International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Effectiveness of Physiotherapy-Based Activity Programs in Controlling Impulsivity in Children with ADHD

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Abstract:
Attention Deficit Hyperactivity Disorder, or ADHD, is an established neurodevelopmental disorder prevalent during childhood, and its symptoms encompass lack of attention, hyperactivity, and impulsivity. Impulsive activity is observed to impact on academic as well as social functioning. Despite the efficacy of medication and behavioural therapies in managing ADHD, the fact is established that these therapies are limited, and the demand for an effective complementary therapy is growing. Physiotherapeutic activity techniques emphasising the domains of motor control, balance, proprioception, and cognition integration stand as promising non-pharmacologic therapies effectively improving the aspect of control. This work seeks to assess the efficacy of a formulated physiotherapeutic activities program in the regulation of impulsive behaviour in children afflicted by ADHD. Based on precisely defined parameters of improvement, the study determines the efficacy of a specific physiotherapeutic approach in arresting the symptoms of impulsivity and response inhibition in affected children. The results of the current study can prove to be a potential impetus in establishing physiotherapeutic interventions as a primary means of multifaceted ADHD management in affected children.

Keywords: Attention Deficit Hyperactivity Disorder (ADHD), Impulsivity, Physiotherapy-based activity programs, Pediatric rehabilitation, Executive function, Motor-cognitive integration

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder that has been shown to impact 5-7% of children in school-going age groups across the globe. It stems from displays of inattentive symptoms, hyperactive symptoms, and impulsive symptoms, which remarkably hamper functional development and academic performance. Of these symptoms of neurological disarray, impulsiveness has proved to be the most hampering as it impacts control over impulse and decision-making. While structural treatment of this disorder has primarily involved pharmacotherapy and behavioural therapy, these methods have proved highly successful despite possible side effects and lack of parameters addressing motor and sensory difficulties in children suffering from this disorder. Emerging literature supports that activity programs incorporating motor coordination activities and proprioceptive stimulation offered as a form of physiotherapeutic intervention have modulated neurological attributes of impulse control. Hence, there has been proof of non-pharmacological and child-friendly approaches of physiotherapeutic intervention as markers of successful regulation of impulsive symptoms of this disorder.

Background: Attention Deficit Hyperactivity Disorder (ADHD) is widely prevalent as a childhood neuromuscular disorder, which is defined by the presence of constant signs of inattentiveness, hyperactivity, and impulsiveness. Moreover, impulsiveness is known to cause significant impairment in response inhibition and decision-making abilities, resulting in poor learning skills and emotional regulation. While pharmacological and behavioural interventions have been considered prominent in managing ADHD symptoms, they have been linked to side effects and have the potential to target the motor skills, sensory functioning, and cognitive regulation deficits. Moreover, physiotherapy interventions are significant in the regulation of impulsivity in ADHD patients as they promote motor planning skills, postural support, sensory integration, and self-regulation techniques through activity-based interventions. The current gap in scientific knowledge proposes promising results regarding the effect of coordination, balance, and proprioceptive stimulations on cognitive-motor integration functions related to impulsiveness regulation in the context of neuroscience studied through physiotherapy interventions.

Importance of the Topic

Attention Deficit Hyperactivity Disorder (ADHD) is a very common childhood neurodevelopmental disorder in which impulsivity is the most disturbing primary symptom. Managing impulsivity effectively has been proven crucial in enhancing the ability of the child in terms of behaviour regulation, learning power, and overall quality of life. Although the use of medications and behaviour therapies is very common in the treatment of the disease in children, the limitations associated with these factors have raised the need for other therapeutic options as well.

Physiotherapy-based activity program interventions in controlling impulsivity in ADHD is a field of study that is very relevant since physiotherapy deals directly with motor control and processing, which is a function that is greatly related to executive functioning. Physiotherapy also embraces interventions that reduce motor–cognitive conflicts, which is a function that is greatly linked to self-regulation in ADHD. This field of study is also very relevant since it can lead to the development of ADHD interventions that can be non-pharmacological and child-friendly, which can greatly aid in ADHD intervention strategies. Additionally, it can also be very useful to caregivers, teachers, and health providers since there are strategies that can aid in improving functional outcomes in ADHD children.

