Research Article

# Study of body composition, VO$_2$max and blood pressure in young adults

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**Abstract**
**Background:** Cardiovascular Diseases (CVD) is on rise in the developing countries. Also it is known that obesity and sedentary life style which are the two most important modifiable factors which top the list of etiological factors for CVD. So, the current study was taken up in young adults who can be targeted for the modifiable factors of CVD. Methods: Both 80 male and 80 female students were included in the study. Their body composition parameters like Body Mass Index (BMI), Fat Mass (FM), Fat Free Mass (FFM) were measured along with their cardiorespiratory fitness indicator (VO$_2$max) and blood pressure measurements. **Findings:** The mean values for the body composition parameters in both the genders were near the normal range for their age. Also, the VO$_2$max was good in males and average in females. The mean blood pressure values were also normal for their age. **Interpretation:** Majority of the subjects were of near normal body composition. So, the knowledge regarding importance of maintaining fitness and preventing fatness at this stage will be an important step towards sensitization towards lifestyle disorders.
**Keywords:** Body Composition, VO$_2$max, CVD, Young Adults

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| **Quick Response Code:** | **Website:** www.statperson.com |
| | **DOI: 04 July 2014** |

## INTRODUCTION

Young people generally become overweight or obese because they don't get enough physical activity in combination with poor eating habits. Many studies link obesity with decreased cardiorespiratory fitness.[1, 2] Low cardiorespiratory fitness is a strong, independent risk factor for cardiovascular morbidity and mortality [3]. Therefore, the improvement of cardiorespiratory fitness is an important tool for the primary prevention of cardiovascular diseases. Maximal oxygen uptake (VO$_2$max) is the highest rate of oxygen consumption attainable during maximal or exhaustive exercise. VO$_2$max is internationally accepted parameter and is the first choice in measuring a person's cardiopulmonary status[4]. An above average VO$_2$max score indicates a healthy level of cardiorespiratory fitness and that an individual is fit to cope with the general demands of living. The evidence from longitudinal studies indicate that early identification of cardiovascular risk factors, particularly for body fat %, hypertension and cardiorespiratory fitness should be addressed as preventive measure in public health perspectives[3]. The studies on relationship among cardiorespiratory fitness, body composition and blood pressure in young adults are scanty in this area. Therefore, the aim of the present study is to study the relation of cardiorespiratory fitness with body composition and estimating blood pressure in collegiate population of Bharatividyapeeth Medical College Sangli.

## MATERIAL AND METHODS

This was a cross sectional study carried out in 160 students (80 males and 80 females) in bharatividyapeeth medical college sangli. The students were in the age group of 18 -22 years. Students with a history of smoking or alcohol were excluded from the study. Also, students with history of diabetes mellitus, asthma or hypertension were not included in the study as these factors affect the

cardiorespiratory fitness. The project was started after institutional ethical committee clearance. Resting pulse rate and Systolic and Diastolic blood pressures (SBP and DBP) were recorded with the help of mercury sphygmomanometer.

**Body composition:**
The body mass and stature for each subject were measured by using a weighing scale fitted with stature measuring stand.

BMI was calculated from the following equation: BMI $(Kg/m2)$ = (Body weight in Kg) / (Body height in meter) [5].

Percentage body fat (%BF) was calculated by a formula based on age, sex, race and BMI [6].

%BF= 63.7-[864 x (1/BMI)] - (12.1 x
 Sex) + (0.12 x age)
 + [129 x Asian x (1/BMI)] - (0.091
 x Asian x age)
 - (0.030 x African American x age)

Where sex = 1 for male and 0 for female; Asian = 1 and 0 for other races; African American = 1 and 0 for other races; age in years; BMI in kg/m².

 Fat mass (FM): It was calculated by the
 Following formula [6].
FM(kg) = Body Mass(kg) × (%BF ÷ 100)
 Lean Mass (LM):It was calculated by the
 following formula [6].
 LM (kg) = Body Mass (kg) – FM (kg).

