



## Physical Performance and Associated Factors in School going Children

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### Abstract

**Background:** *The prevalence of and level of obesity in children is increasing quickly worldwide. The conjecture that today's children are less active than they were in the past decades is mostly based on indirect evidences. Whether obese children are less physically active or less physically fit than their non-obese children still remains controversial.*

**Objectives:** *To evaluate physical performance and its associated factors in school going children using YMCA 3-minute step test and Physical Activity Questionnaire in 7-12 years old children.*

**Methods:** *Comparative study was carried out on 180 school going children. A 12" step was used according to the norms of the step test. The subjects were asked to perform the step test and VO<sub>2</sub>max was calculated and compared. Later the parents were asked to fill a physical activity questionnaire according to which they were graded.*

**Results:** *The comparison of aerobic capacity of these children showed that the mean of the values of VO<sub>2</sub>max of obese and overweight children is 66.315±12.85ml/min/kg while that of healthy and underweight children is 71.482±12.43 ml/min/kg. Results showed that the aerobic capacity in obese and overweight children is reduced when compared with the non-obese children. The p-value was 0.0001 which is statistically significant. The physical performance was using PAQ-C showed that 49 children under moderate where as 65 children are under low physical activity.*

**Conclusion:** *Aerobic capacity, obesity and physical activity level affects the physical performance in school going children.*

**Keywords:** *Childhood Obesity, aerobic capacity, exercise intolerance, YMCA 3-minute step test, Physical Activity Questionnaire (PAQ-C).*

### Introduction

A BMI at or above the 95<sup>th</sup> percentile for children and teens of the same age group is defined as 'Obesity' by the Center for Disease Control and Prevention<sup>1</sup>. The World Health Organization

(WHO) describes obesity as one of today's most important public health problems, which is rising as global epidemic<sup>2</sup>. Childhood obesity is considered to be epidemic worldwide, with incidence rates doubling and tripling over the past

15 years<sup>3</sup>. "Obesity" is defined as a condition of excess adipose tissue or excess body fat mass, to such an extent that the health might be impaired<sup>3</sup>. Despite these definitions, 'obesity' is often used without direct measure of adipose tissue and 'overweight' is generally used to portray 'at risk of obesity status' or 'moderate obesity'<sup>2</sup>. About rate of occurrence reported in India in various studies ranges from 8.5 to 29% for overweight and 1.5 to 7.4% for obesity<sup>[3,4]</sup>

The main causes are poor eating habits and decrease in physical activity. The negative consequences of obesity as a chronic disease have been repeatedly been established<sup>3</sup>. The early onset of obesity leads to an increased probability of obesity in adulthood and links into obesity related disorders like such as coronary heart diseases, insulin resistance, diabetes mellitus, hypertension, sleep apnea, arthritis, cancer, stroke and heart failure in life<sup>3</sup>.

The prevalence of and level of obesity in children is increasing rapidly worldwide. There is an urgent need for the development of effective programs to treat obesity in childhood<sup>2</sup>. Sedentary and low levels of physical activity are assumed to be important contributors to the increasing prevalence of obesity among children and young adults<sup>3</sup>. Hypercaloric diet and sedentary lifestyle have resulted in the development of obesity in younger populations<sup>3</sup>.

In view of the disturbing rise in physical inactivity in children and adolescents worldwide and even possible tendency of physical fitness, primary prevention should be emphasized as early as childhood to prevent the relation between obesity in early life with obesity in later life<sup>3</sup>. Physical activity is an essential part of both a healthy lifestyle and a child's daily routine. Development of good health habits in childhood is associated with physical fitness<sup>3</sup>.

The factors that account for the quick increase in the prevalence of childhood obesity remain uncertain. Available data suggests that obesity results from multiple connections between genes and environment<sup>4</sup>. Parental obesity is an important

risk factor for childhood obesity. Family way of life and surroundings play an significant role in developing children's food and activity preference and this may also to some extent explain the familial patterns of obesity<sup>4</sup>. The guess that today's children are less active than they were in the past decades is mostly based on indirect evidences. However, there are very few studies to confirm that physical activities have reduced in young people over the decades that obesity and overweight have increased<sup>4</sup>.