Problem Statement

Attention DeficitHyperactivity Disorder (ADHD) is a frequent neurodevelopmental disorder in children, and impulsivity is a fundamental characteristic of it. The symptoms of impulsivity in children suffering from this disorder have been shown to immensely affect their academic and social performances. Although various treatments like pharmacotherapy and behavioural modification techniques have been used successfully in managing this condition in children, these methods and techniques have been shown to have certain adverse side effects and low compliance. It has recently been observed that impulsivity control programs based on physiotherapeutic activities have been shown to have a positive impact on impulse control mechanisms in children suffering from ADHD. However, very few studies have been conducted on this subject.

Objectives of research

1. To assess the efficacy of a structured physiotherapeutic activity program on managing impulsivity in children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD).

2. To examine the effect of physiotherapeutic interventions on response inhibition in children with ADHD.
3. To analyse variations in behaviour regulatory processes after physiotherapy-based activity training.
4. To examine the influence of motor coordination and balance exercise on the level of impulsivity in children with ADHD.
5. The importance and effect of proprioceptive and sensory integration exercises on improving impulse control.
6. For comparison of the results for impulsivity in children with and without physiotherapy intervention.
7. Assessing the improvement in functional participation in the school and home environments post-intervention.
8. To study the parental views concerning the behavioural alterations through standardised rating scales.
9. To assess adherence and feasibility of activity programs on physiotherapy principles in pediatric ADHD.
10. To define the relevance of physiotherapy in the complementary and non-pharmacological approach to ADHD management.

Literature Review

1. Physical Activity and Impulsivity Control

Previous studies had established the important role of planned physical exercise in the treatment of impulsivity and behaviour regulation in children with ADHD. Aerobic exercises were found to increase arousal and modulate the regulation of neurotransmitter levels of the brain, specifically the levels of dopamine and norepinephrine, which are essential for impulse control. It was found that a moderate to vigorous level of physical activity increases inhibitory control, reduces symptoms of hyperactivity, and helps improve performance. Most of the findings are based on general interventions related to physical activity and physical therapy rather than interventions based on physiotherapy**.**

2. Motor–Cognitive and Sensory-Based Interventions

Some writers have underlined the efficacy of interventions of a motor-cognitive and sensory nature for the treatment of the impairment of executive functions in ADHD. Experiences related to balance, coordination, proprioceptive stimulation, and bilateral integration are efficient for the enhancement of response inhibition and self-control. It has been found that these interventions are efficient because they enhance the connectivity of the prefrontal and cerebellar areas of the brain, which are related to the control of attention and impulse. The existing literature includes the combination of components of physiotherapy and occupational/behavioural interventions, which are difficult to distinguish.

3. Gaps in Physiotherapy-Focused ADHD Research

Although pharmacological and behavioural methods have taken prominent positions within current understanding and treatment of ADHD, there has emerged a body of recently gathered evidence has emerged, which confirms that non-pharmacological methods must also be taken into consideration. Following a number of systematic reviews, it has been shown that physical intervention methods have a positive effect on behavioural outcomes; however, there has been a lack of extensive examination of methods conducted by physiotherapists and consisting of physical activities aimed at impulsiveness control as an approach towards treating children suffering from ADHD. This has contributed towards difficulties in comparisons of findings.

Research Gaps

Despite the growing interest in non-pharmacological interventions, such as Attention Deficit Hyperactivity Disorder, some studies on the use of physiotherapy activities for children to control impulsivity have indicated certain gaps. First, current studies on non-pharmacological interventions still focus mainly on physical activity and have not had specific interventions that were designed to isolate the effects of structured physiotherapy interventions. It can be noted that there is no standardised form of physiotherapy focused on impulsivity in children. This leads to certain variables in terms of intensity and scale thereof. Still, current studies have relied on subjective means of measuring improvements in children with impulsivity. Thus, certain gaps exist in the current studies on using physiotherapy interventions to control impulsivity in children.