**VO2 max** was measured by a standard bench stepping submaximal exercise, suitable for both sexes of adults [7]. Prior to the test the students were subjected to 5- minute warm up exercise. A wooden stepping bench of 16¼inch was used along with metronome and stopwatch. Metronome was used to monitor the stepping cadence which was set at 88beats per minute (22 complete steps per minute) for females and 96 beats beats per minute (24 complete steps per minute) for males. The subjects were asked to perform each stepping cycle to a four step cadence, up-up-down-down continuously for 3 minutes. After completion of test, subjects pulse rate was measured for 15 seconds, 5 to 20 seconds into recovery. Recovery heart rate was converted to beats per minute (15s HR x 4).

Following equation was used to estimate VO2max $(mL.kg^{-1}min^{-1})$

Males: VO2max = 111.33 - [0.42 x Step-test pulse rate $(b.min^{-1})$]

Females: VO2max = 65.81 - [0.1847 x Step-test pulse rate $(b.min^{-1})$].

Statistical Analysis was done by SPSS software by Z test.

## RESULTS AND DISCUSSION

Total 160 students (80 males and 80 females) of 1st MBBS were included in this study. Their body composition parameters were recorded followed by their blood pressure measurements and post step test heart rate for calculation of VO2max.

**Table 1:** Characteristics of the study population

|  | Gender | Mean | SD | z | P |
|---|---|---|---|---|---|
| Height(cm) | Male | 170.03 | 6.34 | 12.648 | 0* |
|  | Female | 158.11 | 5.56 |  |  |
| Weight(Kg) | Male | 71.93 | 16.22 | 5.063 | 0* |
|  | Female | 60.04 | 13.36 |  |  |
| BMI(kg/m$^2$) | Male | 24.81 | 4.99 | 1.089 | 0.278 |
|  | Female | 23.96 | 4.87 |  |  |
| Fat mass(kg) | Male | 16.28 | 7.87 | -3.068 | 0.003* |
|  | Female | 20.12 | 7.97 |  |  |
| FFM(kg) | Male | 55.66 | 8.61 | 13.533 | 0* |
|  | Female | 39.92 | 5.84 |  |  |
| VO$_2$max (mL/kg/min) | Male | 62.93 | 11.08 | 15.043 | 0* |
|  | Female | 39.46 | 8.49 |  |  |
| SBP(mmHg) | Male | 115.58 | 6.64 | 3.468 | 0.001* |
|  | Female | 112.00 | 6.40 |  |  |
| DBP | Male | 76.20 | 4.29 | 5.969 | 0* |
|  | Female | 71.80 | 5.01 |  |  |

*indicates P<0.05 which is statistically significant.

Table 1 show that BMI of male students is more than female students but the difference is not statistically significant. This may be due to the fact that the students are coming from various parts of the country with a different social background. We have used a modified World Health Organization (WHO) classification of BMI for our analysis. Mean BMI in both males and females are near the normal weight group (<25kgm-2). Table 1 show that height, weight, free fat mass, VO2max, SBP and DBP are significantly higher in males as compared to females. Also it shows that fat mass is significantly higher in females as compared to males. These gender differences are normal. The mean aerobic capacity of females is average and the mean aerobic capacity of males is good [8,9,10]. The mean blood pressure levels are in a normal range in all the subjects. In a prospective observational study by Duck-chul Lee *et al* it was seen that changes in both fitness and fatness were significantly associated with the development of hypertension, metabolic syndrome, and hypercholesterolemia in the healthy adults. The importance of this association needs to be stressed upon these budding health professionals so that they maintain their normal BMI and physical activity and prevent accumulation of fat mass. Persons who are physically fit maintain a more favorable caloric balance and lower body weights, both of which protect against the development of CVD risk.[3] Mechanisms suggested for such observations are reduced systemic vascular

resistance, decreased cardiac output, and decreased plasma noradrenaline concentrations[3].

## CONCLUSION

The subjects included in the study were found to have a borderline normal body composition, normal blood pressure and good cardiorespiratory fitness in males and average in females. Though obesity is known to be increasing in the younger group, awareness regarding a healthy lifestyle seems to be increasing to some extent. Such easy procedures to measure body composition parameters and VO$_2$max should be commonly used at school level by the physical education teachers so that the sensitization programme towards healthy lifestyle is implemented at the budding level.

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Source of Support: None Declared
Conflict of Interest: None Declared