



Original Article

Cardiorespiratory Fitness and Level of Perceived Stress in Exercising and Non-Exercising Physical Therapy Students: A Single-Centered Survey

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ABSTRACT

Background: Cardiorespiratory fitness is one of the basic components of physical fitness. It is considered a direct measure of the physiological status of the individual and it is a chief benchmark of physical well-being. There is a close association between physical fitness and the health outcomes of individuals. **Objective:** To assess cardiorespiratory fitness and perceived stress level and to measure the correlation between them in exercising and non-exercising physical therapy students. **Methods:** A descriptive cross-sectional study was conducted at Lahore Medical and Dental College for a duration of almost six months from April to October 2019. A total of 240 students from 1st to final year students were enrolled in the study using non-probability convenient sampling. The participants were categorized into two groups based on inclusion and exclusion criteria. Cardiorespiratory fitness was assessed by using the modified Harvard step test and the level of perceived stress was measured by the perceived stress scale questionnaire. Data analyses were carried out using SPSS 22 and results were presented in the form of mean and standard deviation. **Results:** A significantly higher degree of cardiorespiratory fitness was found in Group A (exercising) compared to Group B (non-exercising) and a significantly lower level of perceived stress was found in Group A as compared to Group B (p -value ≤ 0.05). Bivariate analysis indicates a moderate, negative connection between physical fitness index and perceived stress ($p < 0.001$; $r = -0.65$). **Conclusion:** The current study concluded that the exercising group showed better cardiorespiratory fitness and lower perceived stress as compared to the non-exercising group. Cardiorespiratory fitness and perceived stress showed a highly significant correlation which is moderate in strength and inversely proportional. This means that as cardiorespiratory fitness increases, the level of perceived stress decreases.

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INTRODUCTION

The association between physical activity and its components such as aerobic or cardiorespiratory fitness and mental health is well-established and important in creating a balance between increasing working capacity and the ability of an individual to perform his daily task.¹ Cardiorespiratory fitness is one of the basic components of physical fitness. It is considered a direct measure of the physiological status of the individual and it consults to the potential of the heart and lung tissue to deliver oxygen to functioning muscles during the continuous activity and it is a key measure of physical fitness.^{2,3} On the authority of the American College of Sports Medicine, it supports four major areas of aerobic & anaerobic fitness: cardiorespiratory stamina, physique composition, muscular power and durability.⁴

There is a close association between low physical fitness and the health outcomes of individuals.⁵ It is recommended that reduced athletics self-assurance and morale, as this can lead to social solitude that is linked with impeded mental health and anticipated stress.⁶ Athletes have been shown to take the edge off stress among adults.⁷ Anticipated stress is the desire or conception that describes a person under how much pressure & tension at once or during a specified period.⁸ Physical therapy students are liable to experience a high level of perceived stress.

The reason for this stress may be related to the pressure of academics, extremely challenging course curriculum, many hours of theoretical and practical study and extended periods in hospitals, indoors and in health centers. This requires a lot of mental as well as physical input from the students. Stress may have a detrimental impact on their academic performance, personal well-being and long-term professional skills. Participation in athletics boosts not only the body's fitness levels but also reduces mental

or emotional strain or stress.⁹ Regularly planned athletics may come up with antistress and antidepressant effects and protect from the harmful effects of stress on physical and mental well-being.¹⁰ For several developing countries such as Pakistan, cardiorespiratory fitness rates of physical therapy students can not be well investigated, which implies the need to examine the fitness levels of physical therapy students. No research has ever established the correlation between cardiorespiratory fitness and anticipated stress in Pakistani students of physical therapy to our knowledge. This research consideration was therefore aimed at exploring the correlation between cardiorespiratory fitness and anticipated stress and at increasing awareness among physical therapy students about the importance of cardiorespiratory fitness.

METHODS

A descriptive cross-sectional study was conducted at Lahore Medical and Dental College for a duration of almost six months from April to October 2019. A total of 240 students from 1st to final year students were enrolled in the study based on benchmark and elimination criteria. The sampling strategy utilized was non-probability convenience sampling. Members were categorized into two classes i.e. exercising and non-exercising.

Male and female physical therapy students aged 18 to 25 years who exercise regularly for two months at least for a minimum of half an hour in the day three to four times a week were included in the study. Students with musculoskeletal, neurological, cardiopulmonary and psychological disorders, with a history of surgery, smoking and drug abuse and those who did not participate in any type of exercise for the past two months were excluded from the study. Participants go through a detailed

revised Harvard step test and fill out the perceived stress scale (PSS) questionnaire. A modified Harvard step test was used to determine cardiorespiratory fitness and a perceived stress scale questionnaire was used to measure the perceived stress level. The reliability of the Harvard step test was 0.84.¹¹ The reliability of the PSS questionnaire was 0.86.¹² Prior consent of all the subjects was taken.

