



## Behavioural response to exercise in children with attention deficit hyperactivity disorder

TN Suresh<sup>1\*</sup>, K Puja Suraj<sup>2</sup>

<sup>1</sup> Vice Principal, SRM College of Physiotherapy, SRM Institution of Science and Technology, Kattankulathur, Tamil Nadu, India

<sup>2</sup> Students, SRM College of Physiotherapy, SRM Institution of Science and Technology, Kattankulathur, Tamil Nadu, India

### Abstract

**Background:** Attention deficit hyperactivity disorder (ADHD) is the most common childhood behavior disorder characterized by three behavior namely inattention, impulsivity and hyperactivity. The influence of exercise on behavior is one of the alternative treatment and also examined on behavior of children which is generally and specially in individuals with behavioral disabilities such as attention deficit hyperactivity disorder (ADHD).

**Objective:** To find the effect of exercise programme on the behaviour of children with attention deficit hyperactivity disorder.

**Study Design:** Quasi experimental.

**Procedure:** 20 subjects were selected based on inclusion and exclusion criteria and divided into 2 groups, Group A - experimental group and Group B - control group. Each group consist of 10 subjects. And group A has followed the warm up phase, exercise phase and relaxation phase. And there was no intervention for group B. Before the commencement of exercise program a children and their parents/guardian WAS attended an information session and parents are told how to complete a Conners Parent Rating Scale.

**Result:** There is no statistical significant changes in the behaviour of both the exercise and control group after the completion of the exercise programme there by ( $p= 0.01$ ).

**Conclusion:** The behavior of the children with attention deficit hyperactivity ADHD in the study has improved clinically over the 5 weeks exercise programme and there are no statistical significant changes in both the exercise group and control group.

**Keywords:** behavior disorder, ADHD (Attention Deficit Hyperactive Disorder)

### Introduction

Attention deficit hyperactivity disorder ADHD is the most common childhood behavioral disorder characterized by problems with

- Inattention
- Hyperactivity
- Impulsivity

Attention deficit hyperactivity disorder (ADHD) is a neurological disorder that develops during childhood. The Attention deficit of ADHD means inattention or difficulty in focusing for long duration and easily distracted. The Hyperactivity of ADHD refers to the constant motion of a individuals. The Impulsivity of ADHD refers to there thinking before they act [1, 2, 3].

When the hyperactivity and impulsivity are combined then the children appears to act without thinking. The symptoms of inattention may be have difficulty in focusing on one thing, become bored with a task after only a few minutes, unless they are doing something enjoyable, have difficulty focusing attention on organizing and completing a task or learning something new, not seem to listen when speaking with them, day dream become easily confused, and moves slowly, have difficulty processing information as quickly and accurately as others. The symptoms of hyperactivity may be fidget and squirm in their seats talk nonstop, dash around, touching and playing with anything and everything in his sight, have trouble

in sitting during dinner, school and story time, be constantly in motion. The symptoms of impulsivity may be very impatient, blurt out inappropriate comments, show their emotions without restraint and act without regard consequence, have difficulty waiting for things they want or waiting their turns in games, often interrupt conversations or other activities. Disorder is especially difficult to diagnose objectively because the clinical manifestations of the disorder are likely to be modified by the age and gender of the client ADHD is also difficult to identify because children with disorder may not exhibit attention deficits and may behave relatively normally in situation that are highly motivating them.

Children with ADHD have cognitive deficits that impair social learning and affect the child innate ability to mediate behaviour. Many children with ADHD have secondary psychosocial diagnosis. Secondary labels like conduct disorder or overanxious disorder may result as the child attempts to compensate for hyperactivity and limited ability to attend Despite being the most commonly studied and diagnosed psychiatric disorder in Children, the cause in the majority of cases is unknown. over the children with ADHD have the disciplinary problems. The most common treatment method used is the medication such as methylphenidate (Ritalin) [4]. And 90% of child with attention deficit hyperactivity disorder (ADHD) population in the USA use this medication and 20% of the child with attention deficit hyperactivity disorder (ADHD) have experienced the side

effects like insomnia, decreased appetite, weight loss, headache, increased crying, and any mood disturbance [4, 5, 6]. So because of these adverse side effects there is need for the alternative beneficial treatment. Participation in exercise can have a psychological benefits like improvement in mood, anxiety, depression [4, 7, 8, 11]. The influence of exercise on behavior is one of the alternative beneficial that also examined by rating on the behavior children which is generally and specially in individuals with behavioral disabilities such as attention deficit hyperactivity disorder (ADHD). The exercise may be beneficial for the children with attention deficit hyperactivity disorder (ADHD). The influence of exercise may influences hypothalamic pituitary adrenal axis function. The effect of exercise may influence on the behaviour of Children with ADHD and may have the alternation in their behaviour. Then the anecdotal reports also saying that exercise is also benefit to children with ADHD so by implementing valid behavioural measures there can be a minimal effect on behaviour by the exercise. The influence of exercise increase when attention is paid by the parent to their children on examine the rating of their behaviour and also during the duration of the study.

