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A comparative study of body mass index between children of government school

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Abstract

The purpose of this study was to compare the body mass index among the different age groups boys and girls of government school. A sample of two hundred ten boys and girls were randomly chosen. All the subjects were from government school and age was between 10- 17 years. All the subjects were divided in seven age groups i.e. 10-11 years, 11-12 years, 12-13 years, 13-14 years, 14-15 years, 15-16 years and 16-17 years and from each group fifteen boys and girls were randomly selected. All the subjects in present study were tested with their height, weight and finally Body Mass Index (BMI) of each subject was obtained. Weight was measured in kilograms & portable weighing machine was used for this purpose. Height was measured in centimetres by stadiometer respectively. To compare the body mass index among different age groups and also to investigate the effects of gender on body mass index Two Way Analysis of Variance (ANOVA) as a statistical technique were employed at the 0.05 level of significance. Further LSD post hoc means comparison was also used when F value was found significant in case of age. Finding of this study revealed that obesity significantly differ in all the age groups of boys and girls but no significant difference was observed between boys and girls. It was also very clear that all the boys of different age groups are in healthy weight zone but in girls age group 12-13 years falls in overweight as BMI is between 85th to less than the 95th percentile.

Keywords: Body mass index, height, weight, obesity

Introduction

The nature of our civilization has been changing slowly from active to more sedentary. While participation in regular physical activities in developed countries gradually increased during the '60s', '70s' & rarely '80s', it level off in the '90s'. In fact current studies found that today 60 percent of world adults are overweight and out of shape because of advance technology & wonderful labor saving devices.

In recent year's considerable attention has been given to the role of adiposity in the development of chronic diseases such as hypertension, diabetes & cardio vascular disease (Samarees, 1997). This is because increased body fat is accompanied by profound changes in the physiological & metabolic functions of the body, which are directly dependent on the degree of excess weight & on its distribution around the body (WHO, 2000) ^[10].

Body mass index has been identified by the world health organization as the most useful epidemiological measures of obesity. It is nevertheless a crude index that does not take into account the distribution of body fat, resulting in variability in different individuals & populations (WHO, 2000) ^[10]. BMI is used as a screening tool to indicate whether a person is underweight, overweight, obese or a healthy weight for their height. If a person's BMI is out of the healthy BMI range, their health risks may increase significantly. BMI values are age-independent and the same for both sexes. The BMI is a statistical measurement derived from your height and weight. Although it is considered to be a useful way to estimate healthy body weight, it does not measure the percentage of body fat. However, in general, the BMI measurement can be a useful indicator for the 'average person'. The BMI equation (BMI = Body Mass Index) was originally framed by Adolphe Quetelet, a Belgium mathematician and scientist, between 1830 and 1850. Adolphe was the first person to think of relating weight to height in a statistical, expressible manner. The BMI is generally used as a means of correlation between groups related by general mass and can serve as a vague means of estimating adiposity.

Moreover, BMI does not necessarily reflect the changes that occur with age. The proportion of body fat increases with age, whereas muscle mass decreases, but corresponding changes in height, weight and BMI may not reflect changes in body fat and muscle mass. Additionally, the relation between BMI and percentage of body fat is not linear and differs for men and women. So here in this study the BMI variable i.e. height and weight are tested on two different schools. In adults, there is a consensus on the definition of overweight and obesity (WHO, 2000) [10]. Body mass index (BMI) at or above 25 kg/m² denotes overweight. BMI at or above 30 kg/m² are classified as obesity. There is no agreed definition on child and adolescent overweight and obesity. In children, BMI increases from birth until 1 y of age. Then BMI decreases until 5–9 y of age. The age at which the BMI begins to increase is the so-called adiposity rebound (Rolland, 1984) [7]. Therefore, it is necessary to have age- and gender-specific cutoffs of BMI for children and adolescents up to the age of 17 years (Cole, 2000) [2].