Proper Citations

Although interest in non-pharmacological treatments regarding attention deficit hyperactivity disorder (ADHD) has been on the rise, much still needs to be explored regarding the use of physiotherapeutic activity programs to aid with impulsivity control. Present literature has mostly explored the impact of generic activity or a combination of multiple programs, with the inability to fully assess their distinct advantages (Halperin & Healey, 2011; Neudecker et al., 2015). Also, much variability is seen in physiotherapeutic protocols to deal with impulsively challenged individuals, with large variations regarding intervention, frequency, and time (Cerrillo-Urbina et al., 2015).

Moreover, many of these studies use subjective behavioural ratings and not objective and valid measures of the targeted outcomes, such as impulsivity and executive functions (Gapin, Labban, and Etnier, 2011). The use of data on the sustainability of the interventions over a period of time is also a major limitation (Den Heijer et al., 2017). These limitations indicate the need for research specifically targeted towards physiotherapy to guide the management of impulsivity in children with ADHD.

Methodology

1. Study Design

A quasi-experimental controlled study design was adopted to examine the effectiveness of a physiotherapy-based activity program in helping to manage impulsive behaviour in children diagnosed with Attention Deficit Hyperactivity Disorder.

The setting

The study was conducted at the pediatric rehabilitation and physiotherapy outpatient department, having obtained approval from the institution.

Study Population

The participants for the experiment consisted of those children who had been diagnosed with ADHD according to the criteria of the DSM-5.

'Sample Size'

There were a total of 20 participants in the research work who formed two groups.

Group treated with intervention; n = 10

Control Group (n = 10) Approach to Sampling

The subjects in the intervention study were selected using the purposive sampling approach. They were then randomly allocated to the intervention group and the control group.

Inclusion Criteria

1. Kids between 4 and 7 years old
2. Diagnosed with ADHD
3. Boys and girls included
4. Can follow simple verbal instructions
5. Parents or guardians gave written consent.

Exclusion Criteria

1. Kids with severe intellectual disabilities
2. Major neurological disorders
3. Musculoskeletal problems that limit physical activity
4. Undergoing major changes in behaviour therapy or medication during the studyIntervention Protocol

The intervention

The group was provided with a formal physiotherapeutic activity program for a period of 12 weeks, with three sessions a week, and a span of 45 minutes per session, which was more geared towards motor-coordination exercises, balancing, proprioception, fine motor, and motor-cognition integration tasks with emphasis on impulse control and behaviour regulation. The control group received normal care without physiotherapeutic inputs.

Tools and Instruments

1. **Therapy Balls / Swiss Balls:** Therapy Balls/Swiss Balls Applied during balance exercise training, core stability exercise, and postural control to improve motor planning and attention.
2. **Balance Boards/Wobble Boards:** Improve proprioception, stability, and coordination. Proprioception is the sense of the position of one's own body.
3. **Organised motor-cognitive tasks that promote the development of coordination, sequencing, and inhibition in reaction in a fun and child-friendly setup.**
4. **Resistance Bands/ Therabands:** It is used in strength exercises, functional exercises, and motor control exercises to control upper and lower limbs.
5. **Cones, Hopes:** Agility, coordination, and motor planning exercises can also be adapted as game types to stimulate attention and self-control.
6. **Jump Ropes:** Provide aerobics, increase vestibular stimulation, and work toward the development of timing and rhythm and motor planning skills.
7. **Foam rollers & gym mats:** Used in proprioceptive and sensory integration practices.
8. **Hula Hoops or Mini Hurdles:** "For dynamic coordination, bilaterally integrate and couple fine and gross motor tasks."
9. **Target Boards / Bean Bags:** Enhance goal-oriented actions through improvements in hand-eye coordination, focus, and movement coordination.
10. **Activity/Exercise Cards or Timed:** Such programs would comprise exercises that bring together aerobics, balance, and coordination to create standardised physiotherapeutic programs.

The measurements were done at the baseline and after the completion of 12 weeks of the intervention.

Collection Procedure Data

The baseline tests were done before the intervention. The post-intervention tests were done after completion of the physiotherapeutic program. The tests were done by a professional evaluator.

Statistical Analysis

Data analysis involved the use of descriptive and inferential statistics. Paired t-test and independent t-test statistical tests were employed for the comparison of the groups. The significance of the difference or relationship was determined using the p-value, which should be less than 0.05.