For the step test, a stepper of 20-inch height was used. Height, weight and resting heart rate were measured before the test. Members were instructed to step up and down on a step for 3 minutes or until exhaustion at a speed of one step per two seconds. Each stepping cycle consisted of a four-step cadence, "Up-Up-Down-Down". Once the stepping has been done, the person immediately sits down and the number of heartbeats was calculated on three different occasions over a 30-second duration at 1-1.5, 2-2.5, 3-3.5 minutes. The formula to score the physical fitness index (PFI) is $100*d/(a+b+c)$ where d is the duration of step exercise in seconds and a, b and c are the three measurements of heart rate in 30 seconds. The interpretation for rating fitness index was divided into excellent (>96), good (83-96), average (68-82), low average (54-67) and poor (<54).

The PSS had 10 questions given and participants had to circle the number to designate how frequently they felt or thought a specific way. Scoring was in a range from 0 to 40. The interpretation for the PSS scale was divided into low (0-13), moderate (14-26) and high (27-40). Data were analyzed using SPSS 22. Demographic characteristics were presented and results were depicted in the form of mean and standard deviation. An unpaired t-test was used to measure the differences between the groups. Pearson correlation was used to measure the association between the PFI and PSS. A p-value of less than and equal to 0.05 was taken as significant.

Table I showed that out of 240 subjects, there were 120(50%) in group A (exercising) and 120(50%) in group B (non-exercising). The mean age in group A was 21.55 ± 1.73 years compared to 21.30 ± 1.54 years in group B with no significant age difference ($p>0.05$). The mean weight in group A was 60.23 ± 11.11 compared to 55.99 ± 9.66 in group B. The mean height in group A was 165.51 ± 7.42 compared to 163.36 ± 5.29 in Group B. The mean \pm SD of body mass index (BMI) of group A was 21.91 ± 3.19 and group B was 20.91 ± 3.28 . The mean resting heart rate in group A was 87.65 ± 13.72 compared to 92.80 ± 12.11 in group B.

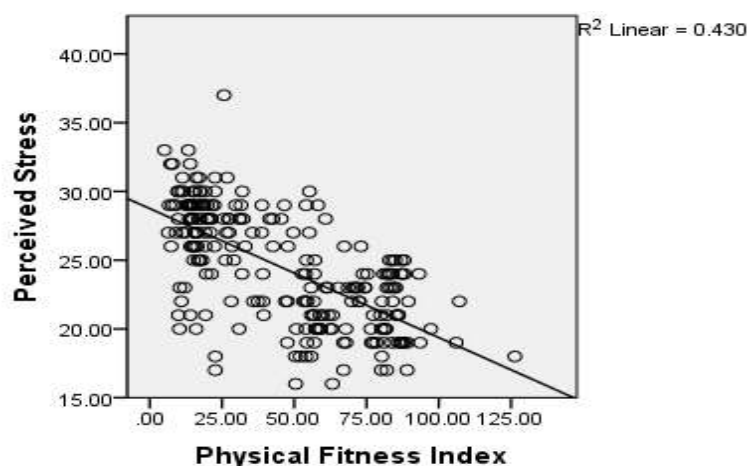
RESULTS

Table I: Demographic Features of Participants

Demographic Features	Group A Exercising (n=120) Mean \pm SD	Group B Non-Exercising (n=120) Mean \pm SD	t-value	p-value
Age (years)	21.55 \pm 1.73	21.30 \pm 1.54	1.17	0.24
Weight (kg)	60.23 \pm 11.11	55.99 \pm 9.66	3.15	0.00
Height (cm)	165.51 \pm 7.42	163.36 \pm 5.29	2.57	0.01
BMI (kg/inch)	21.91 \pm 3.19	20.91 \pm 3.28	2.37	0.01
Resting Heart Rate (beats/mint)	87.65 \pm 13.72	92.80 \pm 12.11	-3.08	0.00

Table II: Comparison of Physical Fitness Index and Perceived Stress Levels Between Groups

Variables	Group A Exercising (n=120) Mean (SD)	Group B Non-Exercising (n=120) Mean (SD)	t-value	p-value
Physical Fitness Index	69.76±17.81	21.27±12.10	24.6	0.00
Perceived Stress	21.43±2.48	27.53±2.96	-17.2	0.00

Figure I: Correlation Between Physical Fitness Index and Perceived Stress

There was a significant difference ($p < 0.05$) in variables like weight ($p = 0.00$), height ($p = 0.01$), BMI ($p = 0.01$) and resting heart rate ($p = 0.00$). Table II showed that a significantly higher degree of cardiorespiratory fitness was found in group A as compared to group B ($p < 0.05$) and a significantly lower level of perceived stress was found in group A as compared to group B ($p < 0.05$). In Figure I, the bivariate analysis indicated a moderately negative correlation between the physical fitness index and perceived stress ($p < 0.01$; $r = -0.65$). This means that as cardiorespiratory fitness increases, the level of perceived stress decreases.

