

# Relationship of Physical Fitness and Body Mass Index in Overweight School Children, Chengalpattu District, India

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## ABSTRACT

**Background:** Obesity among children and adolescents is becoming an epidemic in India due to various life style changes, both in the developed and developing nations. As per World Health Organization estimates, 41 million children under five years and more than 340 million children and young teens of age group 5 to 19 years were having overweight or obesity in the year 2016. The study focuses on factors affecting physical health and its abilities due to overweight, self-esteem and academic performance of children in South India.

**Methodology:** The study design was Non Experimental, Observational study. 130 overweight children were selected out of 1300 students from two schools. The inclusion criteria were BMI of 85 to 95 percentile of their age and sex, 11 to 15 years of age. In physical fitness, anthropometric measurements, 7 sites-skin fold measurements, Fitness Gram sit and reach test, sit up test were measured. In addition to that self esteem was measured by students self concept scale and academic performance of summative assessment marks also noted down.

**Results:** The correlation between data were made by Pearson correlation tests for Body mass Index with sit and reach test, curl ups, fat %, Fat Mass, FFM, other than this Self Esteem Test and Academic Performance Tests. The interrelationship between the BMI and sit and reach test of mean 24.2, 20.07 respectively shows very low positive correlation with non-significant p-value (0.0182), followed by BMI and Curlups, mean values are 24.24 and 6.62 shows very low negative correlation, non-significant value (0.140). No correlation between BMI and self estimate, academic performance with non-significant p-value 0.905, 0.291, their mean values are 57.48 and 230.73.

**Conclusion:** The study concluded that overweight children have negative impact in health promotion and fitness, while this study shows difference in correlation with BMI and other physical performance tests.

**Key words:** Overweight children, physical fitness, skin fold measurements, Self Esteem, sit and reach test, curl ups, fat %.

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## INTRODUCTION

According to recent updates, obesity is considered to be expanded towards the child health. While on the other side developing countries, have increased prevalence rate of obesity from 10% to 30%. Children were known as future of the country but this obesity affecting children spoils the whole community including the socioeconomic model. Comparing to rural areas urban area are affected more (1–3).

Prevalence rate for each country on obesity varies on many factors such as lifestyle, dietary patterns, and physical activity. Especially among children and adolescents is becoming an epidemic due to various life style changes, both in the developed and developing nations(1). As per World Health Organization (WHO) estimates, 41 million children under five years and more than 340 million children and young teens of age group 5 to 19 years were having morbidly obese or obese in the year 2016. (2)

In general, childhood obesity is defined as stagnation of fat above the physical and skeletal ratio with the ideal body weight (1). Quality of health is based on cardiac endurance, complex of body, muscle power, along with muscle properties of an individual (4). Many researchers show negative results for relationship between the BMI and Cardiovascular function for morbidly obese and obese

children, these studies have also depicted that cardiovascular performance of normal weight children was better (5-8).

Among various studies, overweight and obese children of all age groups, both gender had increased percentage of fat mass and decreased fat free mass(7), other researchers have found that children of 6-18 years have weaker abdominal endurance performance (7). Further study leads with flexibility levels among children with all body weights while comparatively overweight and obese children didn't show significance along with the normal weight children (7). Apart from all the above factors overweight and obese children have many affect to physiological and pathological, mental diseases due to less physical activity (1, 15). So there is an important demand increase their activity level.

This study determines the importance of physical parameters among South Indian overweight children. Similarly no published literature can be found with south Indian context regarding the correlation of physical and cardiac fitness among overweight children, however this study will be very helpful to design and implement the exercise methods in specific age group 11-14 years. Therefore, the focus of the study is to determine overweight population among children with less physical activity affecting child health, self esteem and academic performance of children in South India.

