

# Prevalence of Obesity and Its Influence on Physical Fitness and Energy Expenditure during Walking In Rural School-Children

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## Abstract

**Background:** Recently childhood obesity has become common condition in children with widespread effect on other aspects of health too.

**Objectives:** Report obesity prevalence and its influence on physical fitness and energy expenditure (EEI) during walking in rural school-children. **Methodology:** 300 primary, secondary and higher-secondary school children in Changa village aged 5 to 18 years, both girls and boys were included in the study. Outcome measures used were: waist circumference (WC), waist-height ratio (WHtR), EEI and 6 minute walk test distance (6MWD). **Result:** Of 175 boys, obesity prevalence was 6.79% using WC and 4.51% using WHtR. Of 125 girls, obesity prevalence was 14.37% using WC and 13.21% using WHtR. - **Conclusion:** Prevalence of obesity was more in girls as compared to boys. High level of association between obesity and physical fitness in both genders. High association of obesity with EEI during walking amongst girls

## Introduction

Obesity is defined as presence of excess adipose tissue in the body that may lead to health hazards. It is a heterogeneous group of conditions with multiple causes. In India, malnutrition has attracted the focus of health workers, but from past few

years, obesity in children is increasingly observed and it is a major problem or issue for developing countries (Bhardwaj et al, 2008; Saraswathi et al, 2011).

There are many reasons for growing number of children with obesity such as sedentary life style, lack of outdoor games because they have more options at

home like playing video games, mobile networking, watching TV and computer games. Their dietary habits have also changed with more preference for fast food, sugary drinks and neglect of fruits and vegetables (Thomas, 1999; Jeffrey et al, 2003). Obese children and adolescents also are at an increased risk of having physical and psychological health problems. Incidences of cardio-vascular disease and type II diabetes have been found in many studies to be correlating with the development of obesity. There are greater risks of social and psychological problems such as discrimination and poor self-esteem which can continue into adulthood (Samuel, 2010).

In childhood, physical fitness also plays a very important role for growth and development of skeletal muscle, body fat, bones and nervous system and also help in maintaining the normal metabolic rate and body composition. Reduction of the physical activity leads to weight gain which in turn leads to decrease in the physical activity. Hence the treatment for obesity in children and adolescents focuses on dietary management, physical activity enhancement, changing sedentary lifestyle, pharmacotherapy and bariatric surgery (Yu et al, 2006). In childhood, much of the activities of a child are based on walking and running and have been found to be more energetically expensive for obese children than for children of normal body weight. The knowledge of energy costs could be useful in devising a physical activity program to be used in

treatment of obese children. EEI is a very important part of physiotherapy assessment for the obese children (Norman, 2004).

For the evaluation of obesity many outcome measures have been used in the studies. Commonly used outcome measures are from child's body weight, height which include BMI, waist circumference, waist-height ratio, waist-hip ratio and skin fold measurements; etc. Waist circumference (WC) and Waist-height ratio (WHtR) are used to determine the central obesity in children which is more commonly found in case of Asian countries, which is relatively age independent. It might obviate the need for age-related reference charts. WHtR has been found to be highly reliable and valid tool for assessing obesity (Sung, 2008; Mushtaq et al, 2011; Kawatra et al, 2013). Many other laboratory methods have also been used for determining the composition of the human body. These are hydrostatic weighing, absorption of gases by fat and radiography, which measure the adipose tissue, estimation of total body water or potassium for measuring lean body mass. These techniques cannot be used in children for field research.

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children. EEI is a very important part of physiotherapy assessment for the obese children.<sup>13</sup>

Obesity is associated with the reduction in physical activities, which is important component of quality of life in children. From the 6 minute walk test, we can measure the level of physical activity on walking ability in obese children. 6 minute walk test evaluates the global and integrated responses of all systems involved during exercises – pulmonary and cardio-vascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism. It is easy to administer, better tolerated and more reflective of activities of daily living than any other walk tests (*ATS guidelines, 2002; Albert, 2007; Chaudhari, 2012*).

Various studies are done on childhood obesity in cities such as Delhi (*Marwaha and Tandon, 2006; Supreet et al, 2008*), Pune (*Khadilkar & Khadilkar, 2004*), Punjab (*Sidhu et al, 1997*), Mysore (*Premanath et al, 2010*), Ahmedabad (*Bhrambhatt and Oza, 2012*) and Baroda (*Iyer, 2011*). From these studies, we can conclude that prevalence studies on obesity of rural school-children have not been done as most of the studies have focused on the affluent group. Thus, the present study will be undertaken to study the prevalence of obesity of rural school-children and also to find out the extent of relation of obesity on physical fitness and energy expenditure during walking.

## Materials & Methods

The first phase of the study was a cross sectional school-based survey for studying the prevalence of obesity. Primary, Secondary and Higher secondary schools of Changa village were selected. Convenient sampling method was used in the present research. The approval from school authority for conducting the research was taken. Written assent was taken from the participants who were below 7 years old and it was supported by the written consent from their respective teachers. From the participants who were above 7 years of age written consent was taken. The selection of children from the schools was done using the simple random sampling method and over 300 children in the age-group of 5-18 years were selected. Total sample was then divided into 2 age-groups of 5-12 years and 13-18 years, 150 children in each group. This division was made based on the physiology of adipose tissue deposition in body owing to the hormonal influence. Children diagnosed with any musculoskeletal, cardio-respiratory or neurological disorders were excluded from the study. Their medical records available at the primary health centers of the village were referred to check the disorders.

