International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Assessment of the Cardio-Respiratory Fitness in Young College Going Adults by 1 Mile Walk Test - An Observational Study

Rajkiran Tiku[1], Pawan Sharma[2], Bhumika Kaul[3]

[1]Student Researcher, Department of Physiotherapy, Singhania University, Jhunjunu, Rajasthan.
[2]Assistant Professor, Dr. DY Patil College of Physiotherapy, Pune.
[3]Lecturer, Dolphin (P.G) Institute of Biomedical & Natural Sciences, Dehradun.

Corresponding Author: Rajkiran.Tiku

Received: 28/07/2015 *Revised: 30/08/2015* *Accepted: 03/09/2015*

ABSTRACT

Study Objective: To assess & compare cardio-respiratory fitness in males and female using 1 Mile Walk Test (Rockport Test). Design: An observational study. Setting: The study was conducted at Singhania University, Department of Physiotherapy, Jhunjunu, Rajasthan.
Study Duration: Total time duration was of 6 months & 50 subjects were recruited and assessed during this period. Sample Size: The sample size of 50 (Fifty) subjects were divided into two groups- 25 males (Group A) & 25 females (Group B). Method: A total of 50 subjects were recruited for this study and a pre-participation evaluation was carried out to find the descriptive demographic data, history of any exclusion criteria and all were evaluated for the baseline data of Heart rate, Respiratory Rate, Blood Pressure, Body Mass Index (BMI) and Blood Pressure prior to starting of the Rockport Test.
Outcome Measures: VO_2 Maximum, Borg scale.
Results: The two-tailed Mann-Whitney U Test yielded p value 0.001, indicative of significant difference between the two groups. Group A VO_2 max score was significantly higher than that of Group B. The two-tailed Mann-Whitney U Test yielded p value 0.001, indicative of significant difference between the two groups. Group A Borg RPE score was significantly higher than that of Group B.
Conclusion: There was significant difference between the Cardio-Respiratory fitness in young college going males and females.

Key words: 1 Mile WalkTest (Rockport test), VO2 maximum, Borg Scale.

INTRODUCTION

Cardio respiratory fitness, sometimes called cardio, cardio endurance, aerobic fitness, or aerobic capacity, is one of the basic components of physical fitness. Cardio respiratory fitness is a condition in which the body's cardiovascular (circulatory) and respiratory systems function together, especially during exercise or work, to ensure that adequate oxygen is supplied to the working muscles to produce energy. [1]

Cardio respiratory fitness is needed for prolonged, rhythmic use of the body's large muscle groups. A high level of cardio respiratory fitness permits continuous physical activity without a decline in performance and allows for rapid recovery

following fatiguing physical activity. [1]

Physical fitness can be thought of as an integrated measure of most, if not all, the body functions (Skeletomuscular, Cardio respiratory, Hematocirculatory, Psycho neurological and Endocrine–Metabolic) involved in the performance of daily physical activity and/or physical exercise. Hence, when physical fitness is tested, the functional status of all these systems is actually being checked. This is the reason why physical fitness is nowadays considered one of the most important health markers, as well as a predictor of morbidity and mortality for cardiovascular disease (CVD) and for all causes. [2-5]

The gold standard for the measurement of cardio respiratory fitness is the maximal rate of oxygen uptake (VO2max). VO2max is the rate at which an individual is able to consume oxygen. It can be measured during indirect calorimetry in a maximal test, or can be estimated through different equations from the performance achieved in maximal or submaximal tests. The level of cardiorespiratory fitness is highly associated with the performance of other health-related fitness parameters in young people and in adults. [5]

Cardiorespiratory fitness is influenced by several factors including age, sex, health status, and genetics. It has been suggested that up to 40% of variation in the level of cardiorespiratory fitness is attributable to genetic factors. In children and adolescents, there is a positive association between objectively measured physical activity and cardiorespiratory fitness. [6-8]

