



## PHYSICAL FITNESS AND HEALTH RELATED PARAMETERS AMONG STUDENTS IN RELATION TO GENDER AND LIFESTYLE

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**ABSTRACT** Physical fitness is a state of health and well-being, most specifically ability to perform aspects of sports, occupations and daily activities. Health related parameters would identify risks factors and early screening of low physical activity would prevent various lifestyle diseases in the middle and old age. The main objectives were to compare physical fitness and health related parameters among male and female students and to analyse association of physical fitness with B.M.I and physical fitness with lifestyle. Methodology involved 240 subjects out of which 120 were males and 120 were females from schools/colleges. The physical parameters were age, weight and height. Health related parameters included Resting Pulse Rate (RPR), Breath Holding Time (BHT), 40mm Hg endurance test, Physical Efficiency Index (PEI), Cardiac Assessment Factor (CAF), Body Mass Index (BMI) and International Physical Activity Questionnaire. Association of physical fitness with BMI was significant at p value <0.001. Subjects with BMI >24.9 had 6 times more risk being physically unfit as compared to normal BMI. Association of Physical fitness with lifestyle was significant at p value <0.001. Subjects with MET score <600 have 15.5 times more risk being physically unfit as compared to normal MET score. There was significant increase in all the physical fitness tests in males as compared to female students, except RPR and BMI, that was more in female students. Physical fitness is associated significantly with lifestyle i.e. students with sedentary lifestyle are at more risk of being physically unfit than students who are physically active.

**KEYWORDS :** Physical Efficiency Index, Cardiac Assessment Factor, MET score, Physical Activity Questionnaire

### INTRODUCTION

Physical fitness can be defined as "a state of well-being with low risk of premature health problems and energy to participate in a variety of physical activity". Physical fitness (PF) is the ability of the circulatory and respiratory systems to adjust and recover from the effect of whole body exercise [1]. Later, PF was explained as a powerful health index and cardiovascular fitness its most relevant component [2]. Assessing physical inactivity prevalence and the health-related physical fitness in school children and adolescents is necessary for developing programs focused in promoting healthy lifestyle that includes regular practice of physical activity and improvement of dietary habits. These are important strategies to counteract overweight/obesity and its associated diseases [3]. A high physical fitness level in childhood and adolescence is associated with more favourable health-related outcomes, concerning present and future risk for obesity, cardiovascular disease, skeletal health and mental health which highlights the need to include physical fitness testing in health and educational monitoring systems [4]. The present study was undertaken with the aim to compare physical fitness and health related fitness among male and female students and to analyse association of physical fitness with B.M.I and physical fitness with lifestyle. It would further help to identify possible risks for health problems and early screening for low physical activity that could lead to lifestyle diseases in the middle and old age.

### MATERIALS AND METHODS

The present study was conducted on students representing different gender and lifestyle. **Selection Procedure of the Subjects** - The subjects (students) were selected randomly from schools/colleges. A total of 240 subjects, 120 males and 120 females were taken by random sampling technique by drawing lots from schools/colleges. These students belonged to three age groups i.e. 10-15 years, 15-20 years and 20-25 years.

### Inclusion Criteria:

Subjects were enrolled for the study after a thorough history taking and clinical examination. Apparently healthy students with sound mind having given a written consent to participate in the study were included.

### Exclusion Criteria:

History of Diabetes, Hypertension, Cardiopulmonary disease and any recent illness. History of any addiction. history of any inherited /acquired disorder, those having any physical disability and those on any medications.

1. Age in years
2. Weight in kgs
3. Height in cms

Physical and health related fitness parameters included: -

1. Resting Pulse Rate (RPR)
2. Breath Holding Time (BHT)
3. 40mm Hg endurance test
4. Physical Efficiency Index (PEI)
5. Cardiac Assessment Factor (CAF)
6. Body Mass Index (BMI)
7. International Physical Activity Questionnaire

### 1. Resting Pulse Rate (RPR):

The subject was made to rest in a lying down position for few mins. Then the radial pulse was counted for one minute by palpating the radial artery.

### 2. Breath Holding Time (BHT):

The subjects were asked to take a deep inspiration and then stop breathing. Nose clip was applied and lips were tightly closed so that no air could move in or out of lungs. Time for breath holding was noted in seconds with the help of a stop watch.