Comparability between studies investigating the relationship between physical activity and obesity is inadequate because some measure activity performance while others measure energy spending<sup>4</sup>. Obese children are usually less physically active than non-obese children. However, the amount of total energy expenditure devoted to physical activity is analogous in obese and non-obese children. So, there is no definite evidence that reduced energy expenditure in activity accounts for the excess body fat in obese children when results for obese and non-obese are expressed in complete terms<sup>[2,5]</sup>.

It has recently been argued that aerobic capacity is the prime cause influencing future health outcome, although the physiological basis of this notion remains unsure. Whether obese children are less physically active or less physically fit than their non-obese peer remains divisive. Many studies have reported a off-putting connection between physical activity levels and adiposity, whereas others have indicated no divergence in physical activity and aerobic capacity between obese and non-obese peers<sup>6</sup>.

Perplexity still exists on the proper expression of  $VO_{2max}$  data when comparing obese and normal weight individuals. Many studies indicate that overweight and obese children do not have impaired  $VO_{2max}$ , but have a reduced sub-maximal aerobic capacity<sup>12</sup>. Hence, this study was done to assess and compare their aerobic capacities.

**Materials and Methodology:**

**Study design:** Comparative study

**Participants:** The subjects of the study were school going children, both boys and girls from obese, overweight, healthy and underweight weight category aged between 7-12 years. The subjects diagnosed with any cardiovascular or respiratory illness or the ones undergoing treatment for the same were excluded from the study.

**Procedure:** The permission to conduct the project was approved by the Institutional Ethical Committee, Department of Physiotherapy, Tilak Maharashtra Vidyapeeth, Pune. Total 200 subjects were screened among various schools in and around Pune out of which 186 were selected on the basis on the inclusion criteria using simple convenient sampling. Out of which 6 were dropouts. A written consent was taken from the subject's parents or concerned guardians. The nature, purpose, and possible risks of the study were carefully explained to the parents before obtaining their consent. The subject's parents and guardians were made clear that the information obtained will remain classified and would be used

solely for research purpose. The subjects were asked to perform the YMCA 3-minute step test. This step test protocol required the subject to step up and down on a 12-inch step at the rate of 24 rises per minute paced a metronome for 3 minutes<sup>9</sup>. Subjects were provided with verbal instructions and encouragement to maintain the stepping pace throughout the test. The test was to be terminated if the participant's HR came within 10 bpm of their age predicted heart rate (220 minus age) or if they were unable to maintain the prescribed stepping cadence for more than 10. Heart rate was recorded immediately upon the cessation of the protocol for one minute. The subjects were provided with a rest period of 10 minutes after completing the step test to let their heart rate recover within 10 bpm of their HR<sub>rest</sub><sup>9</sup>. Later, the parents or guardians were asked to fill The Physical Activity Questionnaire (PAQ-C)

**Results**

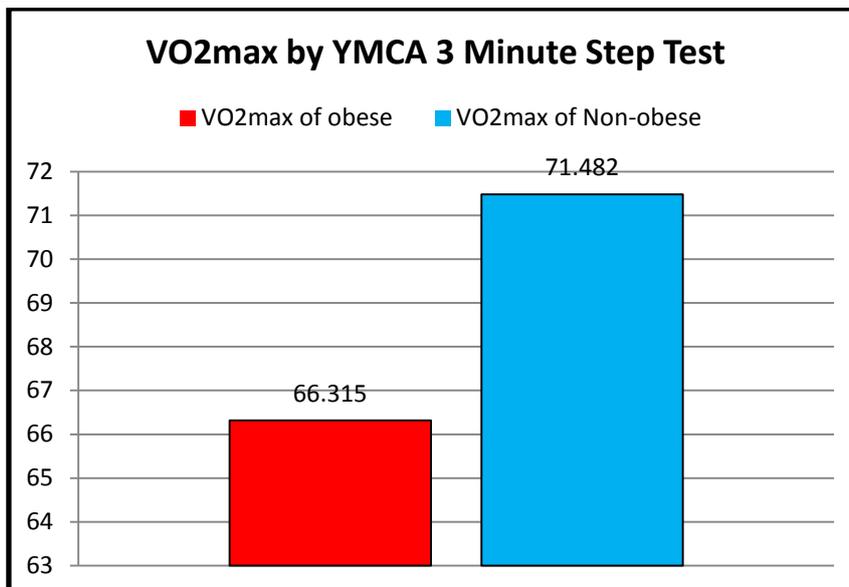
Out of the total 180 subjects aged 7-12 years, 93 subjects were boys and 87 subjects were girls, of which 63 were obese, 21 overweight, 82 healthy and 14 underweight.

