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6-Minute Walk Test Performance in Overweight Children Between the Age Group of 5-10 Years

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ABSTRACT

Background: Obesity is a medical condition in which an abnormal growth of the adipose tissue due to an enlargement of fat cell size or an increase in fat cell size number or combination of both. Childhood obesity is the most prevalent chronic disease that putting children and adolescent at risk for poor health. The 6minute walk test is a practical simple test that does not required exercise equipment or advanced training for techniques. This test provides information about cardiopulmonary exercise response. This study is helps in identify the overweight children functional capacity among school children.
Objective: The aim of the study is to comparison hemodynamic changes in normal weight and overweight children by using 6-minute walk test.
Method: 6-minute walk test was performed in 25 normal weight and 25 overweight children between age group of 5-10 years. Pre and post test cardio and respiratory variables were recorded and compared among normal weight and overweight children.
Result: Result showed a highly significant relation in heart rate, blood pressure, respiratory rate and Borg scale between normal weight and overweight primary school children.
Conclusion: 6-minute walk test study concluded that to prevent overweight in children and its complications, schools required to add more physical activity in primary school also educate the children about diet, overweight, exercises and cardiovascular risks.

Keywords: overweight, blood pressure, respiratory rate, heart rate, Borg scale.

INTRODUCTION

Childhood obesity has reached epidemic levels in developed as well as in developing countries. Overweight and obesity in childhood are known to have significant impact on both physical and psychological health. Overweight and obese children are likely to stay obese into adulthood and more likely to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age. The mechanism of obesity development is not fully understood and it is believed to be a disorder with multiple causes. Environmental factors, lifestyle preferences, and cultural environment play pivotal roles in the rising prevalence of obesity worldwide[2].

In general, overweight and obesity are assumed to be the results of an increase in caloric and fat intake. On the other hand, there are supporting evidence that excessive sugar intake by soft drink, increased portion size, and steady decline in physical activity have been playing major roles in the rising rates of obesity all around the world[2].

Childhood obesity can profoundly affect children's physical health, social, and

emotional well-being, and self-esteem. It is also associated with poor academic performance and a lower quality of life experienced by the child[2].

Children who are overweight may have impaired cardiopulmonary status that can limit functional capacity and their ability to participate in exercise. In adults, it is well established that increased weight leads to decreased exercise fitness and aerobic capacity. In adolescent children, Normal found that obesity is linked with impairment of cardiorespiratory fitness resulting in decreased exercise tolerance. The Institutes of Medicine reports that approximately 60% of children5-10 years of age have at least one cardiovascular disease factor[1].

The demand for clinical assessment tools to functional exercise capacity in children who are Overweight is increasing. The 6-minute walk test (6MWT) is a simple, practical, reliable, and valid measure of submaximal exercise capacity in healthy children and children with chronic disease or neuromuscular disorders or cardiopulmonary disease.

AIM AND OBJECTIVES:

AIM: Evaluation of 6minute walk test in young children who are age and sex match with normal weight and overweight.

OBJECTIVE:

1. To identify 6minute walk distance in normal weight and overweight children.
2. Comparison of cardio and respiratory parameters in normal weight and overweight by using 6minute walk test.

MATERIALS & METHODS

The study was cross sectional study in which primary school 25 normal weight and 25 overweight children at the age of 6-10 were participated. A written consent was taken from school authority and all children parents.

Criteria for selection:

Inclusive criteria-

Age: 5-9year old children

Gender: Both male and female

Weight: Normal weight and overweight

Exclusive criteria-

1. Children with having any lower limb fracture
2. Any disability of lower limb
3. Having fever
4. Cardiovascular and respiratory dysfunction

MATERIAL:

1. Measuring tape
2. Weight machine
3. Pulse oximeter
4. Sphygmomanometer
5. Two cones
6. Pen
7. Proforma of 6-minute walk test
8. Stopwatch

METHODS:

1. Participants were informed that the purpose of the test was to find out how far they could walk in 6minutes and were instructed to walk the longest distance possible at their own pace during the allotted time. Hopping, skipping, running will not allow during the test.
2. Height and weight without shoes were measure using a measuring tape to calculate the BMI for each child.
3. The BMI was calculate using formula Weight/ (Height)2.
4. The 6MWT was performing indoors along a flat Straight walkway in primary school, accordance with the American Thoracic Society (ATS) guidelines.
5. The walking course lengths measured 30 m in the school corridor setting. Cones were placed at either end of the walking course to indicate the beginning and end points.
6. Before and immediately following the test, the participant's Heart rate, Blood pressure, spo2, and Rate of perceived exertion (RPE) were recorded & Participants were not allowed to talk

during the test except to express desire to stop the test.