### 3. 40mm Hg endurance test:

For this test mercury sphygmomanometer was used. Cuff along with pump was detached from it. Subject was asked to blow into the rubber tube (joining the short limb of the manometer) after a deep inspiration and maintain the mercury column at 40 mmHg as long as he/she could. Time was noted with the help of a stop watch. It is a practical test of cardiovascular endurance and is used to distinguish between trained and untrained subjects [5].

### 4. Physical Efficiency Index:

Pulse count was taken from 1 to 1.5 minute after completing the exercise and physical efficiency index was calculated as per the formula [6].

$$PEI = \frac{\text{Duration of exercise in seconds} \times 100}{5.5 \times \text{pulse count (from 1 to 1.5 min after exercise)}}$$

This formula is the short form of Harvard step test. The score got is in arbitrary units and is based on duration of exercise and the rate of recovery of pulse.

### 5. Cardiac Assessment Factor CAF:

In this test, subject was asked to perform severe exercise i.e., very fast

The physical parameters noted for each subject were as follows: -

running till he/she will be exhausted. Then immediately after running, the heart rate was counted for one minute and CAF was calculated as per the formula [7].

$$CAF = \frac{\text{Max. Achievable Heart rate} \times 10}{\text{Basal Heart rate}}$$

**6. Body Mass Index (BMI):**

Body weight was measured without shoes and with light clothing using a mechanical weighing scale. Standing height was measured barefooted with light clothing using a stadiometer. From these parameters, BMI was calculated as per Formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m sq.)}}$$

Body mass index (BMI) was classified as: underweight - <18.5 kg/m<sup>2</sup>, normal - 18.5-24.9 kg/m sq, overweight/pre-obese - 25-29.9 kg/m<sup>2</sup> and obese - ≥30kg/m<sup>2</sup>.

**7. International Physical Activity Questionnaire:**

It was used for measuring the levels of physical activity. The physical activity was converted to metabolic equivalent score (MET scores) [8]. Based on the MET score, students were classified as: MET score <600 = Low physical activity, MET score 600- 3,000 = Moderate physical activity, MET score >3000 = High Physical activity

**Statistical Analysis:**

Data was presented with the help of appropriate tables and graph charts. Statistical analysis was done by Wilcoxon Rank Sum test (Z) and Chi-square test by using SPSS Microsoft version 22.

**RESULTS**

The present study was conducted on 240 subjects (students). The subjects were 120 males and 120 females. These students belonged to three age groups i.e. 10-15 years, 15-20 years and 20-25 years.

Table 1) Comparison of anthropometric measures of fitness among male and female students in the age group 10-15 years

Parameters	Gender	N	Mean (SD)	Wilcoxon Rank Sum test (Z)	P value
Height	Male	12	176.66(4.61)	4.20	<0.001
	Female	13	159.46(3.77)		
Weight	Male	12	72.75 (8.52)	2.78	0.005
	Female	13	64.00(11.57)		
BMI	Male	12	23.32 (3.00)	0.62	0.531
	Female	13	25.28 (5.37)		

The above table shows the Mean ± SD for height in males and females as 176.66 (4.61) and 159.46 (3.77), for weight as 72.75 (8.52) and 64.0 (11.57) and for BMI as 23.32 (3.00) and 25.28 (5.37) respectively in the age group 10-15 years. The difference between them is significant at p value < 0.001 for height and weight and non significant for BMI.

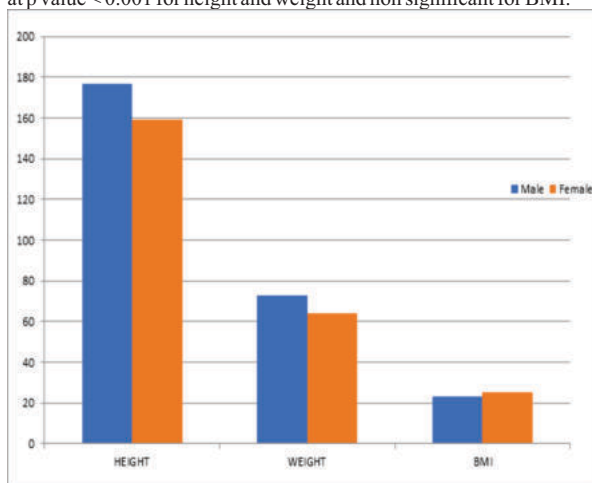


Fig.1) Bar chart showing comparison of anthropometric measures of fitness among male and female students in the age group 10-15 years

