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A study of Body Mass Index in boys of 10-17 years in age

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Abstract

The study was conducted on a cross sectional sample of 228 children ranging in age from 10-17 years. Body weight, height was measured and Body Mass Index (BMI) was computed for each subject. The results indicate that BMI increased as age increased, except at the age of 12-13 years. On an average, it is found that the body mass index for 17-year-old boys was 20-25% greater than that of eight and nine year olds. Comparison of BMI values generated from the present study with those reported by *Cooper (1992)*, it is seen that the average BMI values of boys of the present study lie well below the health fitness zone (HFZ) limits. It is seen that for 10-13 year-olds, the percentage of subjects who fell below the HFZ limits ranged from 21-64%, with only 36-68% of subjects achieving the HFZ limits. Clearly, this indicates inadequate weight mass relative to height measurement, implying a very lean physique. Frequency of BMI values greater than 20 has been found to be very low in the present study. These results contrast those reported for American children, where obesity is clearly on the rise. The observation of underweight subjects in this study also poses a need for people to pay more attention to their health and what is being consumed. Over all, the study shows positive results for Punjabi boys. It can be confirmed that Punjabi boys at present are not confronting the obesity problem.

Key words: Endurance training, Resistance training, Functional capacity, VO_2max.

Introduction

The decline in physical activity as a result of modernization and industrialization has made the people prone to a number of debilitating diseases such as hypertension, obesity, coronary heart disease, diabetes etc. This has drawn the attention of health scientists to study the problem seriously and make efforts for the health promotion of the society. Some of the western countries have recognised the gravity of this situation. The United States of America (U.S.A.) began serious efforts in this direction in the year 1970 and their scientists are continuously engaged in helping its people change their life style to move towards a state of optimal health.

Modernization and industrialization has left great impact on the life styles of the people. This impact has shifted life style towards negative side more in which physical activity is declining. Nutriental intakes are going on increasing. In addition to this juicy food, fast food has taken the place of the essential food required by the body. Physical activity is declining day by day. According to *National Centre for Health Statistics (1994)*, obesity has been found at highest rates among poor and minority groups. *Natural Centre for Health (1994), Kuczmarski (1992), Piani and Schoenborn (1993), Williamson (1993),* have found that during the 1960s there was significant increase in obesity in westerns people. According to *Millar (1987), Laurier et al, (1992)* several

international comparisons have shown that westerns are among the heaviest people as compared to other people of the world.

According to *Gostmaker et al. (1987), Ross et al. (1987), Lohman et al. (1987)* National Surveys also reveal that a large number of western children and teenagers are obese.

Health fitness is a significantly scrutinized subject in the United States, and it is practical to compare this issue among young children and teenagers in India and the U.S.A. Just as the Body Mass Index serves as a key for people to follow and evaluate in the U.S.A., it is similarly used in India to determine the overall fitness of an individual. Across the world, people's habits are changing as technology is evolving more rapidly. This change of habit and how it affects the lifestyles of children, serves as a key issue when health fitness is studied. In order to learn about the health-related fitness of 10-17 year old Boys in India, the present study has been conducted.

Materials and Methods

The study was conducted on a cross sectional sample of 228 children ranging from 10-17 years old in age. These subjects were selected on a random basis from various educational institutes in the Patiala district of Punjab. It is known that children of this age are naturally active and can reach the apex of their fitness potential better and faster than adults can do so (*Shepard, 1978*). This is why it is more meaningful and significant to carry out health-related physical fitness tests on schoolboys of this age range. In addition, the national sports scene is mainly dominated by athletes from Punjab. This fact would also serve a greater purpose when comparing the fitness of males in Punjab to men from other developing countries. Due to the cooperation and high availability of school children, the success rate of the testing had been notably increased.

The subjects for this study were chosen from the following schools:

- V.H.R Senior Secondary School, Patiala
- Govt. Senior Secondary School, Ghanaur, Patiala
- Dudhial Khalsa Senior Secondary School, Patiala
- Dudhial Public School, Bishan Nagar, Patiala
- Govt. Primary school, New Power House Colony, Patiala
- Govt. Primary school, Deep Nagar, Patiala
- Govt. Senior Secondary School, Civil Lines, Patiala
- Govt. Primary School, Civil Lines, Patiala
- Little Flower Senior Secondary school, Patiala
- University Model School, Punjabi University, Patiala

Depending upon the date of birth and the date of the examination, the decimal ages of the subjects were calculated. The following table gives the classification of the subjects into yearly age groups along with the number of subjects (N) tested in each age group.

