



## Original Article

## Cardiovascular Fitness Assessment through 3 Minutes Step Test in Adults of Lahore during COVID-19 Pandemic

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### ABSTRACT

At the end of the year, 2019 world witnessed a disease, which is still affecting the world, this disease was named Corona Virus Disease -19 (COVID-19). It is a highly infectious disease that causes severe acute respiratory syndrome. **Objective:** To find out the impact of COVID-19 on the cardiac fitness of young and middle-aged adults. **Methods:** A cross-sectional study was conducted at ON-Campus Physiotherapy Clinic at University of Management and Technology, Lahore. Convenient sampling was used. The sample size was 437. Healthy participants from both genders aging 17-45 years were recruited in the study. A self-designed questionnaire validated through a pilot study was used to record the data. Three minutes step test was performed and pre and post-test Cardiac rate were recorded. IBM SPSS Statistics for Windows was used to record and analyze all data. **Results:** Results showed that the female participants were 271 (59.7%) while males were 176(41.3%), young adults proportion was 76% while middle-aged adults was 24%. The overall results of the post-test 3-minutes step test show that a majority of the population 30.7 % (n=134) had excellent cardiac rate, a good proportion of the sample had the same value for Good and above-average cardiac rates (f=22.4 %, n= 98) while fewer number participants fall in rest of the categories such as average, below average, poor and very poor ( 12. %, 7.1%, 3.0 %, 2.3 %) respectively. **Conclusions:** The study concluded that the overall cardiac capacity of young and older adults is not affected by the pandemic but the females have a better cardiac condition as compared to men.

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## INTRODUCTION

At the end of the year 2019, the world witnessed a disease, which is still affecting the world, this disease was named Corona Virus Disease -19 (COVID-19) [1]. Coronavirus disease is a highly infectious disease that causes severe acute respiratory syndrome [2]. This disease affects in such a way that it affects the human respiratory system and also lowers the immune system which leads to an increase in the level of underlying medical conditions and increases the chances of other infections as well. This whole process combined in a cyclic manner leads to systemic failure and death [3,4]. Multiple factors are involved in the severity of the disease, this varies from asymptomatic to mild and moderate and can lead to death [5]. The speed of spread was too high that in March 2020 WHO declared this a pandemic. This virus can spread through close contact, sneezing, coughing, and talking [6]. COVID-19 is extremely virulent and because of this many preventive and containment measures were taken including the use of hand sanitizers, gloves, protective eyewear, cancellation of air travel, sports activities, social gatherings, closures of schools, universities, business activities, and the lockdown was also imposed [7,8]. Lockdown is still known best procedure to reduce the risk of spread of COVID-19 [9].

As lockdown was imposed across the world it reduces all types of activities, this resulted in potential adverse effects on the well-being of humans which include psychological as well as physical health. This lockdown also brought a sedentary lifestyle [10]. A sedentary lifestyle, prolonged sitting, and reduced physical activity decrease cardiac and aerobic capacity [11-13] as well as increases the risk for other diseases such as obesity diabetes, and cardiovascular diseases [14,15].

Physically active persons have good cardiac/ aerobic fitness as compared to non-active persons [16-18]. Many studies were conducted to find out the impact of COVID-19 on all professionals and general populations as well, majority of studies were on mental health, stress, anxiety but we did not find any study which shows the effects of a sedentary lifestyle on cardiac capacity due to lockdown and other restrictions imposed by the government and other legislative bodies, that why we started to study these effects.

## METHODS

A single-centered, cross-sectional study was conducted at ON-Campus Physiotherapy Clinic at University of Management and Technology, Lahore. Using Convenient Sampling Technique; Young and Middle-aged Healthy participants with ages between 17 and 45 years of both genders were divided into two groups, young adults aging 17-30 years & middle-aged adults 31-45 years [19] having no known Cardiac, Respiratory, and Musculoskeletal and Systemic disease were requested to participate in the study. A total of 550 participants agreed to participate in the study and a written consent form in either English or Urdu was taken from the participants. Participants were assessed to determine any kind of risk factors that may limit a person's ability to exercise. For this purpose, Physical Activity Readiness Questionnaire (PAR-Q) was filled by the participants [20].