Table 2. Comparison of anthropometric measures of fitness among male and female students in the age group 15-20 years

Parameters	Gender	N	Mean (SD)	Wilcoxon Rank Sum test (Z)	P value
Height	Male	69	178.28(3.09)	10.30	<0.001
	Female	73	158.58(3.60)		
Weight	Male	69	73.56 (6.12)	6.59	<0.001
	Female	73	63.38 (9.44)		
BMI	Male	69	23.16 (2.19)	2.82	0.005
	Female	73	25.29 (4.13)		

The above table shows the Mean± SD of height is 178.28 (3.09) and 158.58 (3.60) , weight is 73.56 (6.12) and 63.38 (9.44) and BMI is 23.16 (2.19) and 25.29 (4.13) of male and female students respectively in the age group 15-20 years and the difference between them is significant at p value < 0.001 for height and weight and for BMI is significant at p value < 0.01.

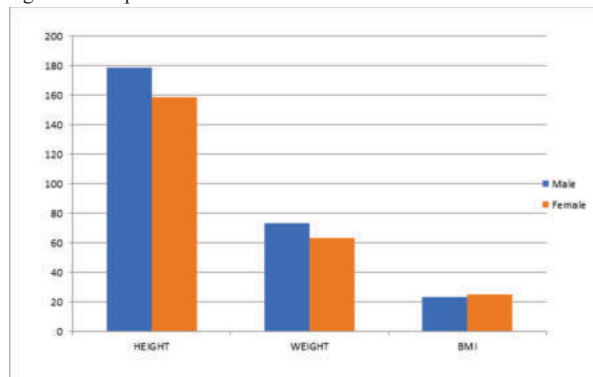


Fig. 2) Bar chart showing comparison of anthropometric measures of fitness among male and female students in the age group 15-20 years

Table 3.) Comparison of anthropometric measures of fitness among male and female students in the age group 20-25 years

Parameters	Gender	N	Mean (SD)	Wilcoxon Rank Sum test (Z)	P value
Height	Male	39	178.35(2.66)	7.35	<0.001
	Female	34	160.52(4.47)		
Weight	Male	39	75.61 (7.38)	4.93	<0.001
	Female	34	63.44(11.39)		
BMI	Male	39	23.78 (2.51)	0.24	0.808
	Female	34	24.72 (5.03)		

The above table shows the Mean ± SD of height is 178.35 (2.66) and 160.52 (4.47), weight is 75.61 (7.38) and 63.44 (11.39) and BMI is 23.78 (2.51) and 24.72 (5.03) of male and female students respectively in the age group 20-25 years. The difference between height and weight is significant at p value < 0.001 and that of BMI is insignificant.

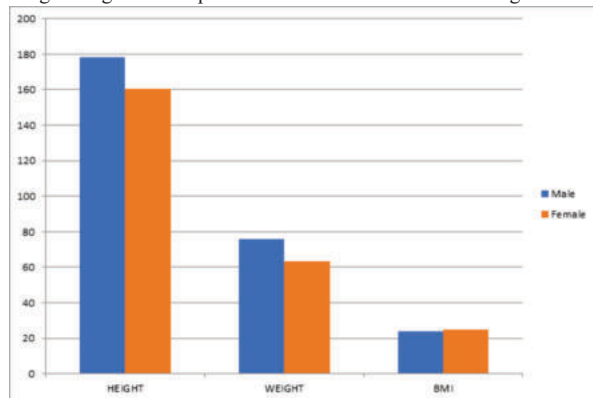


Fig. 3 Bar chart showing comparison of anthropometric measures of fitness among male and female students in the age group 20-25 years

Table 4) Comparison of physiological measures of fitness among male and female students in the age group 10-15 years

Parameters	Gender	N	Mean (SD)	Wilcoxon Rank Sum test (Z)	P value
Resting Pulse Rate	Male	12	72.83 (4.74)	1.80	0.072
	Female	13	77.00 (6.06)		

Breath Holding Time	Male Female	12 13	55.91 (2.93) 50.30 (5.70)	2.13	0.033
40mm Hg Endurance Test	Male Female	12 13	39.33 (4.33) 34.46 (5.45)	1.97	0.049
Physical Efficiency index	Male Female	12 13	86.83 (3.40) 82.76 (5.00)	1.91	0.05
Cardiac Acceleratory Factor	Male Female	12 13	25.53 (1.43) 21.46 (2.40)	3.72	<0.001
Metabolic Equivalent Score	Male Female	12 13	810.16 (92.24) 683.84 (123.05)	2.56	0.01

The above table shows the mean value in male and female students for RPR as 72.83 (4.74) & 77.00 (6.06), for BHT as 55.91 (2.93) & 50.30 (5.70), for 40mm Hg endurance test as 39.33 (4.33) & 34.46 (5.45), for PEI as 86.83 (3.40) & 82.76 (5.00), for CAF as 25.53 (1.43) & 21.46 (2.40) and for MET score as 810.16 (92.24) & 683.84 (123.05) respectively in the age group 10-15 years.

