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Original research article

THE STUDY OF PFI USING CHESTER STEP TEST IN RELATION WITH BMI AMONG THE STUDENTS OF AGE GROUP 18-24 YEARS

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Abstract

Background: Physical fitness is key to a successful outcome. Physical fitness is directly related to the ability of an individual to perform physical activity or exercise. Physical fitness can be measured using cardiopulmonary efficiency tests such as the Physical Fitness Index (PFI %), which is an excellent indicator of cardiopulmonary efficiency. Body Mass Index (BMI) is often used as an indicator of obesity.

Aims and Objectives: The present study is aimed to assess the relationship between physical fitness index and BMI among the students of age group 18-24 years.

Materials and Methods: A cross-sectional study was done to assess the relation between physical fitness index and body mass index. A total of 150 subjects (80 males and 70 females) in the age group 18-24 years participated in the study. Descriptive data for age (years), height (m), and weight (Kg) were obtained and BMI was calculated. Physical fitness index (PFI) was measured using Chester's step test.

Results: Physical fitness index and Physical parameters like, mean height, weight, BMI were higher among male than female participants. Difference of weight, height, BMI and PFI among male and female were statistically significant. The study found negative association (r-value=-0.466) between BMI and physical fitness, which was statistically significant.

Conclusion: The results showed that the physical fitness index of the subjects differed significantly, with the subjects of normal weight possessing a higher fitness than the overweight/ obese subjects. Fitness index decreased progressively as the BMI increased.

Keywords: Physical fitness index, Chester step test, body mass index, young subjects

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Introduction

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" [1]. Physical & mental fitness are the key to such a successful outcome. Physical fitness is used in two closely related senses: a general state of fitness-health and well-being, and a task-oriented definition of fitness based on the ability to perform certain aspects of a sport or occupation. It is the result of regular exercise, proper diet and nutrition, and proper rest for physical recovery. Sedentary and negative life style habits lead to gradual deterioration of physical well-being and disability as well as incidence of cardiovascular diseases and cerebro vascular accidents. The prevalence of non-communicable illnesses is increasing due to fast urbanization, industrialization, and rising prosperity. Despite the wealth of knowledge on the importance of being physically active, the majority of students live a sedentary lifestyle. It is necessary to identify the status of physical fitness of medical students who are the future professionals of healthcare.

Many students during the course of medical education is subjected to different kinds of stressors predominantly the pressure of academics leading to the successful completion of the educational course, It is all too usual for students to neglect good diet and exercise habits in order to focus on their studies. The bad habits developed during this period persist until adulthood. It is important for medical students to have healthy habits as they are responsible for the future healthcare of the society, and should reflect what they preach. It is also observed that doctors are exposed to early risk factors of non-communicable illnesses [2]. Generally, medical students know more about healthy lifestyle and dietary habits when compared to other professional courses [3]. However, whether this information translates into practice in terms of preserving good health remains to be shown [3]. In this regard, there is a need to assess the physical fitness of our future doctors and to make them aware of adopting a healthy lifestyle right from the beginning of their career. There is 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 [4].

Physical Fitness Index (PFI) is one of the important criteria to assess the cardiopulmonary efficiency of a subject [5]. The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) recommended this test to study health related physical fitness programme in youth 4. Physical fitness is defined as ability to carry out daily tasks with vigour and alertness without undue fatigue with ample energy to enjoy leisure time pursuits, to meet unusual situations and unforeseen emergencies [6].

Physical Fitness Index (PFI) is measured by Chester's step test. The Chester's step test (CST) was originally developed to assess aerobic fitness. It also features in commercial health and fitness assessment [7]. It was devised to assess the physical fitness of individual by determining the rate of recovery following intense exercise [8]. It comprises of stepping up and down a step which is 30cm (12 inches) in height. Repeating the movements in the time with metronome.

The body mass index (BMI), or Quetelet index, is a measure of relative size based on the mass and height of an individual. The index was devised by Adolphe Quetelet during the course of developing what he called "social physics", between 1830 and

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1850. A frequent use of the BMI is to assess how much an individual's body weight departs from what is normal or desirable for a person of his or her height. The weight excess or deficiency may, in part, be accounted for by body fat (adipose tissue) although other factors such as muscularity also affect BMI significantly. The WHO regards a BMI of less than 18.5 as underweight while a BMI greater than 25 is considered overweight and above 30 is considered obese (Brouha *et al*., 1943). The purpose of this study was to examine the relationship between physical fitness and body mass index (BMI) in young individuals.