Objectives of the Study

- To investigate the BMI among the students of different age groups of government school.
- To find out the effects of gender on BMI.
- It will be find out the importance of BMI in daily life.
- The study will help every individual to know about their obese factors and how much it is.
- Coaches can also place the players on better positions according to player’s body type.

Methodology

A sample of two hundred ten boys and girls were randomly chosen. All the subjects were from government school and age was between 10- 17 years. All the subjects were divided in seven age groups i.e. 10-11 years, 11-12 years, 12-13 years, 13-14 years, 14-15 years, 15-16 years and 16-17 years and from each group fifteen boys and girls were randomly selected. All the subjects in present study were tested with their height, weight and finally Body Mass Index (BMI) of each subject was obtained by using formula.

$$BMI = \frac{\text{Body Weight in Kg}}{(\text{Height in Meters})^2}$$

Weight was measured in kilograms & portable weighing machine was used for this purpose. Height was measured in centimeters by stadiometer respectively.

Results

To compare the body mass index among different age groups and also to investigate the effects of gender on body mass index Two Way Analysis of Variance (ANOVA) as a statistical technique were employed at the 0.05 level of significance. Further LSD post hoc means comparison was also used when F value was found significant. The data collected was analyzed by using descriptive statistics and scores of different age groups of boys and girls with regards to body mass index is presented in table-

Table 1: Descriptive Statistics of the Data Measured Of Body Mass Index

Age	Gender	N	Mean	Std. Deviation
10-11 years	Boys	15	17.1209	3.09110
	Girls	15	16.7037	2.40096
	Total	30	16.9123	2.72776
11-12 years	Boys	15	18.1038	3.09974
	Girls	15	17.1302	3.15751
	Total	30	17.6170	3.11395
12-13 years	Boys	15	19.6125	4.39212
	Girls	15	22.0995	3.71590
	Total	30	20.8560	4.19264
13-14years	Boys	15	19.2462	2.75799
	Girls	15	21.3956	3.25585
	Total	30	20.3209	3.15983
14-15years	Boys	15	18.1681	2.43371
	Girls	15	21.8904	6.08876
	Total	30	20.0292	4.93357
15-16years	Boys	15	20.9716	2.10244
	Girls	15	20.9716	2.90323
	Total	30	20.6589	2.51080
16-17 years	Boys	15	20.8508	2.82439
	Girls	15	19.3755	2.80686
	Total	30	20.1132	2.86659
Total	Boys	105	19.6852	3.91582
	Girls	105	19.3170	3.48635
	Total	210	19.5011	3.70303

It is evident from Table 1 that the mean scores of 20.97 and standard deviation values of 2.10 of boys with age group 15-16 years was found to be highest in comparison to all the age groups. In case of girls mean scores of 21.89 and standard deviation values of 6.08 with age group 14-15 years was found to be highest in comparison to all the age groups. It is further very much clear that in boys body mass index was highest in age group 15-16 years and lowest in 10-11 years. Similarly in girls mass index was highest in age group 14-15 years and lowest in 10-11 years. The graphical representation of body mass index of different age groups boys and girls is presented in Figure-1.

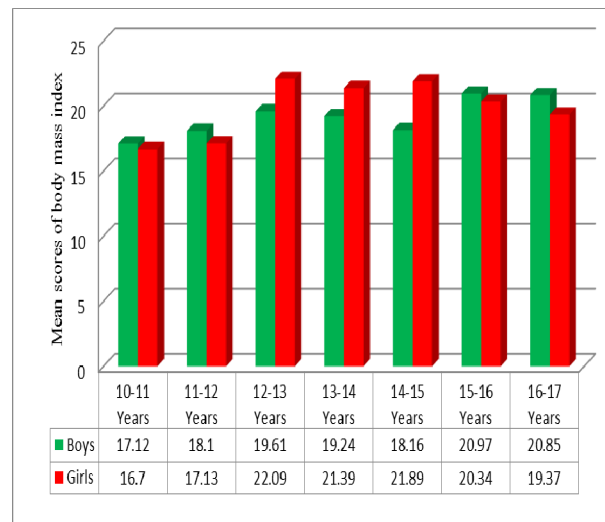


Fig 1: Graphical Comparison of the mean sores of body mass index between boys and girls of different age groups

