

# Influence of height and weight on physical fitness index of amateur gymers of age 17 years

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## Abstract

**Background:** Physical fitness is a set of attributes a person has or achieve, which is linked to the person's capability to do physical activity. Harvard Step Test is a good measurement of fitness and a person's ability to recover after a strenuous exercise. Therefore, this study intends to provide accurate information about the influence of height and weight on physical fitness index.

**Methods:** The present study was conducted on 30 amateur gymers of 17 years of age and physical fitness index (PFI) was calculated by using Modified Harvard Step Test in which the step height was modified to 33cm. Based on height, the subjects were divided in 2 groups 1) Subjects having height >170cm and 2) Subjects having height ≤170cm. Also based on weight the subjects were divided in 2 groups 1) subjects having Wt ≤70 kg and 2) subjects having wt ≥70 kg. The physical fitness index calculated among both groups. Depending upon the score, Physical fitness index is graded as Excellent (>90), Good (80-89), High average (65-79). Low average (55-64) and poor (< 55). Statistical Analysis: Unpaired t' test of Microsoft excel 2007 was used for comparison between height and weight results. P-value less than 0.05 was considered as significant.

**Result:** Study shows that there is significant higher physical fitness score in subjects having height >170 cm than those subjects having height ≤170 cm. Also there is statistical high physical fitness score in subjects having weight ≥70kg than those subjects having weight ≤70kg.

**Conclusion:** The height and weight of subjects was found to be positively and significantly correlated to the PFI score. PFI was higher for subjects with ≥170cm height than for subjects with ≤170cm height. The reason lies in the short stature. The subjects with short height of ≤170cm has higher muscle fatigue. Similarly, in case of subjects with ≥70kg shows high PFI due to more weight to be lifted up during the stepping process.

**Keywords:** Harvard Step Test (HST), Modified Harvard Step Test, Physical Fitness Index (PFI).

## Introduction:

Physical activity relates to any movement produced by the individual's skeletal muscles that results in energy expenditure. Physical fitness is a set of attributes a person have or achieve, which is linked to the person's capability to do physical activity. Fitness is divided into health and skill related components, with the health component further consists of cardio respiratory endurance, muscular endurance, muscular strength, and flexibility. Several studies have shown that the effect of regular exercise is quite beneficial for the health of a being. About 3.3% of all deaths can be attributed to physical inactivity. The lack of physical activity and sedentary lifestyles in the young generation has been a matter of concern in recent days.[1,2] Exercise decreases systemic vascular resistance, in which the autonomic nervous system and renin-angiotensin system are most likely the underlying regulatory mechanism.

The Harvard Step Test (HST) was devised by Johnson et al to assess the physical fitness of individual. [3] It comprises stepping up and down a step, that is 20 inches (50.8 cm) high at a rate of 30 times/min. [4] The higher the fitness of an individual, less is the increase in heart rate and faster is the recovery. However, as the name suggests, the 20" step of the HST is tailored to western anthropometrics and is rather high for Indian, whose height is relatively less. Hence, the Harvard step would pose a greater exercise challenge to the Indian with average height. Therefore, the height of the step is

lower (16.5", i.e. 41 cm) in the modified HST that is used in India. [5] Application of Harvard step test in the physical performance capacity of an individual has aroused interest because of simplicity veracity of test.[6] But for Indians with short stature, it is felt necessary to modify HST and its physiological and anthropometric relations are yet to be explored.[7]

Number of Modified HST's had been recommended by a number of workers either by lowering step height or frequency of up-down per min or by altering duration of exercise instead of maximum period of 5 min and classify of score to categorize the physical fitness index (PFI). Several modified versions of the original Harvard step test exist; an example is the Tecumseh step test and the Sharkey step test was developed in the 1970s for use by the United States Forest Service at the University of Montana in Missoula. Therefore, the height of the step is lowered to (33 cm) in the modified HST for present study.