Puberty and post puberty is the age when crucial changes take place in the body which determines the overall cardiorespiratory fitness of a person. In the last decades, several longitudinal studies in children and adolescents reported on the relationship between physical fitness-related exposures and the risk of developing an unhealthy cardiovascular or musculoskeletal profile later in life. Understanding whether low/high physical fitness in young people is a predictor of future disease/better health status would clarify the debate if physical fitness should or not be assessed in health monitoring systems. [9, 10]

Activities such as running, bicycling, swimming, cross-country skiing, rowing, stair climbing, and jumping rope place an extra demand on the cardiovascular and respiratory systems. During exercise, these systems attempt to supply oxygen to the working muscles. Most of this oxygen is used to produce energy for muscular contraction. Any activity that continuously uses large muscle groups for 20 minutes or longer taxes these systems. Because of this, a wide variety of training methods are used to improve cardio respiratory endurance. [11, 12]

Physical fitness is required not only by athletes for better performance, but also by non-athletes for maintenance of a healthy body and healthy mind fitness is generally considered to have five components: aerobic capacity, muscle strength, muscular endurance, flexibility, and body composition hence, when physical fitness is tested, the functional status of all these systems is actually being checked . This is the reason why physical fitness is nowadays considered one of the most important health markers, as well as a predictor of morbidity and mortality for cardiovascular disease (CVD) and for all causes in the recent decade. A decline in physical activity among college students has been observed recent studies indicate that almost half of the U.S. college student population does not participate in moderate or vigorous physical activity. [13-15]

S Koley et al. (2006) conducted a study in Amritsar, Punjab to see the difference between the Cardiorespiratory and other parameters in the collegiate

population & concluded that the populations which belongs to male gender and involved in the physical activity do have higher cardiorespiratory fitness and hence less chances of Cardio-Vascular disease. [16]

Peter et al. (2010) examined Trends in body fat, body mass index and physical fitness among male and female college students. A high physical fitness level in childhood and adolescence is associated with more favorable health-related outcomes, concerning present and future risk of obesity, cardiovascular disease, skeletal health and mental health, which highlights the need to include physical fitness testing in health and/or educational monitoring systems, vigorous physical activity (aerobic fitness) is closely associated with increase in maximum oxygen consumption (VO2max,ml/kg/min) previous researches examining aerobic fitness levels in African Americans had led to conflicting results. [17]

In the recent time lot of stress have been placed over the measurement of the cardiorespiratory endurance and different methods to measure the same have been devised. Some of the very commonly used tests are queens College Step Test, 1 Mile Jog Test, Bruce Test, Conconi Test, 1 Mile Walk Test/ Rockport Test and many more are in the line to join. 1 Mile Walk Test/ Rockport Test have gained the popularity because of its user friendly, economic, feasibility, and easy calculations. [18]

Fewer studies have been conducted in India to see the gender based difference in the cardiorespiratory fitness and much useful information have been gained from them. The present study is also an attempt to understand how the gender and other such related factors affect the overall cardiorespiratory endurance of a person.

MATERIALS AND METHODS

A total of 50 subjects were taken for the study and assigned to the following groups depending upon gender-

Male Group & Female Group: consisted of 25 members each fulfilling the inclusion criteria that included willingness to participate in study & any gender between 18-25 years.

Sampling Method: Convenient Sampling. The subjects were allocated to different groups depending upon their gender.

Materials used in the study were Written Informed Consent Form, Assessment Form, Pulse Oximeter, Stop Watch, Even Ramp of 1.6 Km, Weight machine & Steadometer.

Group allocation: Depending upon the gender, subjects were allocated to either Group A or Group B.

Procedure: A pre-participation evaluation was carried out to find the descriptive demographic data, history of any exclusion criteria and all were evaluated for the baseline data of Heart rate, Respiratory Rate, Blood Pressure, Body Mass Index (BMI) and Blood Pressure prior to starting of the Rockport Test.