## METHODOLOGY

The study design was Non Experimental, Observational study. The protocol was presented to the members of Institutional Ethical Committee and it was approved by them. 130 overweight children were selected conveniently from 1300 healthy children from two high schools in Chengalpattu District, South India. Before recruitment, a talk was given at each participating school to explain the need and benefits of the study. Prior approval was taken from the school authorities to carry out the study. An informed consent and assent form was obtained from their parents and students. The exclusion criteria were children with cardio respiratory problems, including childhood asthma, congenital heart deficit and hypertension, exercise problems, hospital admissions within the past 3 months and common cold within the last four weeks. Only overweight children, BMI of 85 to 95 percentile of their age and sex, 11 to 14 years of age were included in the study. Explanation in brief regarding the study was given to selected children and they were pre evaluated.

### Anthropometric Measurements

Height of the child was recorded to the nearest 0.5 cm using the calibrated wall mounted measuring tape. Weight was recorded using the weighing scale to the nearest 0.1kg. BMI was computed using the formula,  $BMI = \text{weight (Kg)} / \text{height (m)}^2$ . In physical fitness, skin fold measurements, Fitness Gram sit and reach test, sit up test were measured. In addition to that self esteem was measured by students self concept scale and academic performance of summative assessment marks also noted down.

Skin fold measurements were taken from right side of the body. Skinfold caliper was used to measure the skin fold thickness in millimeters. Seven Locations were on Triceps muscle vertical fold at the midpoint of the posterior side of triceps. On Chest, diagonal fold half the distance between anterior axillary line and the nipple. Subscapular region, diagonal fold 2cm from inferior angle of the scapula. Midaxillary region, horizontal to xiphoid process of the sternum. Abdominal region, vertical fold 2cm to the right of the navel. Suprailiac region diagonal fold parallel and superior to the iliac crest. And Thigh region midpoint of the anterior side of the upper leg. A minimum of two measurements were taken at each location. If the two measurements differ by more than 2 millimeters, a third

measurement was taken. The body composition calculator then uses the average of the 2-3 measurements when making the calculations (8).

### Sit and Reach Test

The position of the child was sitting on the floor with both legs stretched out straight forward. Shoes should be removed. The soles of the feet were kept flat against the box. Both knees should be fully extended. With the palms facing downwards, and the hands on top of each other, the subject reaches forward along the measuring line (23 cm at feet level) as far as possible and holds that position for two seconds while the distance is recorded. Avoid jerky movements. The score - nearest centimeter as the distance reached by the hand, 3 trials and mean was taken for calculation (9)

### Fitness Gram Curl Up Test

To find out the strength and endurance of the abdominal muscles, child was asked to do sit ups for one minute. Starting position was Supine lying, knees bent, feet rest on the floor (9).

### Assessment of self esteem and Academic Performance

Standardized Children's Self Concept Scale has 80 items in all with 'Yes' or 'no' responses. It has Six subscales were Behavior, Intellectual and social status, Physical appearance and attributes, Anxiety, Popularity and happiness and Satisfaction. The sum of scores for each subscale was obtained by adding the scores. The maximum score for the total self concept was 80. Minimum score is zero. Higher the score indicates favorable self esteem (10). Academic Performance was calculated by totaling of summative exam marks in all subjects.

## RESULTS

The study was done with 130 overweight school-going children aged 11-15 years, both boys and girls were included for evaluating their physical performance. All data were analyzed using SPSS-20 with 95% confidence interval and  $p < 0.05$  was advised to be statistically significant. The correlation between data were made by Pearson correlation tests for Body Mass Index with sit and reach test, curl ups, fat %, Fat Mass, FFM, other than this Self Esteem and Academic Performance Tests.