The difference is significant at p value < 0.05 for BHT, 40mm Hg endurance test and PEI; for MET score significance is at p value< 0.01; and for CAF significance is at p value< 0.001 level. RPR shows nonsignificant results among two groups.

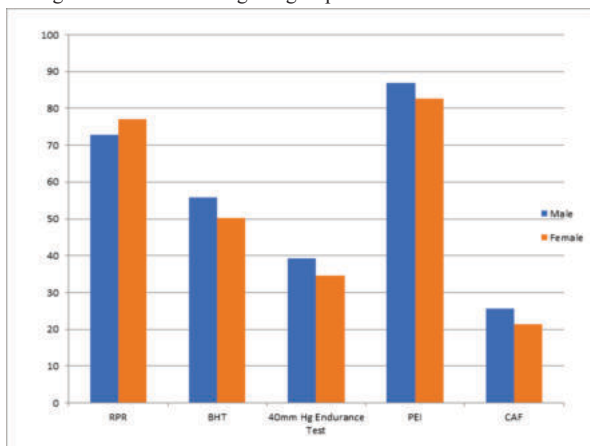


Fig.4a) Bar chart showing comparison of physiological measures of fitness among male and female students in the age group 10-15 years

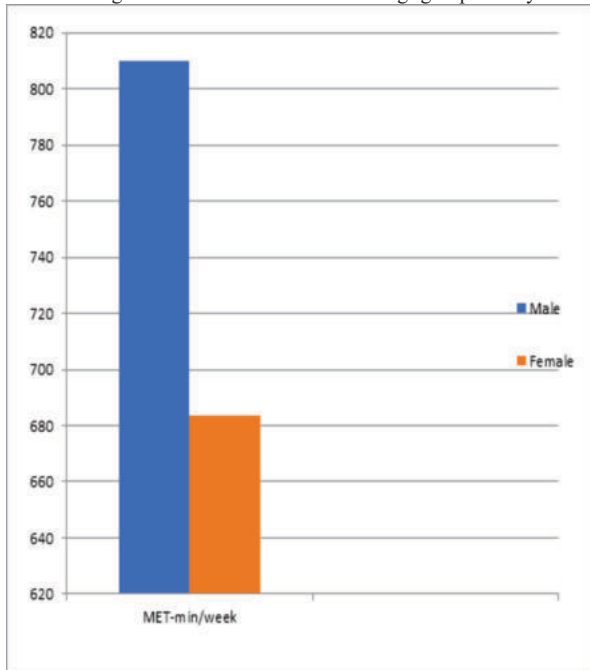


Fig 4b) Bar chart showing comparison of MET score among male and female students in the age group 10-15 years

Table 5. Comparison Of Physiological Measures Of Fitness Among Male And Female Students In The Age Group 15-20 years

Parameters	Gender	N	Mean (SD)	Wilcoxon Rank Sum test (Z)	P value
Resting Pulse Rate	Male	69	73.13 (4.73)	4.95	<0.001
	Female	73	78.36 (6.23)		
Breath Holding Time	Male	69	55.92 (2.59)	8.15	<0.001
	Female	73	48.35 (5.27)		
40mm Hg Endurance Test	Male	69	39.53 (4.38)	5.15	<0.001
	Female	73	34.21 (4.79)		
Physical Efficiency index	Male	69	86.86 (3.60)	5.23	<0.001
	Female	73	81.43 (5.39)		
Cardiac Acceleratory Factor	Male	69	25.05 (1.68)	7.81	<0.001
	Female	73	21.54 (2.27)		
Metabolic Equivalent Score	Male	69	807.24(104.32)	7.18	<0.001
	Female	73	655.75(114.30)		

The above table shows the Mean ± SD of RPR is 73.13 (4.73) & 78.36 (6.23), BHT is 55.92 (2.59) & 48.35 (5.27), 40mm Hg endurance test is 39.53 (4.38) & 34.21 (4.79), PEI is 86.86 (3.60) & 81.43 (5.39), CAF is 25.05 (1.68) & 21.54 (2.27) and MET score is 807.24(104.32) & 655.75 (114.30) of male and female students respectively in the age group 15-20 years. The difference between them is significant at p value<0.001.

