

Effectiveness of School Based Physical Activity on Overweight Children - Prospective Cross Sectional Study Design

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Abstract: Background: Overweight/obesity are worrying factors because of inactive lifestyle and poor eating habits. Worldwide prevalence of obesity in children has increased in past few years. School based settings are an attractive point for childhood obesity and overweight prevention as well as treatment, where decisions regarding physical activity, choice of the food, attendance can be reasonably controlled. Objectives: To study the effectiveness of School Based Physical Activity on body mass, central adiposity and physical fitness in overweight school going children in terms of Body Mass Index, Waist Circumference and Incremental Shuttle Walk Test respectively. Methodology: A total of 30 overweight school going children were included. Pre assessment was done in terms of Body Mass Index (BMI), Waist circumference (WC), Incremental Shuttle Walk Test (ISWT). School Based Physical Activity were given in the form of traditional School Physical Activity, Running, Long Jumping and Trampoline jumping. These exercises were given for 60 min/day, 5 days per week continuously for 8 weeks. Post intervention re-assessment was done and pre-post data was compared. Results: Significant difference in pre and post measurements was seen in all the three components. Pre and post mean for BMI was 22.65 and 22.03, mean for WC was 31.80 and 30.86 and mean for ISWT was 119.44 and 134.72 respectively with p value<0.0001. Conclusion: School Based Physical Activity given for 5 days continuously in a week for 8 weeks was effective in reducing body mass, abdominal adiposity and increase physical fitness in overweight children.

Keywords: Childhood overweight, School Based Physical Activity, BMI, WC, ISWT

Abbreviations: BMI: Body Mass Index, WC: Waist Circumference, ISWT: Incremental Shuttle Walk Test

1. Introduction

Overweight/obesity is common condition which results due to chronic caloric imbalance which means more calories are being consumed than the total expenditure of calories.¹ Major factors which play important role in obesity include, hereditary factors, metabolism, cultural and socioeconomic status.¹ Even various genetic, behavioral and environmental factors play a significant role in its pathogenesis.² Genes are considered to be responsible for about 25 to 40% of obesity cases, while rest of the percentage of obesity is determined to a large extent by environmental factors. Since both genetic as well as the environmental factors play important role in the installation of obesity, It is difficult to be supported by only one factor.³

On the basis of previous research, the United States Centers for Disease Control and Prevention reports state that the hazardous effects of childhood overweight/obesity are both short term and long term. More specifically, overweight/obese children and adolescents are more prone to have risk factors for cardiovascular diseases. Children who are overweight/obese have also been shown to be at an increased risk for joints and bone dysfunctions, sleep apnea, social and psychological issues such as stigmatization and poor self-esteem.⁴

In case of Pediatric age group, BMI-for-age percentile curves which are gender specific are used to define underweight, normal weight, overweight and obese.

Children and adolescents whose BMI is less than 5th percentile are considered as underweight, BMI between 5th percentile to 85th percentile comes under normal weight category, BMI more than 85th percentile but less than 95th percentile for that specific age and gender are considered to be overweight and those with a BMI greater than 95th percentile are considered as obese. Children and adolescents with BMI more than 99th percentile are termed as severely obese.⁵

Waist circumference (WC) is another one of the anthropometric tool used for the measurement of overweight/obesity. It is measured at a level midway between the lowest rib and the superior iliac crest. The measurements are carried out at the end of a normal expiration while the subject stood upright with feet together and arms hanging freely at the sides.⁶

Relationship between physical activity and development of overweight/obesity is inversely proportional and so physical exercises are considered as basic tool in the prevention as well as management of obesity and overweight thus improve the physical fitness.⁷

Physical fitness of a person is objectively measured by various tests, out of those, widely used is the Incremental Shuttle Walk Test (ISWT) which was developed by Singh and colleagues, based on a shuttle run test of 20 meter primarily described by Leger and Lambert to measure disability in patients with COPD. It has been used to assess

exercise capacity in the pulmonary rehabilitation settings for patients with COPD as well as for the patients with other conditions, like cardiac diseases, cancer, obesity, peripheral arterial diseases, critical illness, pulmonary hypertension etc.⁸One of the greatest advantages of the ISWT is its simplicity and its inexpensive nature. The Incremental Shuttle Walk Distance (ISWD) is generally used as an index of cardio respiratory fitness and has been suggested as a prognostic indicator in patients with chronic diseases.⁹

So given that non-physically active children are more likely to become non-physically active adults, it has been proposed that encouraging the development of physical activity habits in children and reinforcing these habits in adolescents, help establish patterns that continue into adulthood.¹⁰

2. Materials and Methods

Participants: 32 school going overweight children were selected for the study. Children were screened according to the selection criteria. Children between the age group of 10 years to 14 years who were healthy, children who were overweight assessed on the basis of BMI and children who were willing to participate were selected for the study. Whereas children with any known case of cardiorespiratory dysfunction, any musculoskeletal deformity or recent fracture, neurological impairment and children who are physically active (e.g. attending daily karate or swimming sessions) were excluded from the study. 2 children were excluded as one of them had recent fracture and other was attending regular karate classes. Hence 30 healthy overweight children were recruited for the study. The study received ethical approval from the Institutional Ethical Committee (IEC) of Dr. A. P. J Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences. All the children's parents filled and submitted a prior informed consent form.

