



IMPACT OF ENDURANCE TRAINING ON COGNITIVE DEVELOPMENT IN PRIMARY SCHOOL CHILDREN

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ABSTRACT

Inactivity in children not only results in poor physical health but also results in poor cognitive function further it has a negative impact on the academic performance of the students. Structured Physical activity has created a positive change in the cognitive and physical well-being of individuals. The purpose of this study is to identify the effect of endurance training on cognitive development among primary school children. An experimental study was designed with ninety school children. Predefined selection criteria are used to identify the children who need endurance training After obtaining consent from the samples, parents and school authorities they were divided into two groups randomly. Group I, underwent 60 minutes of endurance training 5 days a week for six weeks. Group II, underwent 60 minutes of non-competitive physical activity 5 days a week for six weeks. The mindful attention awareness scale (MASS) questionnaire was used as an outcome measure for testing their cognitive skills. This questionnaire was used to collect the data on the first day and at the end of the training program. The SPSS statistical package 22.0 was used to scrutinize the collected information. The results identified that a significance of 33.31 ± 11.89 for children who underwent endurance training and those who were involved in non-competitive physical activity is 16.69 ± 6.96 with a p-value is 0.0001. This study concludes that both the endurance training and non-competitive physical activity program help to improve cognition. Whereas when comparing both the groups values the group which underwent endurance training has shown significant improvement in cognitive skills than the other group.

KEYWORDS: Endurance training, cognitive function, MASS, physical activity.

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Introduction

Cognition or cognitive function refers to multiple mental abilities which include, attention, thinking, learning, reasoning, problem-solving, decision making¹. There are multiple studies revealing the development of cognitive function were conducted among school children all over the world over the last 25 years.

Cognitive function serves a critical role in obtaining academic achievement which is considered as an important social role in the growing age. The cognitive functions enhance periodically during the lifetime². Cognitive ability in school children is reflected on the success they achieve in their academic performances³.

Children who are inactive, experience both physical and cognitive declination⁴. There are various related studies suggest that a strong linkage is identified between health and mental function⁵. Reduced cognitive function, tasks involving attention, perception, memory, and cognitive control, and lower academic performance are all associated with children who are physically inactive^{6,7}. Physical activity produces structural changes in the brain, there is a notable change in the volume of the brain, white matter integrity, and modulation in neurotrophin levels. These would enhance a cognitive improvement⁸.

Many previous works of literature related to endurance training prove that children with higher cognition have significant academic achievements^{9,10}. Reduced cognitive abilities makes individuals to find it

difficult in performing basic daily activities which includes academic performance also¹¹. Further studies are revealed that the unique qualities of fundamental cognitive processes are closely related to academic accomplishment¹². In addition to information processing speed, visuospatial working memory, number sense and higher-order cognitive skills such as fluid intelligence are crucial¹³.

There are emerging shreds of evidence reporting that a strong association between physical activity, cognition and brain functions exists¹⁴. Physical activity has an influence on brain structures and also on brain functions, it appears to be robust in elders and there is a progressive decline in cognitive functions¹⁵. The average fitness training improves cognitive performance^{16,17}.

Exercises promote enhancement in cognitive functions. It has been identified that exercises like yoga and aerobics have contributed towards improving cognitive function¹⁸, whereas studies revealing the effect of endurance exercise on cognition among schoolchildren were not tested recently¹⁹. Exercise can improve cognitive function by increasing vascularisation, energy metabolism, and oxidative stress resistance²⁰.

The mindful attention awareness scale (MAAS) scale is a reliable scale to measure the awareness in attention which is the main parameter for various cognitive functions. The MAAS measures tap into awareness related to self-control and various aspects of wellness²¹. This is a 15-item scale which evaluates open or receptive awareness and attention to



enhance recognition of environment. The MAAS gauges a person's propensity for mindfulness or mindlessness. The scores have a significant positive relationship with self-consciousness, rumination, and self-reflection which is the important skills needed for achievement of daily tasks.

Although there are studies revealing major role of a positive impact of physical activity on cognitive function but there are no studies which portraits the role of endurance exercise in the improvement of cognition in school children. So, this study aims to identify the effect of endurance training on cognitive function among primary school children.

Methods:

This is an experimental study was conducted on primary school children. Ninety children were selected as samples for the study from various schools in and around Komarapalayam, Namakkal district. The study was approved by the Institutional ethical committee. Once ethical approval was obtained, the schools' administrators were approached by the researcher. The principal and the management of the school were first briefed about the study. Class students from third grade to seventh grade were selected as sample for the study who are securing below 50% marks were selected as a sample for the study. The parents of the students were met personally with the student's class teacher and the purpose of the study was explained to them. Those parents who gave their consent to interest

were selected as sample for the study. Written consent was obtained from every parent before the beginning of the study.

Children who are included in the study are based on predefined selection criteria such as a) the student who were attending regular class for the past two years, b) students who are not affected with any congenital, developmental problems including cardiac, or neurological c) age group of the children were from 7 to 11 years d) both gender e) Those who are not involved in active sports f) who come under normal BMI g) who accept to attend the physical activity schedule sessions. All the students were selected randomly and allocated into two groups. A computer-generated randomized table of numbers was used to create the groups. Group I, had forty-five students involved in endurance training for thirty minutes. Group II, forty-five students who were involved in non-competitive physical activity for thirty minutes. Both groups received Endurance training for six weeks, with five days a week and one session per day.

