Abstract

Impaired physical fitness and malnutrition are important causes of overweight and obesity across the age and gender groups. Moreover, the increasing incidence of obesity is associated with complications such as diabetes, cardiovascular diseases and hypertension and hence is a serious cause of concern especially among younger generations including adolescents. The present study has been conducted to understand the influence of body composition on physical fitness among adolescent girls in the age group of 16-19 yrs. 110 adolescent girls in the age group of 16-19 years were selected using purposive sampling technique. The participants were categorized as per their BMI WHO, into 4 groups; i.e. underweight (26.4%), normal (33.7%), Over-weight (10%) and obese (30%). They were assessed for anthropometric parameters (height, weight, waist circumference, hip circumference and waist to hip ratio), total body fat percent, physical fitness (aerobic capacity, muscular endurance and flexibility testing), and physical activity pattern. Highly significant difference was seen between the groups in the BMI, WHR and total body fat percent (p<0.01). There was a decrease in physical fitness with increased BMI. The study suggested a strong need to create awareness among the adolescents about the importance of regular physical activity and to maintain healthy body composition.

Keywords: Over-weight; Obesity; Mumbai; Impaired physical fitness; Medical complications; Adolescent girls; Body composition; Physical fitness

Introduction

Overweight is associated with multiple co-morbidities such as type-2 diabetes mellitus, dyslipidemia, polycystic ovarian syndrome, cardiovascular diseases, hypertension, cancer, and metabolic syndrome, which are increasingly becoming common among children and adolescents. Obesity has become a global problem even among younger generations, affecting many low and middle income people, particularly in urban areas. The problem is of larger magnitude in developing countries such as India where insignificant proportion of the population belongs to younger age group. The rising prevalence of obesity in India and around the world may be attributed to various factors, such as sedentary life-style, unhealthy food habits and lack of physical activity in addition to lack of awareness about the consequences of obesity. Ruiz et. al. [2] showed that sedentary lifestyle was highly prevalent among European adolescents. However, data on body composition and physical fitness of adolescents is sparse. Hence, the present study aimed at determination of the anthropometric parameters and physical fitness of urban Indian adolescents (16-19 years age) residing in the city of Mumbai.

Methodology

Hundred and ten (n=110) adolescent college going girls (16-19 years) belonging to middle- and upper middle income group and residing in the city of Mumbai were selected using purposive sampling technique.

Physical fitness of the participants was assessed using the following tests:

| Parameter Tested    | Test               | Protocol                                                                 |
|---------------------|--------------------|--------------------------------------------------------------------------|
| Cardiovascular fitness | 12-minute Cooper Test | Participants were asked to walk/jog on the treadmill for 12 minutes and the distance covered in those 12 minutes were recorded. This reading was used to calculate VO2 max. |
| Muscular fitness    | Push-up Test       | The participants were asked to do as many push-ups as they can and the number of push-ups done was recorded. |
| Flexibility         | Sit and Reach Test | Participants stretched their hands on the measuring tape which was extended through the table, keeping their feet flat on one of the side of the table |
Anthropometrical Parameters and Physical Fitness of College Going Adolescent Girls Residing in Mumbai

Body fat percentage was measured using Bioelectric Impedance Analysis method with the help of TANITA [BC-601] machine. The results of the test were compared with norms of adolescent population given by Lohman [3]. Anthropometric measurements including weight, height, waist circumference, and hip circumference were measured using weighing scale and measuring tape, and used to calculate waist-to-hip ratio and BMI. Physical activity pattern was also studied using the questionnaire which helped to understand their lifestyle. Data were analyzed using SPSS version 16.0 to study the association between various parameters recorded.

Results and Discussion

Overweight/obesity is a disorder of energy metabolism involving excessive adipose tissue stores, which may be associated with medical or psychosocial morbidity. The prevalence, as well as the severity of obesity in adolescents is increasing at an alarming rate around the world, making it one of the most serious health problems affecting this age group. Data obtained in the current study are presented and discussed below.

Anthropometric parameters & body composition

The BMI of the participants was assessed using the guidelines of WHO (2004) issued for Asians. According to their BMI, the participants were categorized into 4 groups; i.e. underweight (BMI-I.e. BMI < 18.5 kg/m²), normal (BMI-II, i.e. BMI < 22.9 kg/m²), overweight (BMI-III i.e. BMI = 23-24.9 kg/m²) and obese (BMI-IV i.e. BMI > 25 kg/m²). Data collected on the body composition has been presented below.

Surprisingly, almost equal number of participants was seen in normal, underweight and obese categories indicating the presence of both over and under nutrition. Subramanyam et al. [4] reported a 9.6% prevalence of overweight and 6% prevalence of obesity in 1981 to 1998 among adolescent girls between 10-15 years belonging to affluent families of Chennai. In contrast, the present study revealed an alarmingly high prevalence among the adolescent girls i.e. 33%

Both general and central adiposity was seen among the overweight and obese participants with significantly higher total body fat percent and WHR in (F=14.389, P=0.000 & F=4.363, P=0.006 respectively). Highly significant positive correlation of BMI was seen with WHR (R=0.519, P=0.000) and total fat percentage (R=0.296, P=0.002) across the groups. Central fatness using waist to hip ratio was also observed among UK children and adolescents in which the researchers made a quote that the waist circumference should be at least half than one’s height McCarthy & Ashwell [5]. Adolescent obesity leads to serious health complications such as higher ambulatory blood pressure and carotid artery structural alterations Stabouli et al. [6] and hence needs to be addressed. Moreover, overweight in adolescence is an indicator of overweight in adulthood and hence needs to be controlled at an early stage.