7. For Rate of perceived exertion, each child asked to rate the level of perceived exertion using the Borg scale of perceived exertion.

STATISTICAL ANALYSIS

Collected data was entered into Microsoft excel spread sheet. Categorical variables were expressed in frequency and percentages. Continuous variables were presented as Mean± SD. Hemodynamic parameters were compared between Normal and overweight groups by performing independent t-test. P<0.05 was considered as statistical analysis. Statistical software STATA version 14.0 was used for data analysis.

RESULT

The study was undertaken for evaluation of 6minute walk test in normal weight and overweight primary school children, as shows the following results:

- The age and gender distribution were equal in both normal weight and overweight preschool children. Age distribution of study subjects with mean age ± SD (ranges)= 8.02±1.42 (5.11-9.9 years). [In table no.1 and 2]

Table No.1 Age distribution of study subjects.

	Normal weight		Overweight	
Age in years	**N**	**%**	**N**	**%**
<6 year	1	4.0	1	4.0
6 – 7	6	24.0	6	24.0
7 – 8	5	20.0	5	20.0
8 - 9	4	16.0	4	16.0
9 - 10	9	18.0	9	18.0
Total	25	100	25	100
Mean Age ± SD (Range)	8.02 ± 1.42 (5.11 – 9.9 years)		8.02 ± 1.42 42 (5.11 – 9.9 years)	

Table No.2 Gender wise distribution of study subjects.

	Normal weight		Overweight	
Gender	**N**	**%**	**N**	**%**
Male	10	40.0	10	4.0
Female	15	60.0	15	60.0

- In table no.3, the spo2 comparison at baseline showed significant p-value 0.0492.

Table No.3 Comparison of Baseline values of hemodynamic parameters rate between Normal and overweight at Baseline.

Parameter	**Normal weight**		**Overweight**		**t-value**	**p-value**
	Mean	**SD**	**Mean**	**SD**		
Heart rate	107.76	3.90	115.28	3.99	6.2729	<0.0001, HS
SBP	107.76	3.90	115.28	3.99	6.7279	<0.0001, HS
DBP	74.8	5.45	84.48	4.54	6.8158	<0.0001, HS
RR	17.92	1.71	22.16	3.83	5.0486	<0.0001, HS
SPO2	97.68	1.02	96.96	1.45	2.0177	0.0492, S

- In table no.4 comparison of mean HR between normal and overweight children at baseline and at immediate showed highly significant p-value <0.0001.

Table No.4 Comparison of Mean Heart rate between Normal and overweight at different time point.

Time	**Normal weight**		**Overweight**		**t-value**	**p-value**
	Mean	**SD**	**Mean**	**SD**		
At baseline	107.76	3.90	115.28	3.99	6.2729	<0.0001, HS
Immediate	115.68	3.80	122.4	5.85	6.2073	<0.0001, HS
After 2 minutes	112.68	3.74	120.20	4.52	6.3959	<0.0001, HS
After 4 minutes	113.48	4.17	118.37	4.27	6.3432	<0.0001, HS

- In table no.5 comparison of SBP between normal and overweight children at baseline and at immediate showed highly significant p-value <0.0001.

Table No.5 Comparison of Mean SBP between Normal and overweight at different time point.

.	Normal weight		Overweight		t-value	p-value
	Mean	SD	Mean	SD		
At baseline	107.76	3.90	115.28	3.99	6.7279	<0.0001, HS
Immediate	113.4	6.13	124.96	4.57	7.5491	<0.0001, HS
After 2 minutes	120.32	5.02	133.44	4.20	10.0156	<0.0001, HS
After 4 minutes	117.96	4.31	131.56	4.45	10.9644	<0.0001, HS

- In table no.6 comparison of mean DBP between normal and overweight children at baseline showed highly significant p-value <0.0001 and at immediate showed highly significant p-value 0.0003.

Table No.6 Comparison of Mean DBP between Normal and overweight at different time point.

