

Effect of Chester's Step Test on Physical Fitness Index in Students of Age Group 18-25 Years

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ABSTRACT

Background: The physical fitness index measures the physical fitness for muscular work and the ability to recover from the work. The Chester Step Test (CST) assesses the physical fitness of individual. The present study was done to assess the physical fitness index using Chester Step Test in young adult in the age group of 18 to 25 years with varying degree of physical activity.

Objective: To determine the physical fitness index of individuals after performing Chester step test.

Materials and Methods: The study included 50 participants, 35 female and 15 male. They were asked to perform Chester's step test for the period of 4weeks and 5 sessions per week. The physical fitness index was calculated on the first and the last day of intervention.

Result: By applying Student's Paired 't' test there is a highly significant improvement in the average values of physical fitness index from pre to post Chester's Step Test. (i.e. $p=0.001$), in underweight participants the value of physical fitness index are 31.887 and post intervention is 66.59, where as in the normal BMI participants the value of physical fitness index are 32.620 and post intervention is 64.511 and in overweight participants the value of physical fitness index are 31.014 and post intervention is 52.322.

Conclusion: The study concluded that the sedentary life style, lack of sporting activities and over emphasis on academics leads to decreased physical fitness in students. A decreased in physical fitness has been noted in overweight students. Whereas the individuals who are physically fit has less heart rate variability. Thus regular physical activities are important to maintain physical fitness. Thus the study concluded that the physical fitness index was increased after the intervention but not up to the scores of physical fitness index because of the above mentioned reasons.

Keywords: Chester's step test, Physical Fitness Index,

INTRODUCTION

Physical fitness could be a state of health and well-being and, a lot of specifically, the ability to perform aspects of sports, occupations and daily activities. ^[1] The health is defined by WHO "as state of complete physical, mental, and social well-being and not merely the absence of diseases or infirmity". ^[2] Despite the wealth of knowledge on the importance of being physically active, the majority of students

live a sedentary lifestyle. A sedentary lifestyle is a type of lifestyle involving little or no physical activity. Typically this sedentary behaviour emerges between the ages to 17 to 27, when moderate and vigorous activity decreases or stops. This decrease in physical activity further leads to cardiovascular conditions as well as obesity, hypertension and decreased lung capacity at an early age.

Physical fitness implies not only the absence of disabling deformity or the capability to

perform a sedentary task expeditiously however also a way of physical well-being and also the capacity to deal with emergencies demanding unaccustomed physical effort. [3] There are many studies that have reported that individuals showing better cardio respiratory fitness have less abdominal fat or smaller waist circumferences. This is because cardio respiratory fitness is a marker for physical activity and its effect on energy balance. [10] There are many factors affecting physical fitness in individuals such as, injury, lack of physical activity, poor diet or nutrition, inconsistent sleep, dehydration and any serious injury will have an adverse effect on a student's physical fitness. When the body takes time to heal, it takes away opportunities to move and build strength, stamina and coordination, Poor diet/nutrition, poor rest/sleep, dehydration, psychological factors and mental health, lifestyles. [13] Physical activity relates to any movement created by the individual's skeletal muscles that end up in energy expenditure. Physical fitness is a set of attributes a person has or achieved, which is linked to the person's capability to do physical activity. [3] Physical fitness is a combination of many factors, including muscle strength, endurance, and coordination. Fitness is divided into many components like body composition, cardiovascular fitness level, flexibility, speed, power, coordination, balance, agility, muscular fitness, strength. Genetic variations, body designed and physical activity verify the general fitness levels of a individuals. Physical inactivity and hence obesity are major risk factors for ill health. Physical activity contributes positively to the prevention and management of over many chronic diseases, including cardiovascular diseases, pulmonary diseases, diabetes, cancer and mental health, healthcare professionals are being called upon to become more aggressive in implementing physical activity recommendations. The World Confederation for Physical Therapy

(WCPT) believes that with increasing numbers of people with diverse varieties of conditions leading sedentary lifestyles, it is essential to implement effective strategies for exercise across the lifespan. [8]