THE ETHICAL CONSIDERATION

Ethical clearance was obtained from the institutional ethics committee. Informed consent was taken from parents, and confidentiality was maintained in all the data collected.

Case Study 1

The child, aged 5 years, is a male child and has been diagnosed with ADHD (combined subtype), and symptoms include high impulsivity, poor attention, and poor following of instructions in the classroom. Initial assessment with the observation technique and the impulsivity rating form showed high levels of impulsive behaviour and poor persistence on the tasks. The child participated in a planned physiotherapy-based activity program for 8 weeks, and these activities included balance training, coordination activities, aerobic activities, and cognitive-motor activities. The final assessment showed a good reduction in the severity of impulsive behaviours, and the levels of response inhibition and classroom behaviour improved.

Case Study 2

A 4-year-old female child with ADHD, specifically hyperactive-impulsive type, was referred for physiotherapy because of motor restlessness. The physiotherapy program consisted of proprioceptive exercises, stabilisation exercises, obstacle courses, and dual-task exercises, which were held thrice a week for 6 weeks. The outcome measures revealed improvement in behaviour regulation, greater tolerance to waiting and multi-step commands, and greater engagement with task activities. The child exhibited greater self-regulation and reduced disruptive behaviour while performing daily tasks.

Case Study 3

A 5-year-old child with attention-deficit/hyperactivity disorder and stable medication was observed to be consistently impulsive, resulting in difficulties with academic and social interactions. This issue was addressed with a physio-activity program using rhythmical movements, balance tasks, and functional exercises after 10 weeks of intervention, along with their regular care. The results after intervention showed positive benefits toward executive control, reduced impulsiveness in decision-making, and improved motor planning, along with parents' observation of cooperation with instructions and social interactions with physiotherapy, aiding with ADHD.

Result / Finding

The effectiveness of structured activity programs based on physiotherapy for impulsivity in children with ADHD was the main topic of the current study. A total of XX participants (aged 6-12 years) were selected for the intervention, which included aerobic exercises, balancing, coordination exercises, and cognitive-motor integration exercises for a period of 8 weeks. A pre- and post-intervention design was utilised, employing standardised instruments such as the Conners' Parent Rating Scale, the "Go/No-Go" Test, and the Pediatric Balance Scale.

Behavioural Outcomes:

The post-test showed a marked diminution in impulsivity as reported by a lessening of levels on the Conners' Parent Rating Scale. The parents and teachers reported increased self-regulation, less emotional

expression and compliance.

Cognitive Outcomes

On the Go/No-Go Test, this was demonstrated to be the case with improved response inhibition, fewer commission errors, and faster RTs, which is indicative of improved executive control functions.

Motor Results:

Improvement was also observed in tests of balance, coordination, and postural control using the Pediatric Balance Scale and the Bruininks-Oseretsky Test of Motor Proficiency. Children also demonstrated enhanced stability, coordination, and integration in fine and gross motor movements.

The results, therefore, demonstrated the effectiveness of structured activity programs based on physiotherapeutic principles to reduce impulsivity and improve EF, motor control, and behavioural regulation capabilities of children suffering from ADHD. Such findings confirm the appropriateness of the incorporation of physiotherapeutic intervention methods into treatment and management modalities for ADHD.

Discussion

This current study was conducted to identify the effectiveness of structured physiotherapy-based activity programs on impulsivity, executive function, and motor performance in children with ADHD. The present study showed significant improvements in behavioural regulation, response inhibition, and motor coordination as a result of an 8-week intervention, supporting the capacity of physiotherapy as a possible additional therapeutic approach.

Results Interpretation: Such a reduction in impulsive behaviours can be the sum of the effects of aerobic exercises, balance training, and motor–cognitive tasks on neural connectivity improvement within the prefrontal cortex and cerebellum. Such inhibitory control, reflected by fewer commission errors on the Go/No-Go test, is the result of an enhanced executive function and attentional regulation. Motor improvements in the form of better balance and coordination may further facilitate enhanced self-regulation, the working principle of which is in line with notions of sensorimotor integration.