	Normal weight		Overweight		t-value	p-value
	Mean	SD	Mean	SD		
At baseline	74.8	5.45	84.48	4.54	6.8158	<0.0001, HS
Immediate	77.32	14.36	89.08	4.65	3.8944	0.0003, HS
After 2 minutes	78.2	3.32	92.16	15.33	4.4475	0.0001, HS
After 4 minutes	76.68	3.72	87.36	4.40	9.2538	<0.0001, HS

- In table no.7 comparison of mean RR between normal and overweight children at baseline and at immediate showed highly significant p-value <0.0001.

Table No.7 Comparison of Mean Respiratory rate between Normal and overweight at different time point.

	Normal weight		Overweight		t-value	p-value
	Mean	SD	Mean	SD		
At baseline	17.92	1.71	22.16	3.83	5.0486	<0.0001, HS
Immediate	21.76	2.42	27.2	3.02	7.0176	<0.0001, HS
After 2 minutes	19.96	1.39	25.44	3.16	7.9218	<0.0001, HS
After 4 minutes	18.76	1.69	23.56	3.65	5.9635	<0.0001, HS

- In table no.8 comparison of mean spo2 between normal and overweight children at baseline showed significant p-value 0.0492 and at immediate showed not significant p-value 0.3764.

Table No.8 Comparison of Mean SPO2 between Normal and overweight at different time point.

.	Normal weight		Overweight		t-value	p-value
	Mean	SD	Mean	SD		
At baseline	97.68	1.02	96.96	1.45	2.0177	0.0492, S
Immediate	98.16	1.10	98.4	0.76	0.8928	0.3764, NS
After 2 minutes	98.08	1.03	98.44	0.65	1.4697	0.1482, NS
After 4 minutes	97.96	1.20	98.46	0.77	1.8159	0.0756, NS

- In table no. 9 comparison of Borg scale showed highly significant p-value<0.0001and 6minute walk distance showed p-value 0.0049 among normal and overweight children at baseline.

Table No.9 Comparison of Borg Scale and 6 in walk distance between Normal and overweight at Baseline.

	Normal weight		Overweight		t-value	p-value
	Mean	SD	Mean	SD		
Borg Scale	2.0	1.50	6.08	1.78	8.7553	<0.0001, HS
6 in walk distance	266.24	13.41	255.12	13.22	2.9507	0.0049, HS

DISCUSSION

According to WHO In 2019, an estimated 38.2 million children under the age of 5 years were overweight or obese. once considered a high-income country problem, overweight and obesity are now on the rise in low and middle-income countries, particularly in urban setting. Over 340

million children and adolescents aged 5-19 were overweight or obese in 2016.overweight and obesity are linked to more deaths worldwide than underweight.

The study on the ß childhood obesity: A Global Public Health Crisis" suggested some of the interventions used were family based, school based, community based, play based, and hospital based. The effective school-based interventions were seen targeting physical activity along with healthy diet education.[8]

In another study on the "Effect of six-minute walk test in obesity" showed difference between the obese class 1 and obese class 2 groups was statistically significant. This shows the amount of work done increases with increase in BMI.[9]

The current study examined difference in 6minute walk test performance between children classified as overweight and normal weight. Main findings suggests that the two groups are different in their resting and post 6minute walk test values for SBP and spo2 levels.

6minute walk test is frequently used to assess the severity of obesity and level of fitness, which are less expensive and easy to perform. In this study, we evaluated the exercise capacity in normal weight children group and compare it with overweight children group. In the present study, there was a decrease in 6minute walk distance in overweight children compare to normal weight children, and this decrease in walk distance was statistically highly significant. Furthermore, overweight leads to increase in hemodynamic parameters compare to normal weight children.

The advantage with our study was the simple set up for 6minute walk test which was very convenient for the subjects and further exploration on the studied parameters is warranted in future.

CONCLUSION

The 6minute walk test is a cheap, inexpensive and repeatable test, which is technically easy to apply appropriate for large patient groups and well tolerated by the preschool children.

In the study, according to the results this proved that the functional activity level of overweight children is less compare to normal weight children, suggesting remedial interventional to increase fitness level and avoid future cardiovascular risks.

This less is due to increase in work of breathing and decrease respiratory compliance leading to further complications. Physiological cost of walking is directly associated with height, Body Mass Index (BMI), 6minute walk distance in overweight children.

Declaration by Authors

Ethical Approval: Approved.

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