For the cross-sectional survey; height, waist circumference and background information were studied. All anthropometric measurements were taken using the standard protocol. Height and waist circumference were measured with a fiber-glass tape to the nearest 0.1 cm.

Background information was obtained using a structured questionnaire. Prevalence of overweight and obesity was ascertained using Waist-Height ratio (WHtR) and Waist circumference (WC). Waist circumference measured by the help of measure-tape at the umbilicus level. WHtR was calculated by dividing waist circumference (cm) by height (cm).

For the second stage of the study, Energy Expenditure Index and 6MWD was measured using the worldwide standard method. For EEI measurement, each participant was instructed to rest for 5 minutes, in last 2 minutes of rest measured Resting HR. Then the participants were made to walk for 5 minutes and in last 30 seconds of walk, walking HR is measured. For calculation, WHR (beats/minute) minus RHR (beats/minute) was divided by walking velocity (m/minute). For physical fitness measurement, 6 minute walk distance (6MWD) was used as the outcome measure. The test was conducted according to a standardized protocol, using school assembly hall with the 100 foot distance marked by colour chalk on the floor. The participants were told that the purpose of the test was to see how far they could walk in 6 minutes. They were instructed to walk in normal comfortable speed. A repeat test was not performed in this study. Light meal was acceptable before test, but participants were told to avoid vigorous exercise for 2 hours before testing. No warm up period before the test was allowed and participants sat at rest in a chair, near the starting position for 10

minutes before test starting. In 6MWD, the number of laps completed was counted. The distance in meters covered over the 6 minutes was recorded.

## Results

Prevalence of obesity was calculated using descriptive statistics. Spearman correlation coefficient was used to find the association between obesity, energy expenditure during functional activity (walking) and physical fitness of children.

Table 1: Prevalence of obesity in Boys

Age-Group	Category	WC (%)	WHtR (%)
5-12 years	Overweight	0	1.18
	Obese	2.35	0
13-18 years	Overweight	1.11	3.33
	Obese	3.33	0

Table 2 Prevalence of obesity in Girls

Age-group	Category	WC (%)	WHtR (%)
5-12 years	Overweight	1.54	1.54
	Obese	4.62	0
13-18 years	Overweight	6.67	0
	Obese	1.54	11.67

Out of 85 boys of 5-12 years age, prevalence of obesity according to WC, WHtR was 2.35%, 0% respectively. And overweight according to WC, WHtR was 0%, 1.18% respectively. Out of 90 Boys of

13-18 years age, prevalence of obesity according to WC, WHtR was 3.33%, 0% respectively. And overweight according to WC, WHtR was 1.11%, 3.33% respectively. Out of 65 girls of 5-12 years age, prevalence of obesity according to WC, WHtR was 4.62%, 0% respectively. And overweight according to WC, WHtR was 1.54%, 1.54% respectively. Out of 60 girls of 13-18 years age, prevalence of obesity according to WC, WHtR was 1.54%, 11.67% respectively. And overweight according to WC, WHtR was 6.67%, 0% respectively.

**Table 3 Association between Waist Circumference with 6 MWD and EEI**

OBESITY	WC AND 6MWD		WC AND EEI	
	r	p-value	r	p-value
Girls	0.74	0.05	0.82	0.05
Boys	0.69	0.05	0.37	0.05

There was significant correlation found between obesity and physical fitness (WC and 6 MWT) in both gender. Poor correlation between obesity and EEI in boys was found but there was significant correlation in girls.

For prevalence of obesity WC and WHtR were used for a sample of 300 primary, secondary and higher secondary school-children aged 5 to 18 years. It was found that as per waist circumference, which is considered to be a standard

measure of central obesity in children, screened 2 children in the obese category from 5-12 years age-group and 1 child in the overweight category and 3 in the obese category from 13-18 years age-group. If we compare the results of other studies done on Indian children, we come to know that prevalence of obesity in the rural children is very less as compared to the urban children of other studies. As per the WtHR, the prevalence rates were not significantly different, as there was 1 overweight boy in the 5-12 years age-group and 3 overweight boys in the 13-18 years of age-group. None of the boys were in the obese category in our sample of present study.

As per the Waist circumference, the prevalence of overweight and obesity in 5-12 years girls was 1.54% and 0%. And that in the age-group of 13-18 years, the prevalence of overweight and obesity was 6.67% and 1.54% respectively. WHtR revealed that there were no obese girls in the 5-12 years whereas in overweight category only 1 girl was found. In the age-group of 13-18 years, no overweight girls were found while 7 girls were screened for obese category. With no cut-offs of 3 site skin-fold measurement, 1 girl in the 5-12 years and 4 girls in the 13-18 years were found to be having overweight.

To study the influence of obesity on their physical fitness, 6MWD was used. Though the children were obese and overweight, their 6MWD were in the normal range. So when the relation between obesity and 6MWD was

established, significant high correlation was found between the two variables. This might be justified by the reason, that their present obesity status was not affecting their physical fitness. So the age-matched values were revealing a positive correlation between obesity and physical fitness.

When the correlation between obesity and energy expenditure was calculated, it was found that in girls there was significant positive correlation in the girls whereas there was no correlation existing between the energy expenditure during walking and obesity in boys. The reason for this might be because the boys who were found to be overweight/obese were in the wide range of age and hence their height and other physical features might have affected the values of EEI and hence the correlation was not established.

*Conclusion:* Prevalence of obesity was found to be less as compared to the urban population of other studies. There was positive correlation found between obesity and physical fitness in both the genders. Energy expenditure was not related with obesity in boys but there was high correlation found in girls.

Further research can be done with equal gender distribution and in comparison with the urban population.

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**Conflict of Interest None Declared**