1 MILE WALK TEST (ROCKPORT TEST): [19,20]

1 Mile Walk Test (Rockport Test) is one of the most commonly used tools to measure the cardiorespiratory fitness of persons with sedentary lifestyle. It is used to assess the aerobic capacity of the normal subjects as well as of the patients having cardiac and respiratory disorders. In performing the Rockport Walking Test, 1 mile (1.6 Km) is walked (no jogging) as fast as possible on a level surface. The subjects were asked to wear appropriate clothing and shoes and perform 5-10 min light stretching before commencing the walk. It is important that an even pace be maintained throughout the walk, but that the pace is as fast as possible. A heart rate and Respiratory rate is obtained immediately at the end of the walk in sitting

position as well as the time for walking the 1 mile in minutes and fractions of minutes.

VO2max is computed using the formula- VO2max (ml/kg/min) = 132.853 – (0.0769*weight) - (0.3877 * age) + (6.315 * gender) - (3.2649 * mile walk time) - (0.1565 * ending heart rate)

Where: Gender = 1 for male, 0 for female
Weight = pounds, Mile walk time = minutes and fractions of minute (14:30 = 14.5 min).

RESULTS

The results of the presented study were assessed using SPSS version 16.0 (Trial Version) and Microsoft Excel. All 50 subjects completed the 1 Mile Walk Test and 2 assessment sessions. All the subjects completed the 1 Mile Walk Test, and there were no reports of study-related adverse events.

Table 1.1 Age Distribution of the Subjects in years

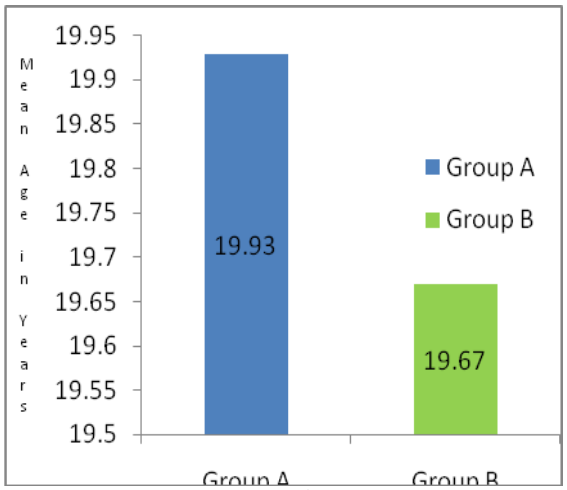
Group	Mean	±SD
Group A	19.93	1.28
Group B	19.67	1.91

Table 1.2: Weight in KG of the Subjects in KG

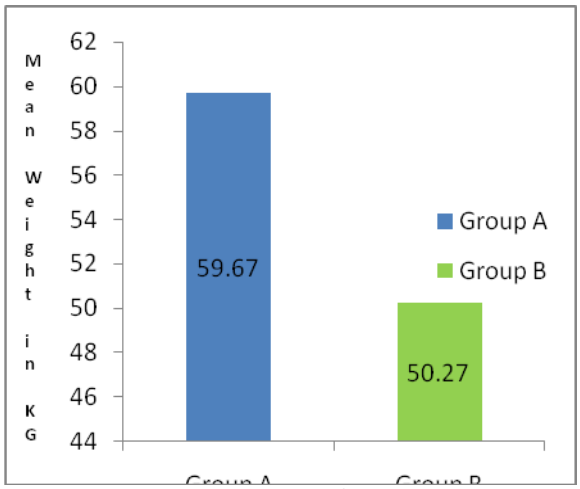
Group	Mean	±SD
Group A	59.67	8.449
Group B	50.27	11.847