**Methodology**

Study design : Quasi Experimental  
 Study type : Pre test and Post test  
 Subject Sampling : 20 children  
 Study duration : 3 weeks  
 Study setting : 1. Maithree, Tambaram  
 2. SRM Medical college Hospital and Research center, Kattankulathur

**Procedure**

20 subjects were conveniently selected based on inclusion and exclusion criteria and randomly divided in to two groups. Group - A and Group - B. Each group consist of 10 samples. Plyometric exercises given to Group - A, and Group - B free from exercises. Demographic data was collected. Rating was taken by using Conner’s Parent Rating Scale before intervention. Subjects have to follow a set of exercise protocol for 3 weeks. Before to the commencement of exercise program a children and their parents/guardian should attend aninformation session. During information session the parents are taught to complete a Conner’s Parent Rating Scale. Group A - Experimental group is calculated by the Conner’s Parent

**Exercise protocol**

Rating Scale and pre test is taken before the commencement of exercise program After pre test the exercise were taught to group A subjects with respective rest period of 3 weeks.

**Exercise duration**

Each session is divided into -15 min warm up phase -30 min exercise phase -15 min relaxation phase

**Mode of Exercise**

**Warm up phase**

In warm up phase stretching is performed as a warm up for the children Warm up which is for the elasticity and extensibility of muscle fibres. And the steps followed during stretching are taking deep breath, exhaling and bending in certain angles Back and hamstring and other general stretching is also performed in warm up. The subject should stand with knees bent slightly and should lean forward from the waist with arm and head hanging towards the floor and in the end it should be continued with a deep exhale a subject should sit and bend and it is done repeatedly By completing warm up phase it is proceeded with the next phase of exercise

**Exercise phase**

**Plyometrics exercise**

It is said be a form of exercise which will continue as rapid and repeated stretching and contracting of the muscles to increase strength. And it involves exercises such as jumping, skipping, hopping, bounding and running

1. **Double leg speed hop:** With both feet together extend the ankles and hip Staying on your toes hop on both feet for 10 yards Spend a little time as possible on the ground pretend your hopping through
2. **Squat jump:** Squat jump means there should be squat position by bending the knees and should Jump up, getting triple extension through the hips, knee and ankles and try to reach high as possible and should spend a little time on the ground

**Relaxation phase**

Relaxation can help to relieve the symptoms of stress Jacobson progressive relaxation technique involves contracting and relaxing the muscle to make feel calm Gently break - in - hold - and let so with exhale 15-20 min to complete this relaxation technique.

**Table 1**

| Day    | Warm Up | Exercise                        | Cool Down             |
|--------|---------|---------------------------------|-----------------------|
| DAY 1  | Stretch | Plyometric                      | Relaxation techniques |
| DAY 2  | Stretch | Plyometric                      | Relaxation techniques |
| DAY 3  | Stretch | Plyometric                      | Relaxation techniques |
| DAY 4  | Stretch | Plyometric                      | Relaxation techniques |
| DAY 5  | Stretch | Plyometric                      | Relaxation techniques |
| DAY 6  | Rest    | Rest                            | Rest                  |
| DAY 7  | Rest    | Rest                            | Rest                  |
| DAY 8  | Stretch | Plyometric, double leg hop jump | Jacobsons relaxation  |
| DAY 9  | Stretch | Plyometric, double leg hop jump | Jacobsons relaxation  |
| DAY 10 | Stretch | Plyometric, double leg hop jump | Jacobsons relaxation  |

|        |         |   |                      |
|--------|---------|---|----------------------|
| DAY 11 | Stretch | Plyometric, double leg hop jump             | Jacobsons relaxation |
| DAY 12 | Stretch | Plyometric, double leg hop jump             | Jacobsons relaxation |
| DAY 13 | Rest    | Rest  | Rest                 |
| DAY 14 | Rest    | Rest  | Rest                 |
| DAY 15 | Stretch | Plyometric, double leg hop jump, squat jump | Jacobsons relaxation |
| DAY 16 | Stretch | Plyometric, double leg hop jump, squat      | Jacobsons relaxation |
| DAY 17 | Stretch | Plyometric, double leg hop jump, squat jump | Jacobsons relaxation |
| DAY 18 | Stretch | Plyometric, double leg hop jump, squat jump | Jacobsons relaxation |
| DAY 19 | Stretch | Plyometric, double leg hop jump, squat jump | Jacobsons relaxation |
| DAY 20 | Rest    | Rest  | Rest                 |
| DAY 21 | Rest    | Rest  | Rest                 |