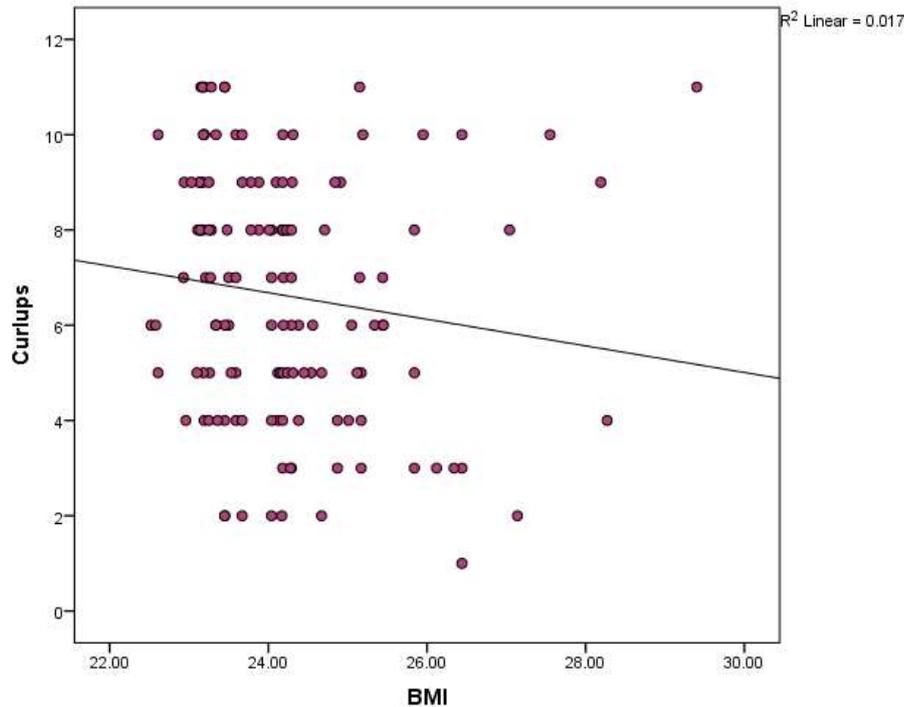
**Table 1:** Correlation of Body Mass Index with sit and reach test, curl ups, fat %, Fat Mass, Fat Free Mass, Self Esteem and Academic Performance Tests.

|                    | Mean    | Std. Deviation | n   | r - Value | p-value  |
|--------------------|---------|----------------|-----|-----------|----------|
| BMI                | 24.2426 | 1.21710        |     |           |          |
| Sit and Reach Test | 20.07   | 4.626          |     | 0.118     | 0.182 NS |
| BMI                | 24.2426 | 1.21710        |     | -0.130    | 0.140 NS |
| Curlups            | 6.62    | 2.610          |     |           |          |
| BMI                | 24.2426 | 1.21710        |     | 0.022     | 0.807 NS |
| Fat %              | 31.0248 | 22.41550       |     |           |          |
| BMI                | 24.2426 | 1.21710        | 130 | -0.075    | 0.398 NS |
| FM                 | 13.4018 | 4.23136        |     |           |          |
| BMI                | 24.2426 | 1.21710        |     | 0.142     | 0.108 NS |
| FFM                | 32.3176 | 6.09579        |     |           |          |
| BMI                | 24.2426 | 1.21710        |     | -0.011    | 0.905 NS |

|                      |         |         |        |          |
|----------------------|---------|---------|--------|----------|
| Self-Estimate        | 57.48   | 5.087   |        |          |
| BMI                  | 24.2426 | 1.21710 | -0.093 | 0.291 NS |
| Total Academic Marks | 230.73  | 8.820   |        |          |

Table 1 shows that the correlation between the BMI and sit and reach test of mean 24.2, 20.07 respectively shows very low positive correlation with non-significant p-value (0.0182), followed by BMI and Curlups, mean values are 24.24 and 6.62 shows very low negative correlation, non-significant value (0.140) Graph 1.

There is no correlation between BMI and Fat % with non-significant value (0.807) and their mean values are 24.24 and 31.02 respectively, BMI and Fat Mass also doesn't correlate with mean value 24.24 and 13.40, non-significant p-value (0.398). BMI and Fat Free Mass with very low positive correlation of mean values 24.24 and 32.31 with non-significant p-value (0.108).