DISCUSSION

The current study assessed and compared

cardiorespiratory health and perceived stress level in students of physical therapy who were doing exercise and those who were not. The modified Harvard phase test and PSS questionnaire were used to assess cardiorespiratory fitness and perceived stress respectively. The findings of the current study suggested that group A (exercising) had high cardiorespiratory fitness (69.76 ± 17.81) and low level of perceived stress (21.43 ± 2.48) while group B (non-exercising) had low cardiorespiratory fitness (21.27 ± 12.1) and high level of perceived stress (27.53 ± 2.96). There was a remarkable connection between fitness and anticipated stress, which was moderate in strength and inversely proportional. In 2018, Sharma performed a study to test athletics and mental stress rates in exercising and non-exercising students and found that the

exercise group had a higher mean value of physical fitness index and a lower perceived stress value relative to the non-exercising group.¹³ The outcome following the findings of the present research work. Gerber et al. (2017) recently brought to light that low-age (6 to 8 years old) with high athletics levels, in terms of cardiorespiratory fitness, experienced a higher level of mental well-being respective to their less-fit peers when lay bare to raised stress levels and extraordinary levels of physical well-being when stress levels are low.¹⁴

Melda et al. conducted a study to assess the relationship between physical activity and anticipated stress in physiotherapists and concluded that less physical activity is associated with a high level of anticipated stress.¹⁵ Findings were consistent with the present study except that it did not measure cardiorespiratory fitness. The current study reported a correlation between cardiorespiratory fitness and anticipated stress. But, in contrast, other studies reported a correlation between physical fitness and other parameters such as BMI or body composition. In one study Parmar reported a correlation between physical fitness and BMI and concluded that overweight students have less physical fitness than normal BMI students.¹⁶

Another study conducted by Pawaria aimed at the assessment of the cardiorespiratory fitness of physiotherapy students. The results showed that the cardiorespiratory fitness of students was average and there was a tight positive link between VO_2 max and physical fitness index.¹⁷ This study measured the correlation between VO_2 max and PFI. On the contrary present study measures the correlation between the PFI and PSS. Another study showed the correlation between physical fitness and anthropometric parameters in foreign and non-foreign school-going children and come to the end that athletics and anthropometric parameters are higher in non-foreign than in foreign groups.¹⁸

Another study reported a correlation between physical fitness and body weight, height, body surface area, age and resting heart rate and concluded that physical fitness index has no significant correlation with height, weight, body surface area and age but PFI has a significant correlation with resting heart rate.¹⁹ Another study reported a correlation between physical fitness and gender and concluded that females have better physical fitness when compared to males.²⁰ All these warrant the importance of active intervention and a healthy lifestyle. Previous studies indicated that physiotherapists are usually vulnerable to work-related musculoskeletal disorders.²¹

One of the key reasons for this increase in musculoskeletal disorders could be reduced levels of aerobic fitness which lead to overstraining of various structures.²² Athletic fitness in particular is important for academic excellence and overall maintenance of cardiovascular and general health, among other things.²³ Regular planning to join in exercise has been shown to improve perceived stress, cardiorespiratory fitness, self-esteem and quality of life.²⁴

Previous studies assessed all components of physical fitness and correlate it with many other parameters however the progress is evident with the assessment now being carried out specifically in cardiorespiratory fitness components of physical fitness and its influence on perceived stress. Studies assessed the physical-related activity and work-related stress in different ways and only reported that stress was associated with robustness behaviors and physical activity.²⁵ There is a limited study investigating the relationship between cardiorespiratory fitness and perceived stress level in physical therapy students. The current study disclosed not only the cardiorespiratory fitness and perceived stress levels but also the relationship between cardiorespiratory fitness and anticipated stress.

Further studies are recommended to explore the relationship of academic performance to cardiorespiratory fitness and perceived stress and to explore strategies to improve aerobic fitness and anticipated stress so that the efficiency of students could be increased. The cross-sectional design of the current study a causal relationship between studied variables which is a limitation. Moreover, the inclusion of other components of physical fitness such as muscular strength and endurance would have provided more information about their fitness levels and is another aspect that demands consideration while designing future studies. Most of the participants were female physical therapy students which may limit the generalizability of the study. Within the limitations of this study, our findings have provided an insight into the health status of physical therapy students.