Premature mortality in terms of year of life lost because of cardiovascular diseases in India increased by 59%, from 23.2 million (1990) to 37 million (2010). [12] Evidence suggest that sedentary and negative life style habits lead to gradual deterioration of physical well-being and disability as well as incidence of cardiovascular diseases and cerebrovascular accidents. [2] The primary purpose of our study is to describe changes in the levels of physical fitness measured as estimation of maximum uptake of oxygen during a graded exercise (VO₂max). [9] With rapid urbanization, industrialization and increasing level of affluence, load of non-communicable diseases are increasing tremendously; WHO estimates indicates that globally physical inactivity accounts for more than one-fifth of all the ischemic heart diseases cases. The lack of physical activity and sedentary lifestyles in the young generation has been a matter of concern in recent days. [4]

The physical fitness index (PFI) measures the physical fitness for muscular work and the ability to recover from the work. [3] The Chester's step test (CST) was originally developed to assess aerobic fitness by predicting maximal aerobic power (VO₂max). It also features in commercial health and fitness assessment. [11] It was devised to assess the physical fitness of individual by determining the rate of recovery following intense exercise. [4] It comprises of stepping up and down a step which is 30cm (12inches) in height. Repeating the movements in the time with metronome. [3] The results revealed a high correlation($r=0.92$) between VO₂Max and CST1 ($P<0.001$) and a standard error of the estimate of 3.9ml O₂/kg/min, thus confirming the face validity of CST as a predictor of VO₂Max. [6,7]

MATERIALS AND METHOD

This was an experimental study which was conducted to evaluate the effect of Chester's step test on physical fitness index in students of age group 18-25 years. The subjects who meet the inclusion and exclusion criteria and willing to participate in the study were included. We had approached about 50 subjects out of which 35 were female and 15 were male. They participants were explained about the study and the evaluation procedure. The informed written consent form was collected from the participants. The inclusion criteria of the study were: 1) Age: 18-25 years. 2) Both male and female participants. 3) Students of Pravara Institute Of Medical Sciences, Loni. The exclusion criteria of the study were: 1) Student with Locomotors & Musculoskeletal disability. 2) History of Cardio respiratory disorder 3) History of Major surgery in past.

Procedure:

The study protocol was presented in front of protocol and institutional ethics committee of Dr. A.P.J. Abdul Kalam College of Physiotherapy, PIMS, Loni. The participants were screened and after finding suitability according to the inclusion and exclusion criteria, they were requested to participate in the study. They were explained about the study and the intervention. An informed written consent form, approved by ethical committee was given to the participants. The demographic data was collected and detailed assessment was done. A demonstration for using Chester's step test was explained to the participants. The participants were given warm up exercises that included stretching for larger group of muscles. The participants were given rest for 5 min in a chair. Resting pulse rate and saturation was measured in the resting position with pulse oximeter. The detail procedure was explained to the

subjects. After explanation subjects were told to perform Chester step test in a rhythmic manner & the data was recorded. At one, three and five minutes after the test, pulse rate was recorded as: 1) PR1– 1 min after exercise 2) PR2– 3 min after exercise 3) PR3– 5 min after exercise.

The participants were asked to start stepping up and down on the step bench in a rhythmic manner according to the beats on metronome. After 2 minutes of stepping the speed of metronome was increased according to the next stage. The step test can be immediately ceased if: The heart rate max reaches 80% at any point during testing, RPE = Moderately vigorous, i.e. 7+, Unable to maintain the pace of metronome, Applicant reports needing to stop

The Pre & Post readings were taken before & after the interventions. The interventions were given for 4 weeks and 5 sessions per week. The data was collected & analyzed by various statistical methods and results were obtained.

Outcome Measures:

Participants are assessed for baseline parameters which included Physical Fitness Index which was calculated before and after the intervention

Physical Fitness Index (Edward Fox Charles et al., 1973)

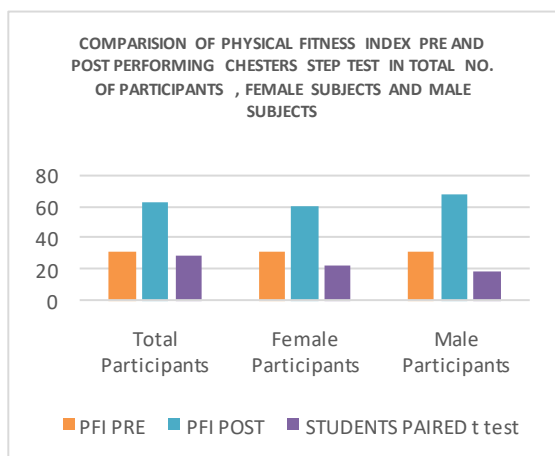
$$PFI = \frac{\text{Duration of exercise in seconds} \times 100}{2(\text{pulse } 1+2+3)}$$