**Table No.1:** BMI of the children according to their percentile

| Percentile | Number of Children | Interpretation |
|------------|--------------------|----------------|
| 1-9        | 14                 | Underweight    |
| 11-19      | 8                  | Healthy        |
| 21-29      | 5                  |                |
| 31-39      | 7                  |                |
| 41-49      | 9                  |                |
| 51-59      | 2                  |                |
| 61-69      | 37                 |                |
| 71-79      | 14                 | Overweight     |
| 81-89      | 21                 |                |
| 91-99      | 63                 | Obese          |

**Table 2:** VO<sub>2</sub>max by YMCA 3 Minute Step Test

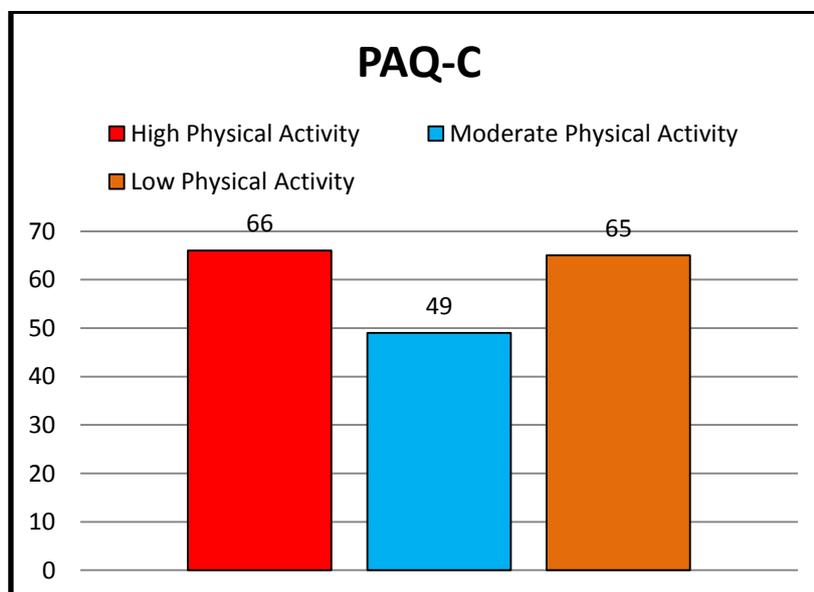
| Group                                     | Mean±S.D (ml/min/kg) | p-value |
|---|----------------------|---------|
| VO <sub>2</sub> max of Obese Children     | 66.315±1.12          | 0.0001  |
| VO <sub>2</sub> max of Non-obese Children | 71.482±1.89          |         |



**Graph no: 1** shows the mean values VO<sub>2</sub>max of the obese and non-obese children. The mean value of VO<sub>2</sub>max of obese children is 66.3±12.85 ml/min/kg while that of non-obese children is 71.48±12.43ml/min/kg. The p-value is 0.0001, hence the difference between the aerobic capacities of obese and non-obese children is highly significant.

**Table 3:** Distribution of Children according to the physical activity questionnaire

| Physical Activity Questionnaire | Number of Children |
|---------------------------------|--------------------|
| Higher Physical activity        | 66                 |
| Moderate Physical Activity      | 49                 |
| Low Physical Activity           | 65                 |



**Graph No:2** shows the number of children according to the interpretation of the Physical Activity Questionnaire. Out of 180 subjects, 66 subjects show high physical activity, 49 subjects show moderate physical activity and 65 subjects show low physical activity.