Table 2: Two Way Anova for the Data on Body Mass Index to Different Age Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	442.609	6	73.768	6.540	.000*
Gender	7.118	1	7.118	.631	.428
Age *Gender	205.513	6	34.252	3.037	.060
Error	2210.658	196	11.279		
Corrected Total	2865.897	209			

Thus, it may be concluded from the table 2 that there was a significant difference in the body mass index of different age groups because the significance value is less than 0.05. The F-value is highly significant, indicating that age significantly affects the body mass index. There was no significant difference was found in gender and interaction at 0.05 level of significance. As significant difference was found in age, in order to know whether body mass index differs significantly among different age groups, a post-hoc analysis was done by using the least significance difference. The result of post-hoc analyses is shown in table-3.

Table 3: Post Hoc Comparison of Adjusted Post Test Means of Body Mass Index among Different Age Groups

10-11 years	11-12 years	12-13 years	13-14 years	14-15 Years	15-16 years	16-17 years	Mean Diff.	Std. Error	Sig. Diff.
16.9123	17.6170						-.7047	.86714	.983
16.9123		20.8560					-3.9437*	.86714	.000
16.9123			20.3209				-3.4086*	.86714	.002
16.9123				20.0292			--3.1170*	.86714	.007
16.9123					20.6589		-3.7466*	.86714	.000
16.9123						20.1132	-3.2009*	.86714	.005
	17.6170	20.8560					-3.2390*	.86714	.005
	17.6170		20.3209				-2.7039*	.86714	.034
	17.6170			20.0292			-2.4123	.86714	.085
	17.6170				20.6589		-3.0419*	.86714	.010
	17.6170					20.1132	-2.4962	.86714	.066
		20.8560	20.3209				.5351	.86714	.996
		20.8560		20.0292			.8267	.86714	.963
		20.8560			20.6589		.1971	.86714	1.000
		20.8560				20.1132	.7428	.86714	.978
			20.3209	20.0292			.2916	.86714	1.000
			20.3209		20.6589		-.3380	.86714	1.000
			20.3209			20.1132	.2077	.86714	1.000
				20.0292	20.6589		-.6297	.86714	.991
				20.0292		20.1132	-.0839	.86714	1.000
					20.6589	20.1132	.5457	.86714	.996

* Significant at 5% level.

It is clear from table 3 that, 10-11 years age group has significant differences with 12-13 years, 13-14 years, 14-15 years, 15-16 years and 16-17 years. Similarly 11-12 years age group has significant differences with 12-13 years, 13-14 years and 15-16 years, as p value of body mass index in all the above age groups was less than 0.05 and was found to be significant at 0.05 level of significance.

To assess which age group have higher body fatness. BMI-for-age weight status categories and the corresponding percentiles are shown in the following table 4 and table 5.

Table 4: Percentile of Body Mass Index of Boys for Different Age Groups

Age Group	Boys	Percentile Range	Weight Status Category
10-11 Years	17.12	50 th – 75 th Percentile	Healthy
11-12 Years	18.10	50 th – 75 th Percentile	Healthy
12-13 Years	19.61	50 th – 75 th Percentile	Healthy
13-14 Years	19.24	50 th – 75 th Percentile	Healthy
14-15 Years	18.16	25 th – 50 th Percentile	Healthy
15-16 Years	20.97	50 th – 75 th Percentile	Healthy
16-17 Years	20.85	25 th – 50 th Percentile	Healthy

Source: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, 2000.