Table 1.3: Height of the Subjects in cms

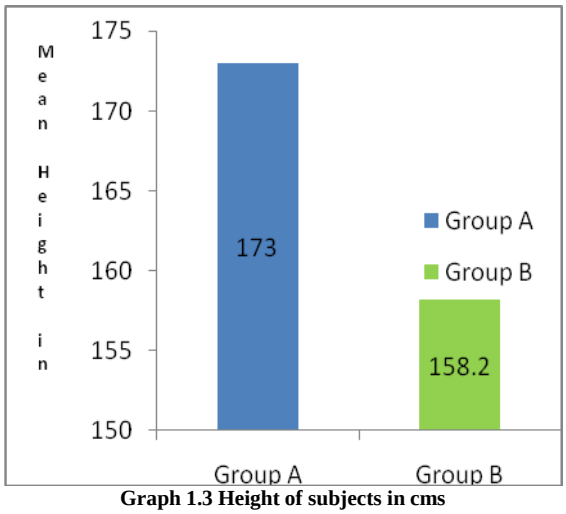
Group	MEAN	±SD
Group A	173	5.916
Group B	158.2	6.394



Graph 1.1 Mean Age of subjects in Years



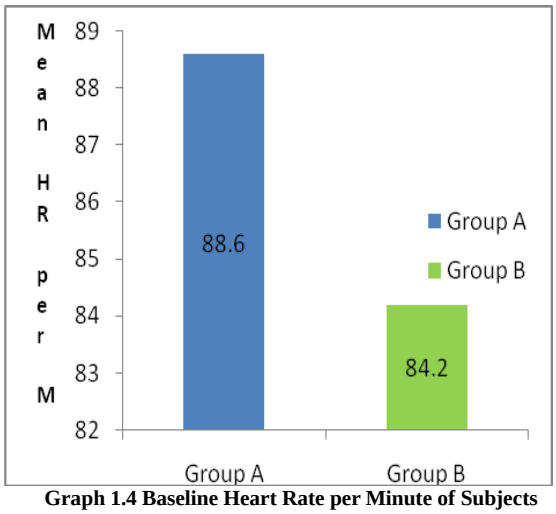
Graph 1.2 Weight of subjects



Graph 1.3 Height of subjects in cms

Table 1.4 Baseline Heart Rate per Minute of subjects

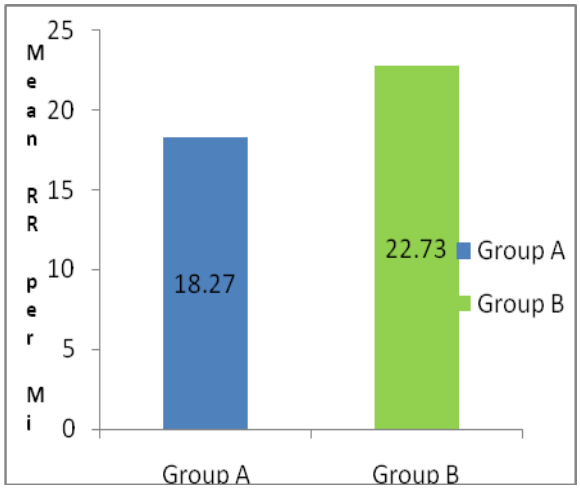
Group	Mean HR per Min	±SD
Group A	88.6	13.9
Group B	84.2	9.09



Graph 1.4 Baseline Heart Rate per Minute of Subjects

Table 1.5 Baseline Respiratory Rate per Minute of subjects

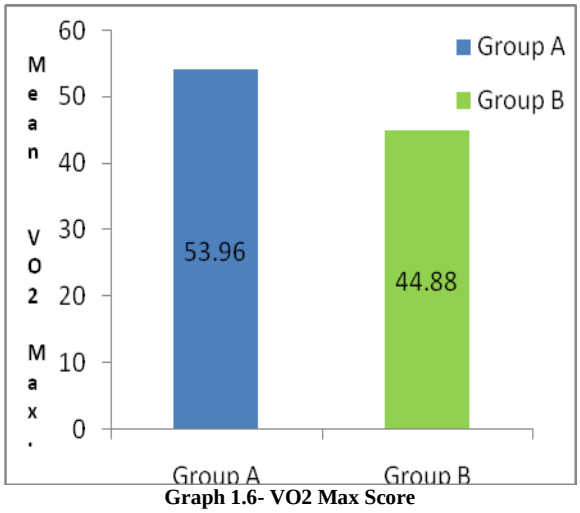
Group	Mean HR per Min	±SD
Group A	18.27	4.07
Group B	22.73	2.96