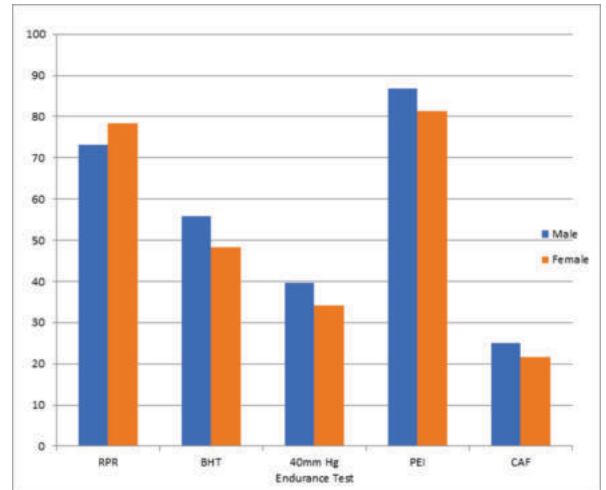


Fig. 5a) Bar chart showing comparison of RPR, BHT, 40mm Hg endurance test, PEI, CAF among male and female students in the age group 15-20 years

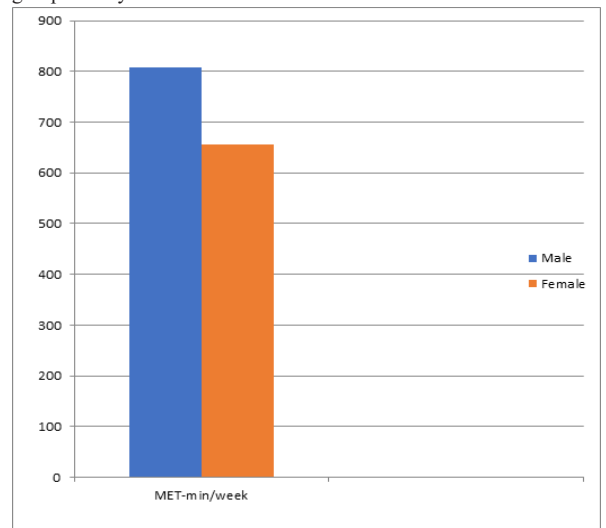


Fig. 5b) Bar chart showing comparison of MET score among male and female students in the age group 15-20 years

Table 6) Comparison of physiological measures of fitness among male and female students in the age group 20-25 years

Parameters	Gender	N	Mean (SD)	Wilcoxon Rank Sum test (Z)	P value
Resting Pulse Rate	Male	39	72.41 (4.56)	3.72	<0.001
	Female	34	78.41 (7.45)		
Breath Holding Time	Male	39	56.25 (2.99)	5.23	<0.001
	Female	34	49.79 (5.00)		
40mm Hg Endurance Test	Male	39	40.12 (4.60)	3.96	<0.001
	Female	34	34.05 (5.23)		
Physical Efficiency index	Male	39	87.20 (3.54)	3.99	<0.001
	Female	34	82.05 (4.68)		
Cardiac Acceleratory Factor	Male	39	25.30 (1.60)	5.82	<0.001
	Female	34	21.64 (2.30)		
Metabolic Equivalent Score	Male	39	793.79(115.32)	5.00	<0.001
	Female	34	639.02(114.31)		

The above table shows the Mean ± SD of RPR is 72.41 (4.56) & 78.41 (7.45), BHT is 56.25 (2.99) & 49.79 (5.00), 40mm Hg endurance test is 40.12 (4.60) & 34.05 (5.23), PEI is 87.20 (3.54) & 82.05 (4.68), CAF is 25.30 (1.60) & 21.64 (2.30) and MET score is 793.79(115.32) & 639.02 (114.31) of male and female students respectively in the age group 20-25 years. The difference is significant at p value < 0.001 among the two groups.

