groups. ANOVA results indicated a significant difference in ADHD symptom scores across groups ($F(2,196) = 6.48, p = .002$) (Table 2).

Between Subjects	Sum of Squares	df	MS	F	p	Observed Power ^b
Corrected Model	5332.321 ^a	2	2666.16	6.481	0.002	0.903
Intercept	283034.618	1	283034.618	688.03	0	1
Exercise Groups	5332.321	2	2666.16	6.481	0.002	0.903
Error	80628.453	196	411.37			
Total	486330	199				
Corrected Total	85960.774	198				

a. R Squared = .062 (Adjusted R Squared = .052)

b. Computed using alpha = .05

Table 2: ANOVA Results: Exercise groups and ADHD score.

Post-hoc comparisons using the Bonferroni correction revealed that the maximal exercise group had significantly lower mean ADHD scores compared to the moderate group

($p < .05$). No significant difference was found between the minimal and moderate or maximal groups (Table 3).

(I)Exercise	(J)Exercise	MD (I-J)	Std. Error	Sig	Lower Bound	Upper Bound
0-60	61-120	-6.95	3.25	0.101	-14.79	0.89
	121-180	6.96	4.41	0.349	-3.7	17.62
61-120	0-61	6.95	3.25	0.101	-0.89	14.79
	121-180	13.91*	4.1	0.002	4.05	23.8
121-180	0-61	-6.96	4.41	0.349	-17.62	3.7
	61-120	-13.91*	4.1	0.002	-23.8	-4.02

Based on observed means.

The error term is Mean Square (Error) = 411.370.

*. The mean difference is significant at the .05 level.

Table 3: Multiple Comparisons of dependent variable of ADHD score: Bonferroni Post Hoc Tests.

These results support the hypothesis that higher durations of daily physical activity are associated with reduced ADHD symptom severity. Specifically, children engaging in over two hours of exercise daily exhibited notably fewer symptoms than those engaging in 1–2 hours.

Discussion

This study contributes to the growing body of evidence supporting physical activity as a viable intervention for ADHD. The finding that 121–180 minutes of daily exercise is associated with significantly lower symptom severity underscores the importance of specific exercise guidelines for children with ADHD. This has practical implications for therapists, educators, and caregivers seeking non-pharmacological strategies to support children with ADHD.

From a theoretical perspective, these findings align with OST, suggesting that extended exercise provides the necessary external stimulation for optimal behavioral

regulation. This is particularly relevant for children with ADHD who may experience chronic under-stimulation.

While prior research supports the general benefits of physical activity, this study adds specificity by identifying effective durations. Importantly, however, the relatively low R-squared value (6.2%) indicates that exercise duration explains only a small proportion of the variance in ADHD symptoms. This suggests that additional factors including exercise type, intensity, timing, psychosocial environment, sleep quality, and co-occurring conditions likely play a meaningful role and should be examined in future studies.

Another consideration is that different modalities of exercise (e.g., aerobic, resistance, or mixed programs), varying intensities, and the timing of activity throughout the day may interact with exercise duration in influencing ADHD symptom severity. These parameters could have important clinical implications and warrant more nuanced investigation.

Limitations

This study is not without limitations. The use of parent-reported data may introduce reporting bias, particularly in estimating daily exercise duration. Future research should incorporate objective tools, such as wearable activity trackers, to enhance the validity and reliability of measurement.

The cross-sectional design prevents establishing causal relationships between exercise duration and ADHD symptom severity. Longitudinal or experimental studies, including randomized controlled trials, are necessary to determine whether increased exercise directly contributes to reductions in ADHD symptoms over time.

Additionally, the convenience sampling method may limit generalizability. Future research should aim for more diverse recruitment strategies, representative samples, and inclusion of broader demographic variables.

Clinical Implications

For physiotherapists and occupational therapists, these findings provide actionable evidence to design exercise-based interventions tailored for children with ADHD. Incorporating extended physical activity into daily routines could serve as an adjunct or alternative to medication-based treatments. Schools and community programs may also benefit from integrating longer-duration physical activities into their schedules.

Recommendations for Future Research

This study examined the relationship between exercise duration and ADHD symptoms, revealing that children and adolescents engaging in higher levels of physical activity (121–180 minutes per week) exhibited the lowest symptom severity. These findings corroborate previous research supporting the beneficial effects of increased exercise on ADHD symptom reduction [2,8,13]. Exercise therefore represents a promising adjunct intervention for ADHD management; however, further research is required to establish optimal exercise duration for therapeutic benefit.

Limitations of this study include reliance on parent-reported exercise data, exclusive measurement of exercise duration, and lack of control over potential confounding variables. Future studies should incorporate additional variables such as exercise type, intensity, timing of activity, and timing of symptom assessment relative to exercise. Research exploring longer durations of physical activity beyond those previously studied is also warranted [14-16].

To strengthen the evidence base, future research should utilize objective physical activity tracking methods and

employ rigorous experimental designs featuring pre- and post-intervention assessments with appropriate control groups. Such methodologies will enable identification of precise exercise parameters most effective in reducing ADHD symptoms [17-20].

Further recommendations include increasing sample sizes, adopting longitudinal study designs, applying validated and comprehensive outcome measures, and incorporating qualitative data to gain a deeper understanding of individual experiences and contextual factors influencing exercise adherence and outcomes.

To Strengthen the Evidence Base, Future Research Should:

- Utilize objective physical activity tracking (e.g., accelerometers, wearable devices) to supplement or replace parent reports.
- Employ rigorous experimental designs featuring pre- and post-intervention assessments with appropriate control groups.
- Investigate additional exercise parameters (type, intensity, timing of activity) in conjunction with duration to identify optimal prescriptions.
- Incorporate longitudinal study designs to assess causal relationships and sustained effects.
- Increase sample sizes and diversify populations to improve generalizability.
- Include qualitative data to better understand individual experiences, barriers, and facilitators to exercise adherence.

Conclusion

In conclusion, this study identifies a significant association between higher exercise duration and reduced ADHD symptom severity in children and adolescents. Exercise exceeding 120 minutes per day appears particularly effective. While exercise duration alone explains only a modest proportion of variance, it represents an important and modifiable factor in ADHD management. These findings contribute to both theoretical and practical frameworks for managing ADHD and highlight the value of structured, sustained physical activity in pediatric care.

Ethical Note: This study was approved by Northcentral University Institutional Review Board. All participants provided informed written consent.

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