**Group B :** The control group does not receive any intervention for period of 3 weeks After the exercise programme post test scoring was taken At last in the 3 week of exercise programme Conner’s Parent Rating Scale is rated.



**Fig 1:** warm up phase back and hamstring stretch



**Fig 2:** Relaxation phase jacobsons progressive relaxation techniques

**Behavioural rating scale**

Behavioral rating scale is for screening and assessing behavior problems by Conner’s Parent Rating Scale. And it was scored and completed before 1 week of the exercise program and immediately after the 3 week of exercise program. Rating was according to the child’s behavior

- Never – 0
- Occasionally – 1
- Quite often - 2
- very frequent - 3

**Outcome measure**

**Conner’s Parent Rating Scale**

The Conner’s Parent Rating Scale-Revised is a parent report scale appropriate for parent report with children between the ages of 5 and 13

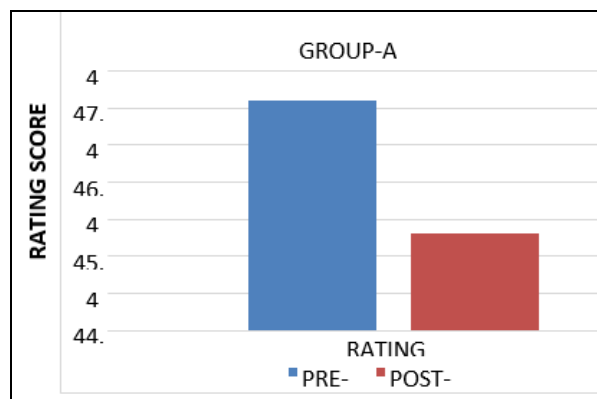
**Data analysis**

Data were analyzed by using IBM SPSS version 20.0 software. Paired t-test and student independent test was applied to assess the behaviour.

**Table 2:** Comparision of pre and post–test within group – a

| Group A | Pre Test |         | Post Test |        | t-test | Significance |
|---------|----------|---------|-----------|--------|--------|--------------|
|         | Mean     | S.D     | Mean      | S.D    |        |              |
|         | 47.6     | 7.47143 | 45.8      | 4.6619 | 0.817  | 0.43296      |

The above table reveals the mean standard deviation t-test, p value of behaviour between pre test and post test within the Group-A. The Group-A has shown a behaviour decrease in mean value from 47.6 to 45.8 between pre test and post test The table infers significant decrease in behaviour at value between pre and post test at p<0.01 level.



**Fig 3:** Comparison of pre and post–test within group - a

**Table 2:** Comparision of pre and post–test within group - b

| Group B | Pre Test |         | Post test |        | t-test  | Significance |
|---------|----------|---------|-----------|--------|---------|--------------|
|         | Mean     | SD      | Mean      | SD     |         |              |
|         | 49.6     | 5.64112 | 49        | 4.2947 | 0.30097 | 0.76965      |

The above table shows the mean standard deviation t-test, p value of behaviour between pre test and post test within the Group-B

The control group has shown a behaviour decrease in mean value from 49.6 to 49 between pre test and post test The table

shows not significant value between pre and post test of behaviour at  $p < .01$  level

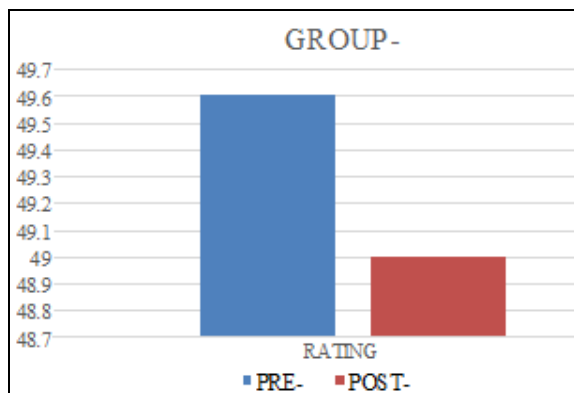


Fig 4: Comparison of pre and post–test within group - b

Table 3: Comparison of post–test values between group –a and group –b

| Group A | Post Test |        | t-test  | Significance |
|---------|-----------|--------|---------|--------------|
|         | Mean      | S.D    |         |              |
|         | 45.8      | 4.6619 | 0.817   | 0.43296      |
| Group B | Mean      | SD     | 0.30097 | 0.76965      |
|         | 49        | 4.2947 |         |              |

The above table Shows the post-test Mean, Standard Deviation of GROUP A and B for behaviour.

