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ANALYSIS OF CARDIORESPIRATORY FITNESS AMONG ATHLETE STUDENTS

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Abstract

Background: *Cardiorespiratory fitness (CRF) reflects the capacity of the heart, lungs, and circulatory system to deliver oxygen during sustained exercise.*

Objective: *To evaluate the cardiorespiratory fitness of university athlete students using the Modified Harvard Step Test.*

Methods: *A cross-sectional study was conducted at the University of Management and Technology (UMT), Lahore. A total of 137 athlete students aged 18–27 years participated. Physical Fitness Index (PFI) was calculated using the Modified Harvard Step Test. Demographic data, BMI, and PFI were analyzed with SPSS Version 25.*

Results: *The mean age was 22.21 ± 2.16 years; mean BMI was 30.21 ± 4.17 kg/m². The average PFI was 83.10 ± 12.76. Among participants, 44.53% demonstrated excellent CRF, 27.74% good, 22.63% high average, and 5.11% low average levels. Significant differences in PFI and BMI were found between male and female students ($p < 0.01$).*

Conclusion: *University athlete students generally exhibited satisfactory cardiorespiratory fitness. Ongoing assessment and encouragement of exercise are recommended to maintain and improve CRF.*

INTRODUCTION

Cardiorespiratory fitness (CRF) is a key indicator of health and athletic performance, representing how effectively the heart and lungs supply oxygen during physical activity. Physical fitness includes both health-related and skill-related components, with health-related elements such as body composition, cardiovascular fitness, flexibility, muscular endurance, and strength (Malshe & Gunjal).

A sedentary lifestyle is a major global health issue, identified as the fourth leading cause of death, accounting for approximately 3.2 million deaths annually (Krishnan et al., 2022). Physical inactivity, poor nutrition, and obesity elevate the risk of cardiovascular disease, diabetes, cancer, hypertension, osteoporosis, and mental health conditions.

Cardiorespiratory fitness in this study was measured using the 20-meter shuttle run. Muscular fitness was assessed through grip strength and the standing long jump tests. An index of muscular health was calculated using standardized measures of these two assessments. Socioeconomic status was evaluated with the household wealth scale, while body composition, weight, and height were measured following established protocols.

The analysis showed that cardiorespiratory fitness was significantly associated with health-related quality of life in young people. ANCOVA results indicated that children with high cardiorespiratory and muscular fitness had significantly better health-related quality of life scores compared to those with lower fitness levels cardiorespiratory fitness with high muscle fitness had practically higher Health Related Quality of life rank and low muscle fitness, low cardiorespiratory fitness, and low muscle fitness compared with high cardiorespiratory fitness p 00533.(Evaristo et al., 2019)

CRF measures the efficiency of the cardiovascular and respiratory systems in supplying oxygen to the muscles. Despite its importance, CRF levels have declined over recent decades for reasons not fully understood (Saleemi et al., 2022). While VO_2max testing is the gold standard, field tests like the Modified Harvard Step Test offer practical alternatives for assessing fitness in larger groups.

Regular engagement in moderate to vigorous physical exercise not only improves levels of fitness but also facilitates mental sharpness and emotional well-being. Sedentary habits and poor levels of fitness may cause an assortment of health issues and lower the capacity to effectively handle daily chores. Long-term participation in physical activity is well-documented to significantly lower the risk of life-threatening diseases, such as cardiovascular illnesses and strokes. Regular exercise maintains body weight, improves blood cholesterol profiles by increasing high-density lipoproteins (HDL), and stabilize blood pressure. The benefits to one's health of having a high level of fitness throughout life are both great and well-supported.(Singh et al.,2025)

University athletes participate in structured training and competitive sports (McKinney et al., 2019). Assessing their fitness levels is vital to enhance performance, prevent injuries, and support long-term health.

During young adulthood, the prevalence of overweight and obesity is accelerated considerably, nearly doubling in women from 17.1% to 31.9% within the 12-19 and 20-39 age groups respectively. In accordance with data gathered by the World Health Organization (WHO) Global Health Observatory in 2016, over 1.9 billion adults were overweight and 650 million were obese. These figures show that the world obesity prevalence almost tripled from 1975 to 2016. (Mădălina et al., 2024)

The main rationale of this study was that Physical fitness index measures the physical fitness for muscular work and the ability to recover from the work. Therefore, it's a need to know the physical fitness level of University Athlete students. They can be sensitized to pursue a healthy life style right from the beginning of their career and by determining their physical efficiency /cardiopulmonary efficiency, these students may plan suitable strategies if necessary

MATERIALS AND METHODS:

This descriptive cross-sectional research was conducted at the different universities in Lahore. Data were gathered from December 2023 to February 2024. The sample comprised 137 university athletes aged between 20 and 30 years who maintained a normal BMI and were in good health. Both male and female students were included. Participants were excluded if they were under 18, smokers, consumed alcohol, had a history of trauma or musculoskeletal injuries, suffered from cardiopulmonary disorders, or were pregnant or lactating.