Table 5: Percentile of Body Mass Index of Girls for Different Age Groups

Age Group	Girls	Percentile Range	Weight Status Category
10-11 Years	16.70	25 th – 50 th Percentile	Healthy
11-12 Years	17.13	25 th – 50 th Percentile	Healthy
12-13 Years	22.09	90 th – 95 th Percentile	Overweight
13-14 Years	21.39	75 th – 85 th Percentile	Healthy
14-15 Years	21.89	75 th – 85 th Percentile	Healthy
15-16 Years	20.34	50 th – 75 th Percentile	Healthy
16-17 Years	19.37	25 th – 50 th Percentile	Healthy

Source: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, 2000.

It is very clear from the table 4 that all the boys have healthy body weight because body mass index of all the boys lies between 5th percentile to less than the 85th percentile which is normal and healthy weight zone. Similarly table 5 states that girls of all the age groups having healthy body weight except 12-13 years age group. In age group 12-13 years BMI lies between 85th to less than the 95th percentile which is overweight zone.

Discussion

Overweight and obesity are usually multifactorial in origin. Obesity is a chronic disorder that has multiple causes. Overweight and obesity in childhood have significant impact on both physical and psychological health. In addition, psychological disorders such as depression occur with increased frequency in obese children. Overweight children are more likely to have cardiovascular and digestive diseases in adulthood as compared with those who are lean. Children are considered obese if they have a body mass index greater than or equal to the 95th percentile for their age (NCH, 2000). From the findings it was evident that obesity significantly differ in all the age groups of boys and girls respectively but no significant difference was observed between boys and girls. It was also very clear that all the boys of different age groups are in healthy weight zone but in girls age group 12-13 years falls in overweight as BMI is between 85th to less than the 95th percentile. It is because of the fact that boys engaged more in physical activity than girls. In all the age group of boys and girls body mass index are in normal range except 12-13 years girls age group. Our study also shows a higher prevalence rates of overweight among girls between the age group of 12 to 15 years. At the age of 12-13 years of girls, it is found that the body weight is notably high. This could be due to the composition of the sample, indicating that the chosen girls were comprised from different socio-economic levels. Due to this heterogeneity, it is possible that between this age group most of the girls were found overweight.

It may be due to the fact that majority of students in this private school are from middle class family and below middle class family. Most of students engage in physical activity during school and also after the school hours. School also provide adequate play time for students to improve their fitness and to provide a healthy lifestyle. Physical activity increases people's total energy expenditure, which can help them stay in energy balance or even lose weight, as long as they don't eat more to compensate for the extra calories they burn. These results are contrast with finding of study form Mumbai had high percentage of overweight children (22.9%) in private schools as compared to government schools. Physical activity levels increased during physical education classes, and fitness levels in girls improved as a result (Allis JF, 1997) [1]. It is interesting to note that, despite a significant increase in physical education class time, there was no interference with academic attainment, and some achievement test results improved. A recent review of the literature suggests that school-based physical activity programs may modestly enhance academic performance in the short-term, but additional research is required to establish any long-term improvements. There does not seem to be sufficient evidence to suggest that daily physical activity detracts from academic success (Taras H, 2005) [1]. Children can increase their physical activity levels in many other ways during school and non-school hours, including active transportation, unorganized outdoor free play, personal fitness and recreational activities, and organized sports. Parents of children in organized sports should be encouraged to stimulate their children to be physically active on days when they are not participating in these sports and not rely solely on the sports to provide all their away-from-school physical activity (Donnelly JE, 1996) [3].

Increases in sports participation and physical education time reduces obesity in children and helps to control body weight. Obese children are five times more likely to avoid participating in sports and other school activities and have

lower emotional, social, and school functioning (Schwimmer, 2003) [8]. Over all, the study shows positive results for this school boys and girls. It can be confirmed that this school boys and girls are not confronting with the obesity problem. Since obesity and other weight problems are not persistent, these boys and girls are less prone to developing complex medical health problems like diabetes, hypertension, coronary heart disease, or even colon cancer. Physical activity needs to be promoted at home, in the community, and at school, but school is perhaps the most encompassing way for all children to benefit. It is advisable to conduct a similar study on a large scale of Chandigarh private school to know the overall trends of obesity among the students of private school.

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