The post test mean values of GROUP A and B are 45.8 and 49.

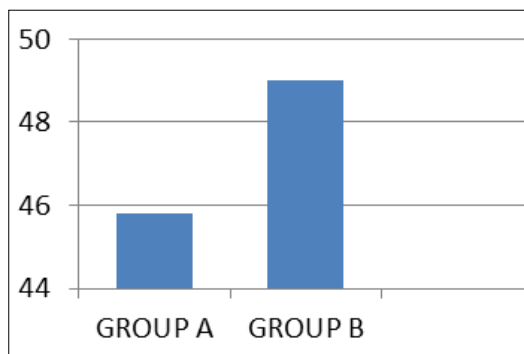


Fig 5: Comparison of post-test value between -group-a and group-b

**Result**

According to Table 1 & Fig 3 the experimental group has shown that mean value of pre test and post test of the experimental group were no significant changes in their behavior

Table 2 shows that the mean value of pre test and post test of the control group were similar to the experimental group Fig 3 shows that there were no significant changes in the behavior of children with attention deficit hyperactivity disorder with p value of ( $p < 0.01$ ) of the experimental group Fig 2 group and it is similar to the experimental group with p value ( $p < 0.01$ ) The activity scores for the control group is same as the experimental group. There were no significant differences between the experimental and control group with behavioral ratings over the 5 weeks. There were significant changes in

the behavior of both the groups when the results were combined.

**Discussion**

This study aimed to find out the effect of exercise programme on the behavior of children with attention deficit hyperactivity disorder In this study 20 subjects in the age group 5-13 years of both gender were rated by Conner’s parent rating scale for behavior of the children with attention deficit hyperactivity disorder. Out of 20 subjects 10 were in experimental group and 10 are in control group.

This study shows that there is no significant decrease in behavior of children with attention deficit hyperactivity disorder. The statistical results have shown that experimental group (10 subjects) with exercise programme showed no statistical significant in behavior of children. Control group (10 subjects) who were not given any interventions also showed no significant changes in the behavior of children. According to the statistical results the experimental group has showed mean from 47.6 – 45.8 between the pre test and post test at  $p < 0.1$  level and this not a significant result in experimental group. The control group has shown mean value from 49.6 - 49 between the pre test and post test and the result is not significant at  $p < 0.1$  level. A limited research has been performed on the effect of exercise in improving the behaviour of children with ADHD<sup>(8,9,10)</sup>. And this study examined the changes in the behaviour of children with ADHD during a 5 week exercise programme then there is no significance differences were found between the behaviour of the exercising children and those of the control group over the 5 weeks. There were significant alternation in behaviour of both the groups with regard to the exercise group and it is said that the role of exercise is influenced for the induced changes in neurotransmitters so this may be the explanation for the change in behavior. And therefore provide preliminary evidence of the potential efficacy of acute exercise in helping to manage ADHD in boys. Additionally it highlighted an important issues relating to gender differences in ADHD symptomatology that may influence the therapeutic benefits of exercise on ADHD behavior. Lou HC, Henriksen L, Bruhn P, brain neurotransmitter pathways have been shown to contribute to the behavioral and neuropsychological features of ADHD Steptoe A, Cox S, exercise has been shown to alter neurotransmitter levels in the blood It has therefore hypothesized that exercise may also facilitate the efficient use of neurotransmitter in the brain neural circuit thereby improving the behavior of children with ADHD. Wendt MS the effect of an activity exercise on the behavior of ADHD children Etscheidt MA, Ayllo T. Contingent exercise to decrease hyperactivity. Tantillo *et al*, in the study the major weakness of the previous studies were addressed. The authors used clinically diagnosed ADHD children, quantified the exercise dose implemented valid behavioral measures related to aetiological mechanism of ADHD that might explain the effect of exercise.

**Conclusion**

The study was concluded that the experimental group with exercise program showed no statistical significant in behavior. Control group who were not given any interventions showed

no statistical significant between pre-test and post test But there is a similar changes in the behavior of the children in both the groups

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