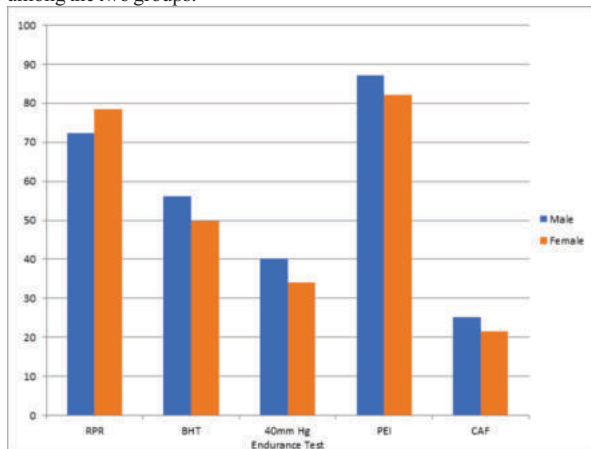


Fig. 6a) Bar chart showing comparison RPR, BHT, 40mm Hg endurance test, PEI, CAF among male and female students in the age group 20-25 years

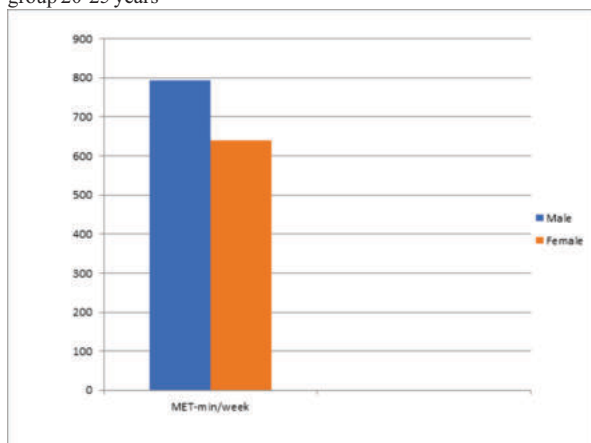


Fig. 6b) Bar chart showing comparison MET score among male and female students in the age group 20-25 years

Table 7. Association Of Physical Fitness With BMI

BMI	Physically unfit	Physically fit	Odds ratio	95% Confidence interval
>24.9	22	52	5.96	2.71-13.12
<24.9	11	155		

Chi-square value  $\chi(1) = 23.04$  (P <0.001)

Association of physical fitness with BMI is significant at p value <0.001. Subjects with BMI >24.9 have approximately 6 times more risk being physically unfit as compared to normal BMI (OR= 5.96).

Table 8. Association Of Physical Fitness With Lifestyle

MET-min/week	Physically unfit	Physically fit	Odds ratio	95% Confidence interval
<600	25	26	15.56	6.85-35.32
>600	11	178		

Chi-square value  $\chi(1) = 58.79$  (P <0.001)

Association of Physical fitness with lifestyle is significant at p value <0.001. Subjects with MET score <600 have approximately 15.5 times more risk being physically unfit as compared to normal MET score (OR= 15.56).

**DISCUSSION**

Body Mass Index (BMI) was found to be significantly higher in female than male students in age group of 15-20 years (p <0.05). Dave H et al., (2017) also observed that obesity and overweight levels were higher among males though physical activity was higher in male than female students. At the same time, though BMI was high in female students than male students in age group of 10-15 and 20-25 years but not statistically significant, may be due to small sample size [9].

In the present study, resting pulse rate (RPR) of females was significantly more than males (p <0.001) in the age group of 15-20 and 20-25 years. Our finding is in accordance with study by Aeschbacher S et al., (2015) who observed that females had higher RPR when compared to males [10].

In the present study, BHT was significantly higher in male than female students in all the three age groups (p <0.001). Similar results were seen in a study by. Dharwadkar AA et al., (2014) who observed decreased BHT in females than males before and after deep breathing sessions [11].

40mm Hg Endurance Test was significantly higher in males as compared to female students in all the three age groups (p <0.05). Similar results were seen in a study by Yadav N et al., (2015), where they observed higher values of 40mm Hg endurance test among males as compared to female students [12].

Physical efficiency index (PEI) significantly higher in male as compared to female students in all the three age groups (p <0.001). Similar results were seen by Babu KR et al., (2015), who observed higher PEI in males as compared to female students [13].

Cardiac acceleratory factor (CAF) was observed to be significantly higher in male as compared to female students in all the three age groups (p <0.001). Similar results were obtained by Al-Mallah MH et al., (2017) whose findings showed limitations in cardiac performance in females [14].