Age Range (years)	Mean Age (years)	N	SD	CV
9.500-10.499	10.00	26	0.25	6.08
10.500-11.499	10.96	28	0.28	7.93
11.500-12.499	12.12	26	0.26	6.96
12.500-13.499	12.87	28	0.30	8.97
13.500-14.499	14.04	30	0.28	8.03
14.500-15.499	14.94	29	0.31	9.76
15.500-16.499	16.00	31	0.28	7.85
16.500-17.499	16.93	30	0.29	8.47

Height and weight of the students were measured by using standard instruments and techniques. The portable weight machine was pre-calibrated and used to measure the body weights of the students. Anthropometeric rod was used to measure the height of the subject. The 2 meter rod consisted of 200, one centimeter divisions; these were further subdivided into 1 millimeter increments. This experiment was conducted by first distributing the cyclostyled Performa to the test subjects; this clearly stated the information used to determine and re-confirm their ages. Then, a field laboratory was established and the normal school boys, falling in the range of 10-17 years, were selected to obtain their heights and weights.

The heights of the subjects were measured by the anthropometric rod. This was done by determining the vertical distance from the horizontal floor to the vertex. The subject was asked to stand erect against a wall. Both of his heels were made to touch each other and the wall, with the toes at approximately 30^{o} apart. The subjects were also told to "stretch their bodies upward" and to keep their heads in a F-H plane. Then the anthropometric rod was held vertically in front of the subject in the mid saggital plane. The horizontal moveable arm of the anthropometer was brought down to the point vertex on the head. At this point, the height was recorded to the nearest millimeter.

In order to measure the exact weight of the subjects, it was important to make sure that they had minimal clothing (preferably a vest and short). The subjects were then told to stand erect in the center of the scale platform. At this point the weight was recorded to the nearest kilogram. The scale was checked before each weight was taken in order to make sure that scale had zero error when recording,

Body Mass Index (BMI) was computed for each subject using the following formula.

$$\text{BMI} = \frac{Weight}{Height^2}$$

Where weight is in kilograms and height is in meters.

The statistical computations were made by using a computer SPS package. The results were then cross-checked manually by using the statistical formulae.

Results and Discussion

Table 1 enlists the mean values of body weight among the boys 10 to 17 years of age.

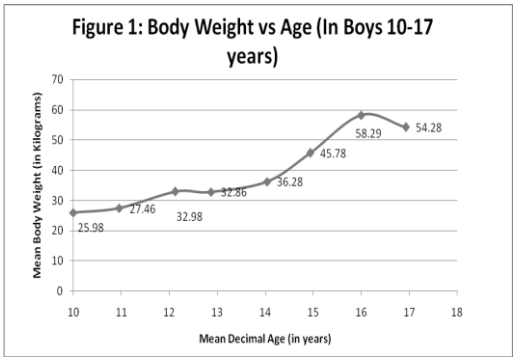
Table 1: Mean values of body weight (kg) of boys from 10-17 years of age

Decimal Age (years)	N	Mean	SD	C.V
10.05	26	25.98	4.06	16.51
10.96	28	27.46	4.37	29.05
12.12	26	32.98	4.59	21.03
12.87	28	32.86	3.96	15.70
14.04	30	36.28	4.79	22.97
14.94	29	45.78	6.08	36.93
16.00	31	58.29	8.31	69.13
16.93	30	54.28	8.33	69.30

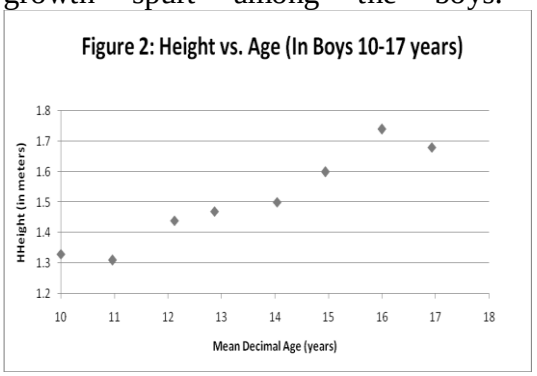
Table 2: Mean values of Height (m) of boys from 10-17 years of age

Decimal Age (years)	N	Mean	SD	C.V
10.00	26	1.33	.12	1.33
10.96	28	1.31	.14	2.04
12.12	26	1.44	.08	5.81
12.87	28	1.47	.09	8.27
14.04	30	1.50	.08	5.80
14.94	29	1.60	.10	9.31
16.00	31	1.74	.06	4.09
16.93	30	1.68	.06	4.11

The distance curve for body weight displays that the maximum weight gain (magnitude of 9.5kg-12.5kg) lies between the ages of 15 and 16 years (Fig. 1).



Generally, body weight is in fact the most frequently used single measurement in determining the growth and health status of children. From the graphical representation, it can be determined that weight continues to increase during the period from 10-17 years in these subjects. At 15 and 16 years of age, it is found that the body weight is notably high. This could be due to the composition of the sample, indicating that the chosen boys were comprised from different socio-economic levels. Due to this heterogeneity, it is possible that the differences in two peaks occurred due to the differences in the adolescent growth spurt among the boys.