Graph 1.5 Baseline Respiratory Rate per Minute in Subjects

Table 1.6- VO2 max score of 50 subjects

GROUP	MEAN	MEDIAN	±SD	p VALUE
GROUP A	53.96	53.01	5.44	0.001
GROUP B	44.88	45.59	5.22	

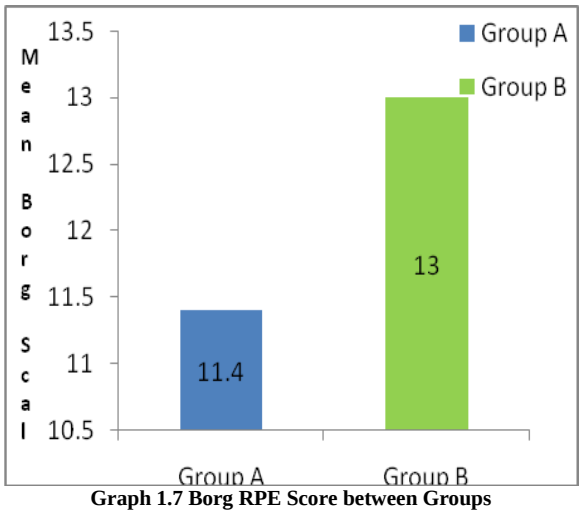


Graph 1.6- VO2 Max Score

Mann- Whitney U test was applied for between group comparison of Group A and B. Group A VO_2 score was significantly higher than Group B.

Table 1.7 Borg RPE score of 50 subjects

GROUP	MEAN	MEDIAN	±SD	p VALUE
GROUP A	11.4	11	1.68	0.001
GROUP B	13	13	1.41	



Graph 1.7 Borg RPE Score between Groups

The above findings suggest that there is statistically significant difference between the both the groups. Hence, Null hypothesis was rejected and it was concluded that there was significant difference between the Cardio-Respiratory in young college going males and females using 1 Mile Walk Test (Rockport Test).

DISCUSSION

The major finding of the study is that Group A is superior to Group B on VO2 Max and Borg Scale and hence are supposed to have better cardiorespiratory fitness than female population in the study.

The reason behind the difference in cardiorespiratory fitness among males and females is mainly due to physiological and anatomical variations in both the genders. Endocrine changes during puberty bring secondary sexual development, cognitive change, increases in growth velocity, and dramatic change in body composition. Several studies, using children and adolescents samples, have demonstrated differences between boys and girls in cardiorespiratory fitness, our results, by showing that girls had lower of VO2max than boys; seem to reinforce the mentioned studies. There was a negative effect of age

in VO2max, indicating that older adolescents seem to present lower values in cardiorespiratory fitness. The explanation for this trend may be that younger individuals tend to be more active and less inactive. In boys, removing the effect of %BF and the age by ethnicity interaction, a non-significant slope in the relationship of VO2max with age was positive, indicating that older boys presented higher values in VO2max, which again reinforces the results of other studies. The differences in VO2max with age may be due to the rapid decline in physical activity in girls during adolescence. Regarding body composition, the author indicates that the age is a factor that affects gender differences because; although differences in childhood exist they are stable, increasing in adolescence with boys presenting a gain of muscle and bone mass. [21-24]