MET Score (MET- min/week) was recorded significantly higher in male as compared to female students in all the three age groups (p <0.001). Similar results were given by Kharche JS et al., (2014) where males showed statistically significant MET score as compared with female students [15].

Results obtained by Turkmen M et al., (2013) showed a positive relationship between levels of Physical Activity of university students with their lifestyle behaviours [16]. Males presented significantly higher physical fitness when compared to women, which is in accordance with study conducted by (Corseuil MW & Petroski EL, 2010) [17].

**CONCLUSIONS**

Physical activity increases cardio respiratory endurance as shown by changes in various tests of present study viz. RPR, BHT, 40mm Hg endurance test, PEI and CAF. Female students have lower physical and health related fitness when compared with male students. Low physical activity is seen more in female students as they show sedentary lifestyle than their male counterparts. Physical fitness is associated significantly with BMI i.e. students with normal BMI are at

low risk of being physically unfit than the students who are overweight and obese. Physical fitness is associated significantly with lifestyle i.e. students with sedentary lifestyle are at more risk of being physically unfit than students who are physically active.

**Conflict of Interest:** There is no conflict of interest.

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#### REFERENCES

- Dutt S. Health related physical fitness of boy's age 8-18 years. *J Exerc Sci Physiother* 2005; 1:12-22
- Ortega FB, Ruiz JR, Mesa JL, Gutierrez A, Sjostrom M. Cardiovascular Fitness in Adolescents: The Influence of Sexual Maturation Status. *Am J Hum Biol* 2007; 19: 801-8
- Andreas V, Michelin E, Rinaldi AE, Burini RC. Aptidão física associada às medidas antropométricas de escolares do ensino fundamental. *JPediatr* 2010; 86(6): 497-502
- Ortega FB, Ruiz JR, Castillo MJ. Physical fitness levels among European adolescents: The Helena study. *Br J Sports Med* 2011; 45(1): 20-9
- McArdle WD, Katch FI, Katch VL. *Exercise Physiology*. Lea & Febiger, Philadelphia 1981: 160-1, 191, 194
- Karpovich PV. Skeletal muscle. In Schneider EC (ed): *Physiology of Muscular activity*. 2nd edition WB Saunders Co, Philadelphia 1953; 4: 27
- Tuttle WW. Pulse-Ratio test for rating physical efficiency. *Res Quar* 1931; 2: 5-17
- Craig CL, Marshall AL, Bauman AE, Sjostrom M, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003; 35: 1381-95
- Dave H, Nimbalkar SM, Vasa R, Phatak AG. Assessment of physical activity among adolescents: A Cross-Sectional Study. *J Clin Diag Res* 2017; 11(11): SC21-4
- Aeschbacher S, Bossard M, Ruperti Repilado FJ, Good N, Schoen T, Zimny M, et al. Healthy lifestyle and heart rate variability in young adults. *Eur J Prev Cardiol* 2015; 23(10): 1037-44
- Dharwadkar AA, Bindu CB, Dharwadkar AK. A comparative study of Breath Holding Time as an index of Central Ventilatory Respiration in young healthy adults of both sex. *J Pharm Biomed Sci* 2014; 4(9): 806-1
- Yadav N, Shete A, Khan ST. Cardiorespiratory fitness in first year MBBS students. *In J Basic Appl Med Res* 2015; 4(3): 63-8
- Babu KR, Malge M, Sable MS, Pavani. Determination of Physical Fitness Index (PFI) with Modified Harvard Step Test (HST) in the male and female medical students of age 17-19 years. *IJSR* 2015; 4(6): 568-9
- Al-Mallah MH, Juraschek SP, Blaha MJ. Sex differences in cardiovascular function during submaximal exercise in humans. *Mayo Clin Proc* 2017; 91(6): 755-62
- Kharche JS, Ashok P, Robin GA, Balsubramanian. Gender differences in MET score and waist:hip ratio in young adults. *IJBAR* 2014; 5(7): 343-4
- Turkmen M, Kul M, Ocalan M, Ozkan A, Bozkus T. Determination of the Relationship between physical activity levels and healthy lifestyle behaviours of university students. *Aust J Basic & Appl Sci* 2013; 7(10): 507-12
- Corseuil MW, Petroski EL. Baixos níveis de aptidão física relacionada a saúde em universitários. *Rev Bras Educ Fis Esporte* 2010; 24(1): 49-54.