DATA ANALYSIS AND RESULTS

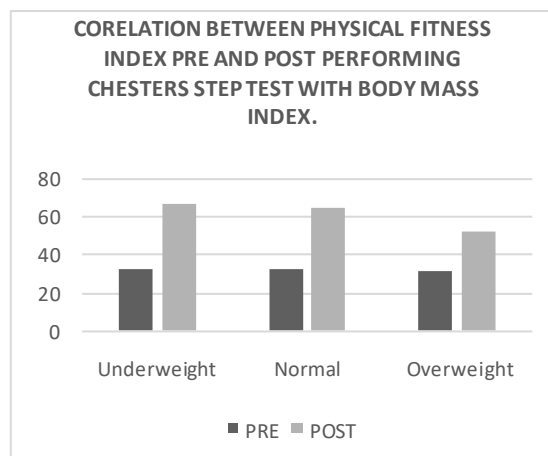
The data was entered into an excel sheet, tabulated and subjected to statistical analysis. Various statistical measures such as the mean, standard deviation, and student's paired "t" test of significance. Probability values less than 0.005 was considered statistically significant and probability values less than 0.0001 were considered statistically highly significant.

TABLE NO 1:- comparison of physical fitness index pre and post performing Chester's step test in total no. Of participants, female subjects and male subjects

	PHYSICAL FITNESS INDEX PRE MEAN \pm SD	PHYSICAL FITNESS INDEX POST MEAN \pm SD	STUDENT'S PAIRED 'T' TEST VALUE	RESULT
TOTAL PARTICIPANTS (n=50)	31.942 \pm 7.48	63.666 \pm 7.97	29.10	P=0.001 Highly Significant
FEMALE PARTICIPANTS (n=35)	32.341 \pm 7.62	61.543 \pm 7.71	22.53	P=0.001 Highly Significant
MALE PARTICIPANTS (n=15)	32.344 \pm 7.36	68.486 \pm 7.41	18.94	P=0.001 Highly Significant



GRAPH 1



GRAPH 2:

In this study mean value of physical fitness index pre- intervention is 31.942 with SD of \pm 7.48 and the post- intervention is 63.666 with SD of \pm 7.97 ($p < 0.0001$, $t = 29.10$). The mean value of physical fitness index in female participants pre- intervention is 32.341 with SD of \pm 7.62 and the post- intervention is 61.543 with SD of \pm 7.71 ($p < 0.0001$, $t = 22.53$). The mean value of physical fitness index in male participants pre- intervention is 32.344 with SD of \pm 7.36 and the post- intervention is 68.486 with SD of \pm 7.41 ($p < 0.0001$, $t = 18.94$). By applying Student's Paired 't' test there is a highly significant improvement in the average values of physical fitness index from pre to post Chester's Step Test. (i.e. $p = 0.001$).

TABLE NO 2:- Correlation between physical fitness index pre and post performing Chester's step test with body mass index.

Physical Fitness Index	Underweight	Normal	Overweight
Pre Mean \pm SD	31.887	32.620	31.014
Post Mean \pm SD	66.59	64.511	52.322

In this study the mean value of physical fitness index in underweight individuals pre- intervention is 31.887 and the post- intervention is 66.59 ($p < 0.0001$). The mean value of physical fitness index in individuals with normal BMI pre- intervention is 32.620 and the post- intervention is 64.511 ($p < 0.0001$). The mean value of physical fitness index in overweight individuals pre- intervention is 31.014 and the post- intervention is 52.322 ($p < 0.0001$).