Physical Fitness

The physical fitness of the participants in terms of their aerobic capacity, muscular endurance and flexibility was assessed using 12-minute Copper test, push-ups and sit & reach tests. It was observed that the aerobic capacity was lower in all the participants across the BMI categories while muscular endurance and flexibility were much higher than reference values. Overweight and under-weight girls showed poor muscular endurance and flexibility than other groups. However, there was not much difference between aerobic capacities across the groups. Among the parameters tested, muscular endurance was highly positively correlated to aerobic capacity (R=0.258, P=0.007). Thus the data revealed poor respiratory fitness among all the participants which might be due to their sedentary life style (Table 1&2).

![Table 1: Anthropometric parameters & body composition of the participants with respect to their BMI (Mean ± SD)](https://example.com/table1.png)

| Body Composition | BMI-I | BMI-II | BMI-III | BMI-IV |
|------------------|-------|--------|---------|--------|
| Weight (kg)      | 41.5 ± 3.9 | 49.6 ± 5.2 | 58.5 ± 3.4 | 69.5 ± 10.6 |
| *Ref value (kg)  | 53.9-57.4 | 53.9-57.4 | 53.9-57.4 | 53.9-57.4 |
| Height (cm)      | 156.3 ± 4.4 | 155.9 ± 6.2 | 157 ± 4 | 152.1 ± 25.6 |
| *Ref value (cm)  | 162.6-163.3 | 162.6-163.3 | 162.6-163.3 | 162.6-163.3 |
| BMI (kg/m²)      | 17 ± 1.2 | 20.4 ± 1.3 | 23.7 ± 0.5 | 98.4 ± 400.5 |
| **Ref Value (kg/m²) | 20.5-21.6 | 20.5-21.6 | 20.5-21.6 | 20.5-21.6 |
| Waist to hip ratio (cm) | 0.8 ± 0.05 | 0.8 ± 0.04 | 0.9 ± 0.07 | 0.9 ± 0.05 |
| *Ref value (cm)  | 0.8 | 0.8 | 0.8 | 0.8 |
| Total fat percent | 21.4 ± 3.2 | 34.5 ± 3.4 | 33.3 ± 4.1 | 39.8 ± 7.2 |
| ***Ref value (%) | 20-30 | 20-30 | 20-30 | 20-30 |

*CDC (2000) [7]; **WHO (1997) [8]; ***Lohman (1986) [3].

Citation: Bhojani P, Mandalika S (2015) Anthropometrical Parameters and Physical Fitness of College Going Adolescent Girls Residing in Mumbai. J Nutr Health Food Eng 3(2): 00103. DOI: 10.15406/jnhfe.2015.03.00103
Table 2: Physical Fitness of the participants.

| Physical Fitness Parameters | BMI- I n=29 | BMI- II n=37 | BMI- III n=11 | BMI- IV n=33 |
|-----------------------------|------------|-------------|--------------|--------------|
| Aerobic capacity (kms)      | 1 ± 0.1    | 1 ± 0.2     | 1 ± 0.1      | 1 ± 0.1      |
| *Reference (kms)            | 1.8        | 1.8         | 1.8          | 1.8          |
| Muscular endurance (no. of push-ups) | 18.1 ± 10.5 | 17.7 ± 6.7* | 16.1 ± 8.8   | 18.7 ± 6.7*  |
| Reference (no of push-ups)  | 7.4        | 7.4         | 7.4          | 7.4          |
| Flexibility                 | 17.7 ± 7.4 | 21.1 ± 9.3  | 21.4 ± 6     | 21.3 ± 8.3   |
| Reference*                  | 35.2       | 35.2        | 35.2         | 35.2         |

*Ref: ACSM (2010)[9].

Conclusion

It was concluded from the results that both under nutrition and over nutrition were present among urban adolescents affecting their body fat percent while impairing their physical fitness. The study advises a serious change in the lifestyle of the adolescents in order to achieve optimum body composition and physical fitness.

Acknowledgement

The authors sincerely thank the participants.

References

1. WHO/FAO (2003) Diet, Nutrition and the Prevention of chronic diseases: Report of a joint WHO/FAO Expert Consultation. TRS 916, Geneva, USA.
2. Ruiz JR, Ortega FB, Gómez DM, Labayen I, Moreno LA, et al. (2011) Objectively Measured Physical Activity and Sedentary Time in European. American Journal of Epidemiology 1-12.
3. Lohman TG (1986) Applicability of body composition techniques and constants for children and youths. Exerc Sport Sci Rev 14: 325-357.
4. Subramaniam V, Jayashree R, Rafi M (2003) Prevalence of overweight and obesity in affluent adolescent girls in Chennai in 1981 and 1998. Indian Pediatr 40(8): 775-779.
5. McCarthy HD, Ashwell M (2006) A study of central fatness using waist-to-height ratios in UK children and adolescents over two decades supports the simple message--’keep your waist circumference to less than half your height’. Int J Obes (Lond) 30(6): 988-992.
6. Stabouli S, Kotsis V, Papatheodorou C, Constantopoulos A, Zakopoulos N (2005) Adolescent obesity is associated with high ambulatory blood pressure and increased carotid intimal-medial thickness. J Pediatr 147(5): 651-656.
7. http://www.cdc.gov/growthcharts/cdc_charts.htm
8. http://www.who.int/csr/don/archive/year/1997/en/
9. Thompson WR (2010) ACSM’s Resources for Personal Trainer, (3rd edn), Lippincott Williams & Wilkins, USA, pp. 274-306.