The aim of present study is to find the influence of height and weight on physical fitness index of teenagers. The objective of study is to perform Harvard step test for physical fitness index and to draw relationship between height and physical fitness index and weight and physical fitness index.

### Methods and material:

**Material:** Modified Harvard step bench= 33cm, stop watch, weight and height measurement machine, oximeter.

**Method:** This study was conducted on 30 teenagers amateur gymers of age 17 years. Students with a history of any cardiovascular disorder, diabetes mellitus, hypertension, bronchial asthma, alcoholism, smoking, major surgery or locomotor, and musculoskeletal abnormalities were excluded from the study and physical fitness index was calculated using Modified Harvard Step Test in which the step height was 33cm, based on height and weight the subjects were divided in two groups. Group 1) subject having height  $Ht < 170\text{cm}$  and  $Ht > 170\text{cm}$ . Group 2)  $Wt \leq 70\text{ kg}$  and  $wt \geq 70\text{ kg}$ . Depending upon the score, Physical fitness index is graded as Excellent ( $>90$ ), Good (80-89), High average (65-79) and Low average (55-64) and poor ( $< 55$ ). Statistical Analysis: Unpaired t' test of Microsoft excel 2007 was used to comparison of two groups. P value less than 0.05 was considered as significant Results.

### Physical fitness Index (PFI)

$PFI = \text{Duration of exercise in seconds} \times 100 / 2(\text{pulse } 1+2+3)$  Procedure: The Subject was advised to step up on the modified Harvard steps of 33cms height once every two seconds (30 per minute) for 5 minutes, a total of 150 steps. At one, three and five minutes during the test, pulse rate was recorded as

(a) PR1 (Pulse Rate 1) – 1 min after exercise.

(b) PR2 (Pulse Rate 2) – 3 min after exercise.

(c) PR3 (Pulse Rate 3) – 5 min after exercise

Depending upon the score, Physical fitness index is graded as Excellent ( $>90$ ), Good (80-89), High average (65-79) and Low average (55-64) and poor ( $< 55$ ). Statistical Analysis: Unpaired t' test of Microsoft excel 2007 was used to comparison of two groups. P value less than 0.05 was considered as significant Results:

**Table 1. Physical Fitness Index Rating**

PFI Rating	Grade
( > 90)	Excellent
( 80-89)	Good
(65-79)	High Average
(55-64)	Low Average
( < 55)	Poor

**RESULT :**

**Table 2: Age, height, weight and BMI of the subjects**

PARAMETER	MEAN ± SD
WEIGHT	70.04 ± 16.3
HEIGHT	170.05 ± 5.8
BMI	22.175 ± 4.4

It was observed that the height and weight were positively correlated to the score. Further, the students were divided into two groups (A and B) on the basis of their heights. As the average height of the subjects was 170 cm, this height (170cm) was used as the cut-off value for dividing the subjects in 2 groups. In group-A, students with heights <170 cm were included and in group B students with height ≥170 cm were included. The mean scores for both groups were calculated. Both groups were compared using *t*-test and *P* value was calculated. There was statistically significant difference between group A and group B ( Table-3). When the scores of groups A and B were compared the scores of group B were significantly higher than a group A

**Table 3. Mean±SD of fitness score of group A(<170 cm) and B (≥170 cm)**

Parameter	Ht≤ 170cm	Ht≥170cm	P - value
No. of subjects	010	20	
PFI	46.016±16.5088	71.1± 13.8165	< 0.01