DISCUSSION

The physical fitness in students is decreased due to lack of physical activities, sedentary lifestyle and over emphasis on academics. The present study evaluated the physical fitness of students using Chester's step test. There are four grades of physical fitness based on the scoring obtained after performing step test. The sample size of the study was 50 participants out of which 15 were male and 35 were female. The participant's physical fitness index was calculated on the first day after performing

Chester's step test. The participants were asked to perform Chester's Step Test for 4 weeks and 5 sessions per week. The outcome measure i.e. the physical fitness index was calculated after 4 weeks.

The present study is an interventional study done to enhance physical fitness in students within a period of 4 weeks whereas similar studies done previously have chosen stepping only to assess the physical fitness of the participants.

The result of the present study showed that there was highly significant change in the physical fitness index (i.e. $p=0.001$). This study shows that the physical fitness is inversely related to the BMI of the individuals. The physical fitness index in overweight participants as compared to that of the participants with normal BMI. The mean values of overweight and normal BMI participants are as follows, before intervention 31.014 and 32.620 and post intervention 52.322 and 64.511 respectively.

The present study showed the mean value of physical fitness index is lower in female as compared to that in male due to their lower body weight and height, muscle hypertrophy with improvement in strength is less in women. Reduced VO_2 max, metabolic responses to exercises, reduced O_2 carrying capacity which further leads to reduced cardio respiratory fitness.

The present study showed the recovery heart rate is increased in participants with normal BMI as compared to the overweight participants. Heart rate recovery (HRR) is the rate where the heart rate declines to the resting levels after an exercise performed, as it is explained earlier females have higher body fat percentage so there is decreased cardiorespiratory fitness. In females fat accumulates as total body fat and subcutaneous fat deposit. But it is different in males, as the fat accumulation occurs more in the intraabdominal area especially visceral adipose tissue. Overweight has a strong effect on the heart rate during recovery. HRR 1 min is due to vagal reactivation while HRR 2 min and

beyond is due to the combination of vagal drive reduction in sympathetic pathway and clearance of metabolites. The increased interest of HRR is its relationship with mortality.

The results of the current study were similar to a study conducted previously by Parmar D, Vaghela V. in which study was undertaken to assess the physical fitness index using Modified Harvard Step Test in young adult within the age group of 17 to 24 years with varying degree of physical activities. The study was done on 105 physiotherapy students and Physical Fitness Index was measured using Modified Harvard step test. This study concluded that physical activity is an important determinant and predictor of physical fitness. Pulse rate variability was minimum in subjects with excellent physical fitness and it was maximum in subjects who had poor physical fitness index.

Another study conducted by Zakiuddin et.al study was done to assess the physical fitness index using Modified Harvard Step Test in young adult in the age group of 19 to 28 years with varying degree of physical activity. The subjects selected for this study were medical students of first year MBBS course and physical fitness index was measured using Modified Harvard Step test. The findings of this study suggested that there is significant difference in physical fitness index or Harvard index in male and female medical students. Also there is significant difference in height and weight in males than females, so PFI affects by body size as evidenced in positive correlation between PFI with height and weight.

Several studies have established that physical fitness is necessary to carry out daily tasks. The regular exercise is known to have beneficial effect on health.

This study had certain limitations such as the sample size was small so results may not be similar when seen in a larger population. The intervention was given for duration of 4 weeks which is a very short duration to have significant changes in

physical fitness. There was only one outcome measure used to assess the physical fitness of individuals included in the study.

CONCLUSION

The study concluded that the sedentary life style, lack of sporting activities and over emphasis on academics leads to decreased physical fitness in students. A decreased in physical fitness has been noted in overweight students. Whereas the individuals who are physically fit has less heart rate variability. Thus regular physical activities are important to maintain physical fitness. Thus the study concluded that the physical fitness index was increased after the intervention but not up to the scores of physical fitness index because of the above mentioned reasons.

Limitation of Study:

- 1) The duration of the intervention was short
- 2) The sample size of the study was small.

ACKNOWLEDGEMENTS

Authors are thankful to all the participants who co-operated for the study and all those who directly and indirectly helped for the study.

Ethical Approval Ref. no.:

PIMS/CPT/IEC/2019/213/BPT/INT/2019/06

Source of Funding: The source of funding for study is self

Conflict of Interest: None

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How to cite this article: Potdar KP, Vardhan GDV. Effect of Chester's step test on physical fitness index in students of age group 18-25 years. Int J Health Sci Res. 2019; 9(10):183-188.