In this study, it was important to note that these boys were consistently heavier by 2-3 kg than the results from a similar growth study that was conducted by *Giri (1990)*. In 2001, *Kaur* studied the health related fitness of Jat Sikh school boys in the age range of 9-12 years. *Kaur* also reported higher body weights in her study in comparison to the boys studied by *Giri (1990)*. The results related to body weight in the present study are in agreement with *Kaur's* findings. This is due to the difference in several factors such as dietary habits and life styles due to further development of technology in Punjab. It is thought that development in technology has reduced people's movement, which in turn has produced negative impact on the metabolic activity, resulting in weight gain in the boys tested. Parents are sending their children to schools in buses or using their own conveyance as compared to the earlier means like bicycles or walking to attend to the school activities. This probably has resulted in the decline in physical activity of the school going children. Although the body weight of the boys at all age levels has shown an increase over the years but a comparison with the body weight of American boys of similar ages reveal that Punjabi boys on an average are still much lighter than their American age peers.

It is interesting that the comparison of the stature of Punjabi boys from the present study with the boys studied by *Giri (1990)* produced almost comparable values from 8-11 years. After this age range, differences appeared. It is thought that a difference in growth spurts and

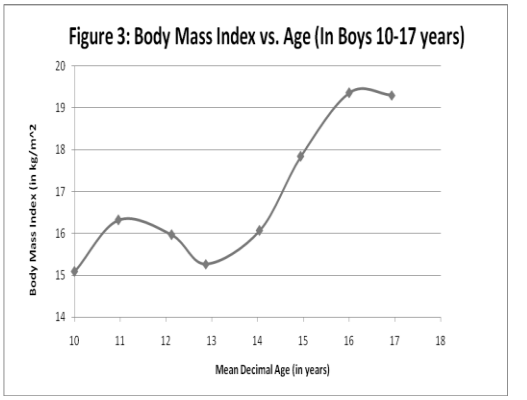
growth rates could be a major factor contributing to the dissimilarity between the two studies. At 18 year of age, the heights attained by the subjects of both the studies actually show comparable values, indicating no change in the final attainment of the adult stature. The differences in the rate of growth are understood and can be linked to the genetic and environmental factors.

BMI provides a relative comparison of a subject's weight and height. Even though measuring the BMI is more accurate than height/weight tables, BMI is also based upon the concept that a person's weight is proportional to his or her height. This technique is regarded to be fairly accurate for those individuals who do not have excessive muscles mass. This means that the BMI should not be used for athletes. This method should however be used for sedentary individuals who are not over active. Thus, BMI can provide relevant information regarding the prevalence of overweight/underweight trends in boys from the present study.

Table 3: Mean values of Body Mass Index (BMI) of boys from 10-17 years of age

Decimal Age (years)	N	Mean	SD	C.V
10.05	26	15.09	4.05	16.39
10.96	28	16.32	3.99	15.88
12.12	26	15.97	1.67	2.80
12.87	28	15.27	1.93	3.71
14.04	30	16.07	1.63	2.66
14.94	29	17.84	2.17	4.69
16.00	31	19.36	2.56	6.52
16.93	30	19.30	2.48	6.12

The table 3 enlists the results pertaining to this BMI index on Punjabi boys in the age range of 10-17 years.



The results indicate that BMI increased as age increased, except at the age of 12-13 years. On an average, it is found that the body mass index for 17-year-old boys was 20-25% greater than that of eight and nine year olds. By comparing the BMI values generated from the present study with those reported by *Cooper (1992)*, it is seen that the average BMI values of boys of the present study lie well below the health fitness limits. It is seen that for 10-13 year-olds, the percentage of subjects who fell below the HFZ limits ranged from 21-64%, with only 36-68% of subjects who could achieve the HFZ limits. Clearly, this indicates inadequate weight mass relative to height measurement, implying a very lean physique. Physiologically, this is unhealthy for these subjects. Young bodies need to prepare for intensive growth processes, and body systems need to prepare for the challenges faced by adolescent changes.

Ultimately, it is uplifting to note that the number of overweight individuals is decreasing, meaning that number of BMI values over 20 has been found to be very low in the present study. These results contrast those reported for American children, where obesity is clearly on the rise. The observation of underweight subjects in this study also poses a need for people to pay more attention to their health and what is being consumed. Over all, the study shows positive results for Punjabi boys. It can be confirmed that Punjabi boys are not confronting with the obesity problem. Since obesity and other weight problems are not persistent, these boys are less prone to developing complex medical health problems like diabetes, hypertension, coronary heart disease, or even colon cancer. This is not the case for their American peers.

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