Aims and Objectives

The aim of present study is to study PFI in medical students in relation to body mass index with Chester step test. This study may be of use to make the students aware about the importance of physical fitness as to prevent lifestyle related chronic diseases.

Materials and Methods

This cross-sectional study was conducted in the Department of Physiology, Bareilly (UP), India, for a period of 6 months from April 2023 to October 2023 on young healthy participants. A total of 150 participants, age of 18-24 years were enrolled in the study after approval from Institutional Ethics Committee.

Subjects who met the inclusion and exclusion criteria and were willing to participate in the study were selected. 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 was measured. 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.

Physical Fitness Index (Edward Fox Charles *et al*., 1973) was calculated by using the following equation.

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

Body Mass Index (BMI): Body mass index (BMI) was calculated by Quetelet Index, which is a statistical measure of the weight of a person scaled according to height. It was developed in 1832 by the Belgian polymath Adolphe Quetelet6.Body Mass Index (BMI) was calculated based on the formula-

BMI = Weight in kg/Height in mt^2

Statistical Analysis

Data were collected and grouped using MS excel. Statistical analysis was performed using a statistical software program SPSS. Standard descriptive statistics (percentages, means, and standard deviations) were computed to describe the sample. Chi square and T tests were performed to confirm statistical association among observed variables.

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Pearson Correlation (R) was used to test the hypothesis to determine the relation between physical fitness index and BMI. A p-value <0.05 was considered significant.

Results

The present study was performed among 150 first-year medical students out of which 53.33% students were males and 46.67% students were females. The prevalence of overweight/obesity according to BMI was 45.33%. The underweight group was not included in this study because none of the students fit it. The basic features of the students are listed in Table 1.

Table 1: Basic features of the students

Variables	Number of students
Age	
18-22 yr.	130 (86.67%)
22-25 yr.	20 (13.33%)
Gender	
Male	80 (53.33%)
Female	70 (46.67%)
BMI	
Normal	82 (54.67%)
Overweight/ Obese	68 (45.33%)

All the mean values were slightly higher in males. A significant gender differences were found (Table 2). Table 3 shows the association between categories of BMI and PFI, significant difference was found between PFI of normal and overweight/obese participants.

Table 2: Comparison of Anthropometric Parameters and physical fitness index between male and female

Variables	Mean + SD		P value
	Male	Female	
Age	20.18 + 0.5	20.30+0.96	0.4340
Weight	61.37±9.89	58.66±9.07	0.0839
Height	1.60±0.04	1.55±0.05	0.0001
BMI	23.5+4.09	21.66+3.12	0.0026
PFI	72.96+5.81	70.11+5.09	0.001828

Table 3: PFI according to BMI categories

Normal	77.89+26.57
Overweight/obese	68.16+32.19

Independent t-test; $p<0.05$ was considered as statistically significant

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Table 4 shows that 86.67% of the study's participants had a PFI ranging from fair to excellent, while 13.33% had a PFI poor, a significant difference was observed between male and female physical fitness.

Table 4: Mean values of PFI in male and female according to category

	Male	Female	Total subjects
Excellent	17	23	40 (26.67)
Good	20	27	47 (31.33)
Fair	29	14	43(28.67)
Poor	14	6	20(13.33)
Total	80	70	150

The chi-square statistic is 9.7518. The *p*-value is .020798. The result is significant at $p < .05$

Table 5 shows the association between PFI using Chester step test and anthropometric parameters. Pearson's correlation showed a negative association (r-value=-0.466) between BMI and physical fitness, which was statistically significant.

Table 5: Association between PFI and Anthropometric

Variables	PFI	
	R	P
Height	0.021	.7987
Weight	-0.24	0.0031
BMI	-0.466	<0.0001

$p<0.05$ was considered as statistically significant. BMI: Body mass index

Discussion

Several studies have established that physical fitness is necessary to carry out daily task. The effect of proper diet and regular exercise is known to have beneficial effect on health. Importance of physical fitness has been mentioned in the history of mankind including Vedas. Yet, physiology of exercise is a recent advancement and is an open field for research [9].

Physical Fitness Index (PFI) is considered as one of the significant index to assess the cardio-pulmonary efficiency of a subject. PFI is correlated with various health parameters of a person. PFI is used to ascertain the status of cardiovascular risk, obesity, mental health, bone density etc., a good PFI indicates overall good health status of an individual [10, 11].

Now days, physical fitness and obesity are important issues from the perspective of public health [12]. As BMI is the main determinant of obesity, it is assumed that overweight and obese individuals tend to have lower fitness levels compared to normal weight individuals. However, the present study found a negative association (r-value= 0.466) between BMI and physical fitness, which was statistically significant.