School Based Physical Activity Program: Intervention consisted of 60 minutes per day 5 days in a week for total of 8 weeks which included, Warm up for 5 minutes comprised of, Stretching of major muscle groups (Quadriceps, Hamstrings, Triceps, Biceps, Pectorals, Neck side flexors), Free and full range of motion exercises (Neck Side Flexion, Neck Half Rotation, Neck Full Rotation, Shoulder Circles, Shoulder Elevation, Shoulder Depression, Lumbar Side Flexion, Pelvis Rotations), Conventional School Based Physical Training (PT) which was in the form of mass drill was conducted for 20 minutes. These exercises comprised of flexion, abduction, extension of shoulders, W-position of upper limbs, flexion extension of elbow, wrist circles, neck rotations, side flexion, trunk rotations, trunk side flexion, squatting and spot marching. Running: Children were asked to run for 5 minutes on the school ground. They were asked to complete 4 rounds in 5 minutes on ground track. After running, 2 minutes of rest was given. Trampoline Jumping: Trampoline jumping was initiated and continued for 5 minutes. Jumping on trampoline was showed to the participants before starting the study protocol and they were asked to jump with same speed and reaching up to the same height. Break was given for 2 minutes. Long Jumps: Instead of conventional long jumps, children were asked to perform one long jump forward and two short jumps backwards

again continuing the same for 5 minutes which was more enjoyable for them. Cool down for 5 minutes in the form of deep breathing exercises for 2 minutes and Shavasana for 3 minutes was given.

Outcome Measures: Measurements were taken at the baseline and at the end of the study that is after 8 weeks. For the assessment of body mass, Body Mass Index percentile growth chart curves for specific age and gender given by CDC was used.⁵For abdominal adiposity Waist Circumference was taken. WC was measured with the help of measurement tape at a level midway between the lowest rib and the superior iliac crest.⁶To assess the physical fitness, 10 meters Incremental Shuttle Walk Test was performed and distance covered was recorded.¹¹

3. Data Analysis and Results

The data was entered in the excel spread sheet tabulated and subjected to statistical analysis. Data was analyzed using Graph Pad Instat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as t test. The confidence interval was set at 95% and data was considered statistically significant with $p < 0.05$ and highly or considerably significant with $p < 0.001$.

Out of total 30 participants, 13 (43%) participants were male and 17 (57%) participants were female, receiving treatment for 8 weeks. The mean value of BMI before intervention was 22.62 and SD was 1.254 and mean value after intervention was 21.83 and SD was 1.305 (Table 1.1), the mean value of WC before intervention was 31.93 and SD was 3.183 and mean value after intervention was 30.73 and SD was 3.118 (Table 1.2), the mean value of ISWT before intervention was 121.66 and SD was 37.054 and mean value after intervention was 138 and SD was 38.721 (Table 1.3). On comparing scores of pre and post intervention, it was observed that this difference was extremely significant in all the three components with p value < 0.0001 and t value 8.657 with 29 degrees of freedom.

Table 1.1: Comparison of Pre-Intervention and Post-Intervention Body Mass Index

	Mean	SD	Paired 't' test value	'p' value	Result
Pre-Intervention	22.62	1.254	7.897	<0.0001	Extremely Significant
Post-Intervention	21.83	1.305			

Table 1.2: Comparison of Pre-Intervention and Post-Intervention of Waist Circumference

	Mean	SD	Paired 't' test value	'p' value	Result
Pre-Intervention	31.93	3.183	6.378	<0.0001	Extremely Significant
Post-Intervention	30.73	3.118			

Table 1.3: Comparison of Pre-Intervention and Post-Intervention of Incremental Shuttle Walk Test

	Mean	SD	Paired 't' test value	'p' value	Result
Pre-Intervention	121.66	37.054	8.657	<0.0001	Extremely Significant
Post-Intervention	138	38.721			

4. Discussion

This study aimed at evaluating the effectiveness of school based physical activity program in overweight school going children between age group of 10 years to 14 years studying in Padmashree Dr. VithalraoEknathraoVikhepatilVidyalaya, after the period of 8 weeks duration. Total of 30 participants were included in the study.