**Discussion**

This study was done to investigate the aerobic capacity in obese and non obese children. In this

study, we found that there is significant reduction in aerobic capacity in obese and overweight children when compared with underweight and

healthy weight children when assessed by using YMCA 3 minute step test and The Physical Activity Questionnaire (PAQ-C) for school going children.

In this study we have found that the aerobic capacity in obese children was reduced then the healthy weight children. The mean of  $VO_2\max$  of obese is  $66.315 \pm 12.85$  while the  $VO_2\max$  of non-obese children is  $71.482 \pm 12.43$ . The p-value of the study is 0.0001 which is  $< 0.001$ , which is statistically and clinically highly significant.

The interpretation of the PAQ-C for older children showed that out of total 180 subjects assessed, 66 subjects showed high physical activity, 49 subjects showed moderate physical activity and 65 subjects showed low physical activity,

The study's findings are similar to that of B. Ruth Clark et al. study on obesity and aerobic fitness among urban public school in elementary, middle and high school. The study concluded that a community university collaboration identified obesity, severe obesity, overweight and low aerobic fitness to be common risk factors among urban public school<sup>7</sup>.

In their study they have considered all elementary, middle and high school children whereas we have targeted only elementary school children between the ages of 7 to 12 years. Also as an outcome measure they have used BMI specific formula to determine the health related fitness and  $VO_2\max$ ; whereas in this study YMCA 3 min step test has been used which is more reliable and convenient to calculate the aerobic fitness in children. The finding suggests that  $VO_2\max$  in non-obese children is more than the obese school going children<sup>8</sup>.

A study conducted by Maria S. Johnson concluded that the study provided strong evidence that reduced physical activity, expressed as lower aerobic fitness, results in greater adiposity<sup>11</sup>. Ventilatory function is compromised by excessive body fat and thereby reduces aerobic capacity. Obesity has been reported to reduce pulmonary compliance, decrease vital lung capacity and decline the competence of the ventilatory muscles.

Cardiovascular health is also reduced because of the inactive way of life adopted by the subjects<sup>8</sup>.

Increasing commonness of childhood obesity is being observed with the changing lifestyle of families with increased purchase power, increasing hours of idleness due to obsession to television, videogames and computer, which have replaced outdoor games and other social activities. It has been suggested that amplify in body weight have been caused chiefly by reduced levels of physical activity, rather than by changes in additional food intake or by other factors.<sup>14</sup>

The physical development of the children is negatively affected by obesity. Health endorsement based on physical activity in cardiovascular function, body composition muscle strength, muscle endurance and flexibility<sup>17</sup>. Researchers show that there is downbeat association between BMI and cardiovascular function of overweight and obese children, and that normal children of normal weight scored better in tests that resolute cardiovascular function than overweight and obese children<sup>17</sup>.

Secular trend have shown that the aerobic presentation of young individuals is declining. The decline in the has reached 0.36% a year<sup>19</sup>, with the incidence of low aerobic capacity in young individuals. The decline in aerobic fitness is associated with some individual distinctiveness such as, sociodemographic and life style factors<sup>19</sup>. In metropolitan areas, considering the safety of keeping children away from the heavy traffic congestion, parents feel more at ease, if their children played indoor games or watched television, consequently hindering their children participation in outdoor games or sports. A person's atmosphere (at home, school, at play in the community etc.) can have a noteworthy impact on his or her risk of developing morbid obesity. His or her environment in this regard would be comprised of, types of food that is available to the individual, the amount of food available, the level of physical activity available or achievable, and hence, it suggests that the aerobic capacity is reduced in obese children due to excessive fats

when compared with non-obese children the diet and exercise habits of the individuals.<sup>14</sup>

### Conclusion

Study concluded that aerobic capacity; obesity and physical activity level affects the physical performance in school going children.

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