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From our study we conclude that the physical fitness, anthropometric parameters are higher in male as compared to female.

This is observed because of females are less physically active and less participation rates in sport. As compared to boys, girls may not actively participate in organizing sport activities. Rao *et al*. also had done study on 240 university students in which he found that physical activity was more among boys (62%) as compared to girls (38%) [13]. Lack of time and laziness or lack of motivation was also reported by over 50% of the students to be the most important hindering factors for practice of regular physical activity, which may be cause for lower physical fitness in girls. So, regular exercise and nutritious diet increases the physical fitness and growth. The nutritious food may be one of the contributing factors in attainment of such growth. Thus, variations in anthropometric parameters are related to physical exercise and nutritious food [14].

In this study, majority of subjects had normal BMI. Average BMI of male was little higher than the average BMI of females. This study also showed that the physical fitness index of the subjects differed significantly from one another, with the subjects of normal BMI possessing a higher fitness than the overweight or obese subjects.

It was found from present study that BMI was inversely proportional to physical fitness index. Fitness capacity therefore decreased progressively as the BMI increased. This view is supported by the finding of Sameer Srivastava *et al*. who conducted a study on 18-25 years college students and concluded that Fitness capacity decreased progressively as the BMI increased [15]. Present study also agrees with the study done by Anabel *et al*. which showed that the overweight and obese individuals exhibit lower levels of physical fitness [16].

These results correlate with other studies that researched the same variables [17, 18, 19]. The overweight and obesity are associated with lowered muscle strength [19, 20]. Leila Jaafari *et al*. had done study of anthropometric measures focusing on health indices and physical fitness and concluded that there was a negative significant between most of health-related anthropometric measures and physical fitness factors which is also consistent with or finding ([21].

Future research needs to examine methods for increasing physical fitness levels among this population group and identify cut-points related to health outcomes for all fitness components. There is a need to encourage physical activity in adults and also to emphasize the importance of inculcating physical activity in their lifestyle.

The results of the present study suggest that there is the need to identify and monitor cardiovascular risk factors like obesity among the young students. Medical students face a lot of psychological distress, especially during freshmen year of training and this continual stress has been associated with various mental and physical problems including stress-related eating which makes these students more prone to obesity/overweight, sedentary lifestyle, and decreased physical activity which have been demonstrated by various studies [22-26]. It is extremely important to introduce early changes in style of living with proper interventions to better the health-related variables (exercise, eating, stress, etc.). Screening of college students should be done at entry level and they should be encouraged to participate in fitness programs (sports, regular exercise, and yoga) in addition to discouraging fast food consumption and smart phone addiction. This will not only help in decreasing the health problems associated with reduced physical activity but will also reduce the gap between knowledge and practice

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[26]. Adoption of a healthy lifestyle by a medical students will facilitate the formation of healthy physicians who most likely would give effective preventive counseling to their patients [27].

Conclusion

From the present study, it's concluded that physical fitness is negatively affected to a great degree in Young subjects who are overweight and obese. It's apparent that obesity is the precursor of various chronic disease, which includes hypertension, type II diabetes mellitus, coronary heart complaint and hyperlipidaemia. Statistics worldwide also indicate that the obesity rates seen among these young adult will most probably not improve in the future. Information from this study can therefore be used to design health-related exercise programs and increase awareness of the use of yoga and physical exercise. In this study, the subject size was relatively small, which made generalization of the results difficult.

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References

1. https://en.wikipedia.org/wiki/Healthhttps://e n.wikipedia.org/wiki/Health
2. Rao CR, Darshan B, Das N, Rajan V, Bhogun M, Gupta A, *et al*. Practice of physical activity among future doctors: A cross sectional analysis. Int. J Prev. Med.2012;3(5):365-69.
3. Brehm BJ, Summer SS, Khoury JC, Filak AT, Lieberman MA, Heubi JE, *et al*. Health status and lifestyle habits of US medical students: A longitudinal study. Ann Med Health Sci. Res. 201;6(6):341-347.
4. Ortega FB, Tresaco B, Ruiz JR, Moreno LA, Martin-MatillasM, Mesa JL, *et al*. Cardiorespiratory fitness and sedentary activities are associated with adiposity in adolescents. Obesity. 2007 Jun;15(6):1589-1599.
5. Parmar D, Vaghela V. Study of physical fitness index using modified Harvard step test in relation with body mass index in physiotherapy students. International Journal of Recent Advances in Multidisciplinary Research. 2015 Oct 31;2(12):1075-1077.
6. Clarke HH. Basic understanding of physical fitness. Physical fitness Research Digest series. 1971;1:2
7. Buckley JP, Sim J, Eston RG, Hession R, Fox R. Reliability and validity of measures taken during the Chester step test to predict aerobic power and to prescribe aerobic exercise. British journal of sports medicine. 2004 Apr 1;38(2):197-205.
8. Zakiuddin M, Saha S, Khalid Z. A cross sectional study of physical fitness index usingmodified Harvardsteptestin relation with body mass index in medical students (1styear MBBS) in Major S.D. Singh Medical College, Farrukhabad, U. P, India. J Evolution Med. Dent. Sci. 2016;5(42):2621-2624.
9. Wuest DA, Bucher CA. Historical foundations of physical education and sport. 13th Ed. Boston, Mass: WCB/McGraw Hill. 1999;146:193.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 04, 2024