Graph 1: Very low negative correlation of BMI and Curlups

No correlation between BMI and self esteem, academic performance with non-significant p-value 0.905, 0.291, their mean values are 57.48 and 230.73.

Comparatively all the correlated values shows non-significant while some factors of physical performance test varies from very low negative correlation, no correlation and very low positive correlation. This may be due to anthropometric measurements, life style, socio-economic status, physical activity.

### DISCUSSION

The results showed that overweight school-going children has no correlation with physical performance, this could be due to change from childhood phase to adolescent phase especially in girls it may be associate with puberty age.

The raising risk of premature death due to increasing childhood obesity, decreases overall quality of life.<sup>11</sup> Especially the adolescent children aged 7-15 years have higher prevalence of overweight about 18% (WHO) in 2016. Previous studies have reported that sedentary lifestyle is associated with increasing body fat in age 10-11 year

particularly male children.<sup>12</sup> while girls have greater risk of overweight. The study also suggests that considering cultural factors is also important to promote interventions for healthy habits. Zimmerman et al concluded that nutrition education and physical activity based programs to target primary and secondary school going children.

C Graf et al concluded that BMI and endurance performance has a mild correlation, while Chatrath et al concluded no correlation between BMI and endurance performance, this study goes in hand with Chatrath et al. and suggested that reducing the screen time may prevent obesity. This study also suggested that overweight and obesity children have poor gross motor development and insist them to add in active lifestyle.<sup>13</sup>

Earlier studies showed that cultural pressure influences adolescent girls to be slim and as age increases of weight gain leads to body dissatisfaction which is one of the psychological issue.<sup>14</sup> The results of this study relates our study, BMI and curl-ups show poor performance among overweight group children.

Childhood energy expenditure was evaluated at 10-14 years of age showed total energy expenditure increased 60 % from age 5-9 years but still many children are prone to have overweight and obesity apart from no gender difference.<sup>15</sup>

Apart from physical activity, musculoskeletal has also influence on overweight children, this may be due to morphology of connective tissues with unknown effect, but indicates there is effect with adipose tissue and skeletal structural and alignment mainly in lower limbs.<sup>16</sup>This may be one of the cause for decrease in flexibility tests such as sit and reach test, curl ups etc.

Childhood obesity is very difficult to define as child's anthropometric changes accordingly sometimes they be in normal, overweight and obese. Identifying these children is a big task and proper tool has to be used.

Distribution of body fat rather than BMI calculation is used as a criteria to classify them, certainly there are different percentile skin fold thickness on different levels to evaluate , few studies show that 85<sup>th</sup> percentile of skin fold thickness may not be an indicative of overweight/obesity as it corresponds to different levels of body fat. In children body fatness range from 17-22%.<sup>17</sup>High lipid levels in normal children aged 8-10 yr also have high risk of body fat levels.<sup>18</sup> Waist – hip ratio is other factor that can be used for the children to categorize overweight, the circumference measurement of hip-waist helps in targeting in strength program as well as body fat ratio.<sup>19</sup>

BMI and academic performance correlation is a new way of evaluation among overweight children, as children spend most of their time in academic phase, the body structure influencing academics, this study results doesn't show any correlation but there are few studies, concluding consumption of fast foods has significant relation which low grades especially in maths and reading.<sup>20</sup>

Usually academic performance is considered for cognitive and memory capacity of child but then obese or overweight children might have poor impact on academic achievement. Due to poor academic grade there may be development of low self esteem, lack of confidence and even change in emotions.

## CONCLUSION

The study concluded that overweight children have negative impact in health promotion and fitness, while this study shows difference in correlation with BMI and other physical performance tests.<sup>21</sup>

Providing them proper-oriented physical performance and intervention may prevent them from secondary complications which saves the future of budding young adults from diseases.

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