A purposive sampling method was employed to select participants. All students provided written, informed consent before enrollment. Data collection utilized the Modified Harvard Step Test with a 33 cm high step, along with a stopwatch and metronome for precise timing. Height and weight were measured to compute BMI. Participants performed continuous stepping for up to 5 minutes or until reaching exhaustion. Following the exercise, pulse rates were recorded at 1.5, 2.5, and 3.5 minutes. The Physical Fitness Index (PFI) was calculated with the formula:

PFI=2×(PR1+PR2+PR3)Exercise duration (seconds)× 100 Data were processed using SPSS Version 25. Descriptive analyses were conducted, and

independent sample t-tests assessed differences between groups.

Inclusion criteria :	Exclusion criteria :
1 Ages of 20 to 30 2 Normal BMI, 3 Both male and female students 4 healthy students were included	1.age under 18, 2.smoking and cigarette usage 3.trauma history, injury related to the musculoskeletal system, cardiopulmonary disorders

Ethical Consideration	Ethical approval for this study was obtained. All participants were fully informed about the study's purpose, procedures, potential risks, and benefits. Written informed consent was obtained prior to participation. Confidentiality and anonymity of participants were strictly maintained throughout the research process. Participation was entirely voluntary, and participants had the right to withdraw at any stage without any consequences.
Data Analysis Procedure	Data were processed using SPSS Version 25. Descriptive analyses were conducted, and independent sample t-tests assessed differences between groups.

Results:

Table 1: Demographics

Variable	Mean ± SD	Range
Age (years)	22.21 ± 2.16	18 – 27
Gender	M(69.3%),F(30.7%)	100
Body Mass Index (kg/m²)	30.21 ± 4.17	20.25 – 43.40
Physical Fitness Index	83.10 ± 12.76	54.25 – 127.12
Duration of Exercise (sec)	300.00 ± 0.00	300.00 – 300.00

Table 1 indicates the population of 137 participants with age of 18-27 years with Mean age 22.21 ± 2.16 with minimum age of 18 years and maximum age of 27 years with Percentages of Male and Female Athletes out of 137 Athletes with 69.34% males and 30.66% females, mean Body Mass Index (BMI) 30.21 ±4.17. Minimum BMI was 20.25 and Maximum BMI was 43.40 Mean PFI were 83.10 ± 12.76 with Maximum exercise time of 5 minutes.

Figure 1

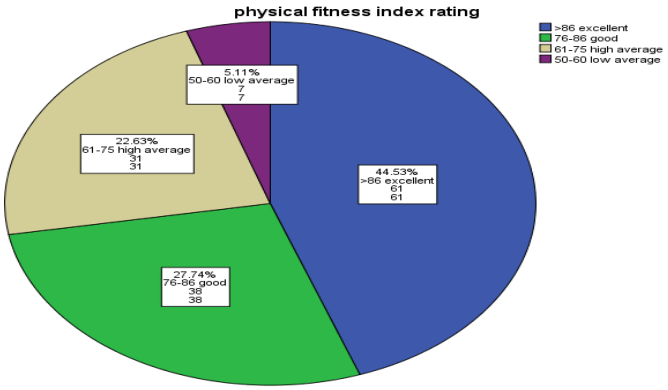

Figure 1 results shows that out of 137 athlete students we concluded that 44.53% of students have excellent cardiorespiratory fitness, 27.74% have good CRF, 22.63% have high average and 5.11% have low average CRF.

DISCUSSION:

This study revealed that the majority of university athlete students exhibited adequate to excellent cardiorespiratory fitness levels. Male participants showed significantly greater Physical Fitness Index (PFI) and Body Mass Index (BMI) scores compared to their female counterparts.

These findings are consistent with earlier research highlighting gender differences in CRF among university populations (Jena & Research, 2020; Krishnan et al., 2022). The Modified Harvard Step Test has been shown to be an effective and practical method for evaluating large cohorts (Chand et al., 2021).

Another study found a clear positive association between cardiorespiratory fitness (CRF) and executive function (EF) among Chinese adolescents. Higher CRF levels were linked to faster reaction times in inhibition, working memory, and cognitive flexibility tasks, even after adjusting for confounding factors. Adolescents with lower CRF showed higher risks of EF impairments. These findings highlight the importance of promoting CRF to support both physical health and cognitive development in youth. However, the cross-sectional design limits causal conclusions, and future longitudinal studies are recommended.(Gunjian B et al.,2024)

Other investigations, such as Pawaria et al. (2017), observed average CRF levels among physiotherapy students, while Khan and Sheth (2019) reported generally lower fitness among Ghanaian physiotherapists, with reductions linked to increasing age. Such evidence underscores the need for ongoing fitness assessments and personalized training strategies for university athletes.

Limitations of this research include its cross-sectional nature, dependence on self-reported demographic details, and being confined to a single institution. Additionally, participants' busy schedules limited both recruitment and adherence to the testing protocol.

Conclusion:

This study concludes that university athlete students generally exhibit satisfactory to excellent levels of cardiorespiratory fitness, with male students demonstrating significantly higher Physical Fitness Index (PFI) and Body Mass Index (BMI) compared to females.

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