10. Ortega FB, Ruiz JR, Castillo MJ, Sjöström M. Physical fitness in childhood and adolescence: A powerful marker of health Int. J Obes. 2008;32:111.
11. Dumith SC, Ramires W, Souza MA, Moraes DS, Petry FG, Oliveira ES, *et al*. Overweight/obesity and physical fitness among children and adolescents J Phys. Act Health. 2010;75:6418.
12. Artero EG, España-Romero V, Ortega FB, Jiménez-Pavón D, Ruiz JR, Vicente-Rodríguez G, *et al*. Health-related fitness in adolescents: Underweight, and not only overweight, as an influencing factor. The AVENA study. Scand J Med Sci. Sports. 2010;20(3):418-427. Available from: https://doi.org/10.1111/j.1600-0838.2009.00959.x
13. Rao. Physical activity among medical students practice, International Journal of Preventive Medicine, 2012; 3(5): 365-369.
14. Snowling NJ, Hopkins WG. Effects of different modes of exercise training on glucose control and risk factors for complication in type-2 diabetes patients: a meta-analysis. Diabetic care. 2006;29(11):2518-2527.
15. Sameer Srivastava. Correlation between physical fitness and body mass index, Int. J Cur. Res. Rev. 2013;05(23):44-48.
16. Anabel NR, Anselmo JP, Luciana C, Nazare SB. The association between cardio-respiratory fitness and cardiovascular risk in adolescent. J Paediatria (Rioj). 2007;83(5):1-12.
17. Graf C, Koch B, Kretshmann-Kandel E, *et al*. Correlation between BMI, leisure habits and motor abilities in childhood (CHILT-Project). Int J Obesity. 2004;28:22-26.
18. Chen LJ, Fox KR, Haase A, Wang JM. Obesity, fitness and health in Taiwanese children and adolescents. Eur. J Clin. Nutr. 2006;60:1367-1375.
19. Tokmakidis SP, Kasambalis A, Christodoulos AD. Fitness levels of Greek primary schoolchildren in relationship to overweight and obesity. Eur. J Pediatr. 2006;165:867-874.
20. Wearing SC, Hennig EM, Byrne NM, Steele JR, Hills AP. The impact of childhood obesity on musculoskeletal form. Obes. Rev. 2006;7:209-218.
21. Leila Jaafari. Health-related anthropometric measures in connection with physical fitness factors; IPEDR, 2012, 31.
22. Nowreen N, Farhana A. Psychological distress among first year students in a medical college in J and K, India. J Evol. Med. Dent. Sci. 2018;7(13)26:1563-1566. Available from: http://doi.org/10.14260/jemds/2018/353
23. Yusoff MS, Rahim AF, Yaacob MJ. Prevalence and sources of stress among university sains Malaysia medical students. Malays J Med. Sci. 2010;17(1):300-307.
24. Mehta K, Kaur S, Girgla KK, Kaur P, Kaur H. A study of mental distress in medical students. Nat J Physiol Pharm Pharm. 2015;5:190-194. Available from: https://doi.org/10.5455/njppp.2015.5.2810201415
25. Niemi PM, Vainiomaki PT. Medical students' academic distress, coping and achievement strategies during the preclinical years. Teach Learn Med. 1999;11:125-34. Available from: https://doi.org/10.1207/S15328015TL110302
26. Al-Asadi JN. Perceived stress and eating habits among medical students. Int. J Med.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 04, 2024

Pharm Sci. 2014;4(3):81-90.

27. Sirard JR, Pate RR. Physical activity assessment in children and adolescents. Sports Med. 2001;31(6):439-454.Available from: https://doi.org/10.2165/00007256-200131060-000