CONCLUSION

The study concluded that the exercising group showed better cardiorespiratory fitness and lower perceived stress as compared to the non-exercising group. Cardiorespiratory fitness and perceived stress showed a highly significant correlation, which is moderate in strength and inversely proportional. This means that as cardiorespiratory fitness increases, the level of perceived stress decreases.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

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REFERENCES

1. Rai R, Chugh P, Negi M. A Study on cardiovascular fitness of sedentary college students. *Int J of Sci Res* 2015; 4(6): 109-12.
2. Cheng J-C, Chiu C-Y, Su T-J. Training and Evaluation of Human Cardiorespiratory Endurance Based on a Fuzzy Algorithm. *International Journal of Environmental Research and Public Health* 2019; 16: 2390.
3. Ruiz JR. Cardiorespiratory fitness and cardiovascular disease risk factors in children and adolescents: *Biovetenskaper och näringslära/Biosciences and Nutrition*; 2007.
4. Medicine ACoS. ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins; 2013.
5. Williams PT. Physical fitness and activity as separate heart disease risk factors: a meta-analysis. *Med Sci Sports Exerc* 2001; 33(5): 754-61.
6. VanKim NA, Nelson TF. Vigorous physical activity, mental health, perceived stress, and socializing among college students. *American Journal of Health Promotion* 2013; 28(1): 7-15.
7. Aldana SG, Sutton LD, Jacobson BH, Quirk MG. Relationships between leisure time physical activity and perceived stress. *Perceptual and Motor skills* 1996; 82(1): 315-21.
8. Phillips AC. Perceived Stress. In: Gellman MD, Turner JR, eds. *Encyclopedia of Behavioral Medicine*. New York, NY: Springer New York; 2013: 1453-4.
9. Nabkasorn C, Miyai N, Sootmongkol A, et al. Effects of physical exercise on depression, neuroendocrine stress hormones and physiological fitness in adolescent females with depressive symptoms. *European journal of public health* 2006; 16(2): 179-84.
10. Salmon P. Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. *Clinical psychology review* 2001; 21(1): 33-61.

11. Meyers CR. A Study of the Reliability of the Harvard Step Test. *Research Quarterly American Association for Health, Physical Education and Recreation* 1969; 40(2): 423-.
12. Reis RS, Hino AAF, Añez CRR. Perceived stress scale: reliability and validity study in Brazil. *J Health Psychol* 2010; 15(1): 107-14.
13. Sharma P, Sharma R, Choudhary A, Vats H, Kataria J, Asif M. Assessment of level of physical fitness and level of mental stress in exercising and non-exercising physiotherapy students. *Assessment* 2018; 3(5).
14. Gerber M, Endes - Imhof K, Brand S, et al. In 6- to 8-year-old children, cardiorespiratory fitness moderates the relationship between severity of life events and health-related quality of life. *Quality of Life Research* 2016; 26.
15. Tomruk M, gürpınar b, Özyürek S, KaradİBak D, ÇAkir Ö, Angin S. Relationship between physical activity and perceived stress in physiotherapists. *JETR* 2016; 3: 15-20.
16. Parmar D, Vishwasvaghela. 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 (IJRAMR)* 2015.
17. Pawaria S, Kalra S. Study on Cardio-Respiratory Fitness of Physiotherapy Students: A Cross-Sectional Study. *International Journal of Yoga, Physiotherapy and Physical Education* 2017; 2: 22-4.
- S18. Khodnapur JP, Dhanakshirur GB, Bagali S, Mullur LM, Aithala M. Status of Physical Fitness Index (PFI%) and anthropometric parameters in residential school children compared to nonresidential school children. *JKIMSU* 2012; 1: 137-41.
19. Bandyopdhyay B, Chattopadhyay H. Assessment of physical fitness of sedentary and physically active male college students by a modified Harvard step test. *Ergonomics* 1981; 24(1): 15-20.
20. Parmar D, Modh N. Study of physical fitness index using modified harvard step test in relation with gender in physiotherapy students. *Int J Sci Res* 2013; 4(1): 1215-7.
21. Adegoke BO, Akodu AK, Oyeyemi AL. Work-related musculoskeletal disorders among Nigerian physiotherapists. *BMC musculoskeletal disorders* 2008; 9(1): 112.
22. Smith D, Wei N, Ishitake T, Wang R-S. Musculoskeletal Disorders among Chinese Medical Students. *The Kurume medical journal* 2005; 52: 139-46.
23. Franklin B, McCullough P. Cardiorespiratory Fitness: An Independent and Additive Marker of Risk Stratification and Health Outcomes. *Mayo Clinic proceedings Mayo Clinic* 2009; 84: 776-9.
24. Atlantis E, Chow C-M, Kirby A, Singh MF. An effective exercise-based intervention for improving mental health and quality of life measures: a randomized controlled trial. *Preventive medicine* 2004; 39(2): 424-34.
25. Martins LCX, Lopes CS. Rank, job stress, psychological distress and physical activity among military personnel. *BMC public health* 2013; 13(1): 716.