Physical activity plays a vital role in obesity prevention and control as it alters the balance between caloric intake and expenditure states juozasraistenskis et al. Physical activity on daily basis enhances parameters of metabolic fitness including glucose tolerance, lipid metabolism, and insulin sensitivity. Instead of glucose, the body starts mobilizing stored fat from fat cells and burns this fat for energy. by means of increasing resting metabolism physical activities can increase lean muscle mass, reduce body fat, lower down the blood pressure, improve blood lipid as well as cholesterol levels and enhance body's ability to utilize glucose. Hence by this mechanism participants lose their body fat and decrease the waist circumference with significant decrease in the mean value of their body weight.¹²

The Body Mass Index used in this study to assess children for being overweight and percentile curve is plotted on a growth chart for specific age and gender. The BMI growth chart used in this study is given by Centre of Disease Control and Prevention in year 2000. Pre-intervention mean for BMI was 22.62 (Table: 4.1). All the children (n=30) included, had their BMI more than 85th percentile which according to definition comes under overweight category. This finding is supported by the work of NeslihanKoyuncuoğluGungor who published a review concluding the definition, prevalence, assessment, causes, comorbidities, preventive strategies and management of childhood overweight and obesity.⁵

Children were also evaluated for Waist Circumference (WC) and mean for pre-intervention WC was 31.93 (Table: 4.2). In a study published by AgnieszkaSuder et al in 2017 stated that WC helps as an easy diagnostic measure for detection of central obesity in children at risk. Investigation of School children through a period of almost 50 years was done in their study and data on weight, height and WC was taken from four cross- sectional survey studies conducted between 1966 and 2012. Their result showed that for the last nearly 50 years, the increase included not only in the mean values of BMI but also in WC and the major finding was that the growth is much higher for WC than BMI.¹³

Physical fitness was assessed in the form of distance covered by Incremental Shuttle Walk Test (ISWT). Before intervention mean for ISWT was 121.66 (Table: 4.6 and Graph: 4.6). There are many studies which stated that physical fitness is hampered in overweight/obese children. The significant relationship is seen between physical activity and physical fitness. While performing a physical activity the amount of energy expended largely depends upon body weight. The more is the body weight, the greater is the energy cost of a specific activity. The same body movement in obese as well as in children who are normal weight will

have different amount of energy cost. Obese children are generally less physically active than the children who are non-obese.¹⁴

After assessment all the children underwent School Based Physical Activity program for 60 min per day, 5 days continuously per week for 8 weeks of duration. A Randomized control trial study done by Danielle Lambrick, where they assessed the effectiveness of a 6 weeks, games-based, high-intensity intervention on anthropometric and physiological components of health, in obese and in normal weight children of age 8 years to 10 years. They were divided into two groups - intervention group and control group. For the intervention group 40 minutes of active games intervention for twice a week along with their usual physical education classes was given. Control group was given no intervention. Participants completed both a maximal and submaximal graded exercise test before and after the intervention. Improvement was seen in exercise group in terms of maximal oxygen uptake, peak running speed, and a decrease in the oxygen cost of submaximal exercise between assessments. Their result showed decrease in Waist Circumference and increase in muscle mass between assessments for the obese participants randomized to the intervention group. Hence this study reveals that a short-term, high-intensity games intervention may elicit positive changes in physiological and anthropometric indices of health in normal weight and obese children.¹⁵

At the end of 8 weeks of intervention, re-assessment was done. The post-intervention result showed that, the mean was 21.83 (SD=1.305) for BMI (Table:1.1), mean was 30.73 (SD=3.118) for WC (Table:1.2) and mean for ISWT was 138 (SD=38.721) (Table:1.3). Which means after the intervention the body composition and abdominal/central adiposity decreased significantly whereas the physical fitness improved considerably. By using test of significance, it is proved that, there is extremely significant improvement seen after intervention in all the three components. Hence regular School Based Physical Activity was significantly effective to reduce body mass and improve fitness in children who are overweight.

Physical activity is directly related to physical fitness. So when there is less amount of physical activity automatically physical fitness is also hampered. There are many studies which concentrated on decreasing weight in overweight/obese children but only few of them focused on the physical fitness component. In this study we used regular physical activity conducted in the school in the form of mass drill with which the children were familiar. We also used activities which were enjoyable by the children and keep them motivated to participate regularly. Hence in this study we aimed at decreasing body mass and improving physical fitness of overweight children with School Based Physical Activity.

5. Conclusion

From the above study it was concluded that, there were 32 school going children aged between 10 years to 14 years of age were overweight. After receiving School Based Physical Activity intervention designed for 8 weeks, 60 minutes per

day for 5 days in a week, their BMI and WC reduced significantly. Moreover significant effect was seen on physical fitness. Hence the School Based Physical Activity in the form of regular Physical Training, Running, Long Jumping and Trampoline Jumping is an effective intervention in the treatment of overweight children.

Limitation of the study

- 1) Obese children were excluded.
- 2) Lack of control group.
- 3) No follow up after 8 weeks was planned for this study so long term effect of intervention could not be measured.

6. Recommendation

- 1) Dietary advice and behavioral modification at home can be given by including parents in study.
- 2) Study should also include the psychological aspect in children who are overweight/obese.

7. Acknowledgements

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