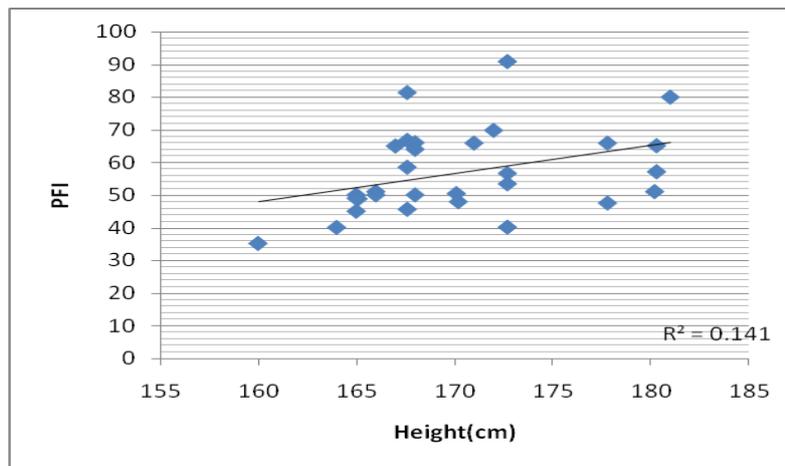


Figure 1 : Scatter plot between height and physical fitness index score

Similarly, the students were divided into two groups (A and B) on the basis of their weights. As the average weight of the subjects was 70 kg, this weight (70kg) was used as the cut-off value for dividing the subjects in 2 groups. In group-Aw, students with weight <70 kg were included and in group Bw students with weight ≥70 kg were included. The mean scores for both groups were calculated. Both groups were compared using *t*-test and *P* value was calculated. There was statistically significant difference between group Aw and group Bw ( Table-4). When the scores of groups Aw and Bw were compared the scores of group Bw were significantly higher than a group Aw.

**Table 4. Wt ≤70 kg and wt ≥70 kg**

Parameter	Wt≤ 70 Kg	Wt≥ 70 Kg	P - value
No. of subjects	19	11	
PFI	56.925±13.389	67.825±16.1579	< 0.5%

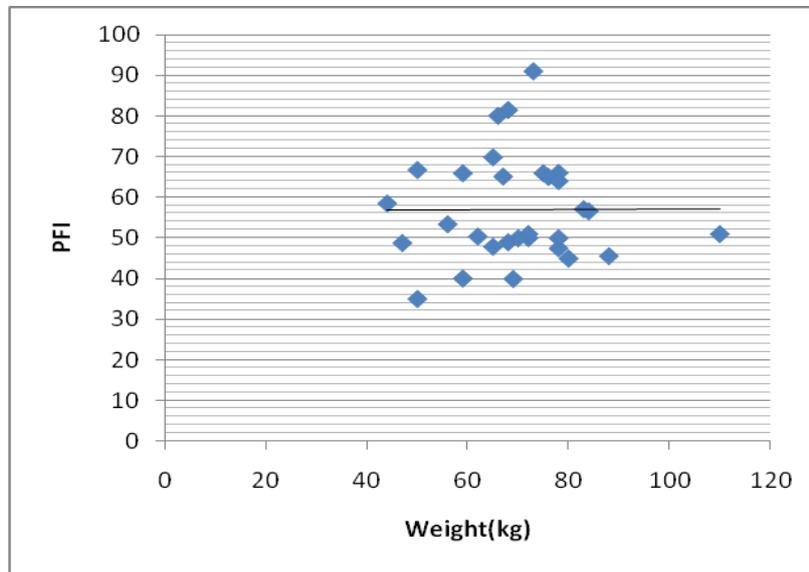


Figure 2 : Scatter plot between weight and physical fitness index score

**Conclusion:**

In the present study subjects were analysed for their height and weight and physical fitness index was calculated. The analysis shows that the PFI was higher for subjects with >170cm height. The reason maybe in short subjects with the height <170cm muscle fatigue is higher so taller people are at an advantage as it will take less energy to climb up on to the step while the lower height of the short people hinder the comfortable lifting up and lowering of their legs during the stepping process. This leads to the onset of premature fatigue in their legs.

Similarly, in case of subjects with >70kg shows high PFI due to more weight to be lifted up during the stepping process. This leads to the onset of premature fatigue in their legs. The higher the fitness of an individual less in the increase in heart rate and faster is recovery. Further studies are required to verify that the lower score in short and higher weight healthy subjects is due to muscle fatigue or due to cardio-respiratory impairment.

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