Many such pieces of literature are available which focuses over the cardiorespiratory fitness difference among athletes of different gender. In the present study non athlete students or the students falling in the category of recreational players were included. The findings of the present study is similar to the one found by Bandyopadhyay et al. in which he concluded of males having better cardiorespiratory fitness than females. Same were the findings of Fox et al., 1973; Das and Bhattacharya, 1995; Kline et al., 1987; Mcardle et al., 1972. But the values of VO2max obtained in both sexes is comparatively low indicating that the studied population have lower aerobic capacity and poor physical fitness in respect to Caucasians, Kurds, Yemenites, Europeans, Africans, Japanese, young population of Denmark and Americans. [25-28]

Measurement of the maximum amount of oxygen your heart and lungs can deliver to your working muscles. It is the best way to judge a person's cardiovascular fitness. For men and women, VO2 max differs. Absolute VO2 max is, on average, 40 percent greater in a man than a woman, according to the book "Exercise Physiology" by Brooks, Fahey and Baldwin. Even when measuring relative difference, when taking into account body weight, men have a 20-percent greater VO2 max. [29]

The whole of the study suggest that males stand superior to females in regard of cardiorespiratory fitness despite of following equivalent daily routine and not being involved in any sort of sporting activity. The human physiology plays a crucial role in producing such changes.

CONCLUSION

All the subjects were similar at the baseline in terms of vitals and other parameters. After completion of 1 mile walk test all the subjects were assessed for their VO2max and Rate of Perceived Exertion (RPE) on Borg scale. There was statistical significant difference between the above mentioned parameters. Thus, it can be concluded males stands superior to females in terms of cardiorespiratory fitness.

Conflict of interest: We declare that there were no conflicts of interest in the entire journey of the study.

REFERENCES

1. Jourkes, Sadri et al. Determination of fitness level in males and females college aged students. *Archives of Applied Sciences Research*, 2011, 3(2); 326-333.
2. Blair SN, Kohl III HW, Paffenbarger Jr RS, Clark DG, Cooper KH, Gibbons LW. Physical fitness and all-cause mortality. A prospec- tive study of healthy men and women. *JAMA* 1989; 262: 2395–2401.
3. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men

referred for exercise testing. N Engl J Med 2002; 346: 793–801.
4. Mora S, Redberg RF, Cui Y, Whiteman MK, Flaws JA, Sharrett AR et al. Ability of exercise testing to predict cardiovascular and all-cause death in asymptomatic women: a 20-year follow-up of the lipid research clinics prevalence study. *JAMA* 2003; 290:1600–1607.
5. Ortega FB, Ruiz JR, Castillo MJ, Moreno LA, Gonzalez-Gross M, Warnberg J, Gutierrez A (2005) [Low level of physical fitness in Spanish adolescents. Relevance for future cardiovascular health (AVENA study)]. Rev Esp Cardiol58, 898-909.
6. Andersen LB, Harro M, Sardinha LB, Froberg K, Ekelund U, Brage S, Anderssen SA (2006) Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study). Lancet368, 299-304.
7. Brage S, Wedderkopp N, Ekelund U, Franks PW, Wareham NJ, Andersen LB, Froberg K (2004) Features of the metabolic syndrome are associated with objectively measured physical activity and fitness in Danish children: the European Youth Heart Study (EYHS).Diabetes Care27, 2141-2148.
8. Gutin B, Yin Z, Humphries MC, Barbeau P (2005) Relations of moderate and vigorous physical activity to fitness and fatness in adolescents. Am J Clin Nutr81, 746-750.
9. Castillo-Garzon M, Ruiz JR, Ortega FB, Gutierrez-Sainz A. Amediterranean diet isnot enough for health: physical fitness is an important additional contributor to health for the adults of tomorrow. World Rev Nutr Diet2007;97:114-38.
10. Ruiz JR, Ortega FB, Meusel D, Harro M, Oja P, Sjöström M. Cardiorespiratory fitness is associated with features of metabolic risk factors in children. Should cardiorespiratory fitness be assessed in a European health monitoring system. The European Youth Heart Study. J Public Health2006; 14(2):94-102.
11. Sallis JF, Alcaraz JE, McKenzie TL, Hovell MF. Predictors of change in children'sphysical activity over 20 months. Variations by gender and level of adiposity. Am J Prev Med. 1999;16 (3):222-229.
12. Petersen L, Schnohr P, Sorensen TI. Longitudinal study of the long-term relation between physical activity and obesity in adults. Int J Obes Relat Metab Disord.2004;28(1):105-112.
13. Jolliffe CJ, Janssen I. Vascular risks and management of obesity in children and adolescents. Vasc Health Risk Manag. 2006; 2(2):171-187.
14. Must A, Strauss RS. Risks and consequences of childhood and adolescent obesity. Int J Obes Relat Metab Disord. 1999;23 Suppl 2:S2-11.
15. Schaefer F, Georgi M, Wuhl E, Scharer K. Body mass index and percentage fat massin healthy German schoolchildren and adolescents. Int J Obes Relat Metab Disord.1998;22(5):461-469.
16. S Koley et al. Association of Cardio respiratory Fitness, Body Composition and Blood Pressure in Collegiate Population of Amritsar, Punjab, India. The Internet Journal of Biological Anthropology. 2006;1:1.
17. Peter et el. Relationship between habitual physical activity and aerobic fitness in adolescents. Pediatr Exerc Sci. 2010;6:315-329.
18. Coleman R, Wilkie S, Viscio L, O'Hanley S, Porcari J, Kline G, Keller B, Hsieh S, Freedson P, Rippe J. Validation of the 1-mile walk test for estimating vo_2 in 20-29 year olds. *Med Sci Sports Exerc* 1987;19: Suppl. 2, 29.
19. Kline, G. M. et al. Estimation of VO2max from a one-mile track walk, gender, age, and body weight. Medicine and Science in Sports and Exercise, 19, 253-259, 1989.
20. Dolgener, F.A. et al. Validation of the Rockport Fitness Walking Test in College Males and Females. Research