The mindful attention awareness scale (MAAS), was used to measure the cognitive functions. It has 15 items which help to identify the mental health of children. SPSS 21.0 version was used to evaluate the data collected from the students. The sample size was calculated from Cohen's table using $\alpha = 0.05$, Endurance =85%, and effect size =0.85. To assess the gathered data, a parametric test was utilized. The demographic variables that were employed in the study



were examined using descriptive statistics. The p-value for all the values was 0.05, indicating a clear difference between the pre-test and post-test results which is highly significant.

RESULTS AND DISCUSSION

Results were analyzed using a parametric test by SPSS version 20.0.

Within-group analysis and between-group analysis of MASS was conducted and found a significant difference between the activity. Table I shows the demographical data of the participants. Table II shows the within-group analysis of the school children and Table III shows the between-group analysis.

Table I Demographic Data

Variables	Mean	S. D	No of children
Age	8.53	1.424	90
Height	102.04	9.74	90
Weight	35.28	5.5	90
Duration of Physical activity			
< 30 mins	8.28	1.29	53
30-1 hr	8.73	1.58	22
> 1 hr	9.13	1.51	15
Sleeping Hours			
7--8 hours	7.32	0.48	19
9--10 hours	9.12	1.05	33
> 10 hours	8.63	1.65	38
Watching TV			
< 30 min	7.73	1.28	26
30 mis to 1 hour	8.93	0.91	30
1 hour to 2 hours	8.79	1.67	34
> 2 hours			
Watching Mobile/ Tablet			
< 30 min	7.1	0.32	10
30 mis to 1 hour	8.9	0.9	29
1 hour to 2 hours	9.08	1.67	26
> 2 hours	8.12	1.45	25

Table 1 show that demographical data of BMI, duration of physical activity, sleeping hours, watching TV and electronic gadgets.



Table II
MASS analysis within groups

Study Groups	Pre test Mean (SD)	Post test Mean (SD)	Mean difference	t value	p value
Group A	51.58 ± 3.12	74.33 ± 3.85	22.75	33.31 ± 11.89	0.0001
Group B	51.91 ± 3.34	63.60 ± 4.24	11.96	16.69 ± 6.96	0.0001

The within-group analysis of the MASS from Group A shows an improvement in cognitive skill of 33.31. with a p-value of 0.001. Group B shows improvement with t value of 16.69 with a p-value of 0.001, Statistically, both the activities were equally effective in both the groups, for enhancing cognition.

Table III
Mass analysis between groups

Study Groups	Group A Mean (SD)	Group B Mean (SD)	Mean difference	t value	p value
MMST	74.33 ± 3.85	63.60 ± 4.24	10.73	12.57 ± 6.70	0.0001

The between-group analysis of the pain and the range of motion analysis from Group A & Group B are shown in table III. On the analysis, it was statistically demonstrated that the MASS values improved significantly in Group A when compared with Group B. This shows that the endurance training shows marked improvement in the cognition.

Discussion

This study aims to identify the effect of endurance training on cognitive development in primary school children. Physical activity referred to the movements of the body. Children need to do a lot of activities without schedules. It develops self-esteem, fitness and confidence in children²². Physical activity promotes cognitive function through its effect on improving fitness and thereby improves cerebral functions²³.

Physical activity plays a significant role in improving their fitness physically

aids in controlling the various psychological symptoms and which in turn reduces the risk of developing multiple health issues. Studies have identified that age appropriate physical activity in children between the ages of 7 to 11 years show a positive effect on cognitive flexibility and working memory.

In this study both male and female children were assessed. specific care was given to female children to avoid socio-ethical problems. In male children parents are more co-operative than the female children. Various pieces of evidence suggest that an increase in physical activity and physical fitness improve academic performance²⁴. Studies reveal that physical activity improves brain function and also improves cognition in students²⁵.

Exercise increases cerebral blood flow, changes in brain neurotransmitters, central nervous system modifications, and



altered arousal levels. Studies carried out by Etnier and his group in 1997 revealed that exercise enhances cognition²⁶. Endurance exercises are done at a moderate to vigorous intensity to promote the child's effortful and goal-directed cognition and behavior²⁷. Long-term memory function has been shown to improve as a result of the beneficial effects of endurance training²⁸. According to Hötting and Röder 2013, exercise may have a greater impact on cognitive processes that are undergoing developmental changes^{29,30}.

The statistical analysis for this study reveals, that there is a marked difference between the groups. There was a notable significance in the endurance training group when compared with non-competitive physical activity. There are certain limitations in this study which include, the oxygen consumption during the exercises is not monitored, at times there were changes in the attendance in the daily schedule due to illness. Children were down with cough and fever during the study, so variations in the performance are noticed during the study period.

CONCLUSION

Physical activity which improves endurance, play a significant role in improving cognition in primary school children, when comparing those children who were engaged in endurance training were highly significant. This study concludes that the children who were engaged in endurance related physical

activity enhancing showed better in mass score than those children who were engaged in non-competitive physical activity

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