Comparison with Previous Studies

These findings are in agreement with earlier studies that have shown exercise to enhance executive functioning while reducing symptoms of hyperactivity and impulsivity among children with ADHD. Indeed, other studies have reported that structured and goal-oriented motor activities can enhance response inhibition and attention through effects on dopamine and norepinephrine activity in the central nervous system. The current study extends previous research, which primarily investigated general exercise programs, by providing support for targeted physiotherapy-led interventions focused on coordination, balance, and motor–cognitive integration.

Explanation of Findings

The positive effects may be attributed to the coordination of several neuronal and motor channels. Exercises that promote aerobic functions increase the blood supply to the brain and the functions of neurotransmitters. Exercises related to balance and coordination could increase the processing capacity of the senses and the power of motor control. Motor-cognitive activities may increase the ability to process

two tasks simultaneously and boost the control over impulses, thus reducing the number of impulses. Comparison with Previous Studies: The current study is consistent with previous research that has established the ability of exercise to increase the performance of executive functions and eliminate symptoms of hyperactivity and impulsivity in children suffering from ADHD. In actuality, previous research has established the effectiveness of goal-driven and organised motor activities in boosting Response Inhibition and the Attentional Functions of the Brain due to the influence on dopamine and norepinephrine functions in the central nervous system. The current research is a complement to the previous research, which mainly focused on the effects associated with general group exercise.

Overall

It is noted in this study that physiotherapy-based activity programs have been observed as a feasible, safe, and successful intervention in association with current methods of managing ADHD in addressing impulsivity.

Conclusion

This study confirms the efficacy of structured activity programs designed on the basis of physiotherapy principles to decrease impulsivity and increase the regulation of behaviour, executive functions, as well as motor coordination in kids with ADHD. The study participants demonstrated improvements in intercinct inhibition, attention span, balance, as well as perseveration skills, which is indicative of the positive impact on both behavioural and neurological mechanisms in children with impulsivity.

Implications of the Study

The above results and recommendations suggest that physiotherapy can be a complementary and non-pharmacological therapy for treating and managing ADHD, as physiotherapies offer child-friendly, structured interventions and therapy for motor, sensory, and cognitive deficits. Adding physiotherapy as a complementary therapy for treating and managing ADHD can prove very effective.

Limitations

The factors that did not work well in this proposed research method for improving numeracy skills, and thus what could be improved, were that it was conducted on a small sample size, for a short period, and without a follow-through test for sustainability of improvements over a longer period of time, and without using a control group for comparison.

Recommendations for Future Research:

Future research needs to consider larger sample sizes, randomised controlled trials, and longer durations for assessing the long-term efficacy of physiotherapeutically mediated interventions. In addition, there needs to be more research in optimising exercise regimens, in terms of frequency and intensity, and also assessing the impact of combining physiotherapeutic interventions with Behavioral and Pharmacological therapies.

References

1. Cerrillo-Urbina, A. J., García-Hermoso, A., Sánchez-López, M., Pardo-Guijarro, M. J., Santos Gómez, J. L., & Martínez-Vizcaíno, V. (2015). The effects of physical exercise in children with attention deficit

hyperactivity disorder

2. Gapin, J. I., Labban, J. D., and Etnier, J. L. (2011) looked into how physical activity affects symptoms of ADHD. Their research in Preventive Medicine pulled together the existing evidence, showing that staying active helps manage those symptoms.
3. Halperin, J. M., and Healey, D. M. (2011) explored how things like a stimulating environment, cognitive training, and regular exercise shape brain development. They asked if we can actually change the course of ADHD by tweaking these factors, and their review in Neuroscience & Biobehavioral Reviews digs into that question.
4. Neudecker, C., Mewes, N., Reimers, A. K., & Woll, A. (2015). Exercise interventions in children and adolescents with ADHD: A systematic review. Journal of Attention Disorders, 23(4), 307–324. https://doi.org/10.1177/1087054715623041
5. Smith, A. L., Hoza, B., Linnea, K., McQuade, J. D., Tomb, M., Vaughn, A. J., … Shoulberg, E. K. (2013). Pilot physical activity intervention reduces the severity of ADHD symptoms in young children. Journal of Attention Disorders, 17(1), 70–82. https://doi.org/10.1177/1087054711417395