Quarterly for Exercise and Sport, 65, 1994, 152-158., 1994.
21. Malina RM. Variation in Body Composition Associated With Sex and Ethnicity. In: Heymsfield S, Roche A, Lohman T, eds. Human Body Composition. Champaign, IL: Human Kinetics; 1996. 271-298.
22. Pate RR, Pfeiffer KA, Trost SG, Ziegler P, Dowda M. Physical activity among children attending preschools. Pediatrics 2004;114(5):1258-63.
23. Ortega FB, Tresaco B, Ruiz JR, Moreno LA, Martin-Matillas M, Mesa Jl, et al. Cardiorespiratory fitness and sedentary activities are associated with adiposity in adolescents. Obesity 2007;15(6): 1589-99.
24. Ekelund U, Franks PW, Wareham NJ, Aman J. Oxygen uptakes adjusted for body composition in normal-weight and obese adolescents. Obes Res 2004;12 (3):513-20.
25. Fox, E.L. 1973. A simple accurate technique for predicting maximal aerobic power. Journal of Applied Physiology, 35: 914-916.
26. Das, S.K., and Bhattacharya, G. 1995. A comparison of cardiorespiratory fitness in non-athletes and athletes of eastern India. Indian Journal of Physiology & Allied Science, 49: 16–23.
27. Das, SK. 1968. The maximum aerobic capacity of Gorkha soldiers. Indian Journal of Medical Research, 56: 1054-1062.
28. McArdle, W.D., Katch, F.I. and Pechar, G.S. 1972. Reliability and interrelationships between maximal oxygen intake, physical work capacity and step test scores in college women. Medical Science of Sports & Exercise, 4: 182–186.
29. Exercise Physiology: Human Bioenergetics and Its Applications 4th edition by George A. Brooks, Thomas D. Fahey and Kenneth Baldwin. McGraw-Hill Publishing Company, 2005.

How to cite this article: Tiku R, Sharma P, Kaul B. Assessment of the cardio-respiratory fitness in young college going adults by 1 mile walk test - an observational study. Int J Health Sci Res. 2015; 5(9):338-345.

****