The participant answering "YES" for any question in the questionnaire was excluded from the study. So, data from a total of 437 participants was used for statistical analysis. A self-designed questionnaire validated through pilot study was filled out from 437 participants. It includes demographic data and pre and post 3 minutes step test values. The Procedure was verbally and practically demonstrated to the participants. They were asked to sit comfortably in a chair in a quiet, Temperature and Humidity controlled room. The heart rate and Pulse rate of the participants were measured for exactly one minute. A metronome mobile application was used to indicate the steps for the test; the frequency was set to 96 BPM. Stepping rate was 24 cycles (1cycle = 4clicks). Box used had a height of 30cm. After completing the test, participants were advised to sit on the chair, remain still and participants' heart rate is measured for 1 minute [21]. All the data was recorded and analyzed through IBM SPSS. Measurements were compared between two groups of young and older adults by using the independent sample t-test for the normal data and Mann-Whitney test for the skewed data. Whereas the relationship between age, and gender with 3-minute step tests indices was investigated by using multivariate regression analysis. A *p-value* of less than 0.05 was used to designate the statistical significance of all analyses. Ethical approval was granted by the Office of Innovation and Research, University of Management and Technology, Lahore (UMT-008/009-2021), Pakistan.

## RESULTS

For the age group, frequency of young adults was 76% while for the older adults it was just only 24%. It also revealed that post-test aerobic capacity is higher  $91.02 \pm 16.08$  (SD) than the resting cardiac rate  $73.07 \pm 10.64$  (SD). The overall results of post-test 3-minutes step test show that the majority of the population 30.7 % (n=134) had excellent cardiac rate, a good proportion of sample had same value for Good and above-average cardiac rates (f=22.4 %, n= 98) while less number participants fall in rest of the categories such as average, below average, poor and very poor ( 12. %, 7.1%, 3.0 %, 2.3 %) respectively.

Characteristics /Variables	Mean + SD	f % (n)
Age	27.06 + 6.96	
Age Groups		
Young Adults		76.0 (332)
Middle-Aged Adults		24.0 (105)
Gender		
Male		40.3 (176)
Female		59.7 (261)
Resting Cardiac Rate (Pre-test)	73.07±10.64	
Cardiac Rate (Post-test)	91.02±16.08	
3-Minutes Step Test (3MST)		
Excellent		30.7 (134)
Good		22.4 (98)
Above Average		22.4 (98)
Average		12.1 (53)
Below Average		7.1 (31)
Poor		3.0 (13)
Very Poor		2.3 (10)

**Table 1:** Socio-demographic and Descriptive analysis of the study subjects (n=437)

**Notes:** Data were expressed as mean ± SD for numerical variables and presented as percentages and numbers for categorical variables

In table 2 Mean values of age, and cardiac rate in resting and post-test were compared between different genders using an independent t-test, and findings are presented. Results showed that the mean age of female participants was significantly (p = 0.036) higher as compared to the mean value of male participants. One of the clinical variables, pre-tests resting rate did not show any significant (p=0.705) difference among the participants of the different sex. However, 2<sup>nd</sup> clinical parameter post-test cardiac rate showed that females had a significantly (p=0.078) higher rate than the opposite gender.

Characteristics /Variables	Mean ± SD		p-value
	Male	Female	
Age	26.21 ± 6.70	27.64 ± 7.09	0.036 <sup>a</sup>
Resting Cardiac Rate (Pre-test)	73.31±9.43	72.91±11.40	0.705 <sup>a</sup>
Cardiac Rate (Post-test)	89.37± 15.37	92.13 ± 16.49	0.078 <sup>a</sup>

**Table 2:** Comparative analysis of the Numerical variables as per gender (n=437)

**Notes:** Normal data were given as the mean ± SD and skewed data were given as medians (interquartile ranges). A level of significance value was set (p< 0.05) and data were analyzed using an independent t-test for normal data; b= Mann–Whitney Test for skewed data.

In table 3 the categorical variables like age groups and the 3-minute step test were compared among males and females using the *Pearson Chi-Square test* and proportion values are demonstrated. Not surprisingly, in the age groups also, women’s number and frequency is significantly (0.034) higher than the men. The overall result of all parameters of three minutes step test is significant (p=0.023).

Characteristics /Variables	f % (n)		df (p-value)
	Male	Female	
Age Groups			
Young Adults	43.1 (143)	56.9 (189)	0.034 <sup>a</sup>
Middle-Aged Adults	31.4 (33)	68.6 (72)	
3-Minutes Step Test (3MST)			
Excellent	32.1 (43)	67.9 (91)	0.023 <sup>a</sup>
Good	38.8 (38)	61.2 (60)	
Above Average	46.9 (46)	53.1 (52)	
Average	49.1 (26)	50.9 (27)	
Below Average	45.2 (14)	54.8 (17)	
Poor	15.4 (02)	84.6 (11)	
Very Poor	70.0 (07)	30.0 (03)	

**Table 3:** Comparative analysis of the Categorical Variables as per gender (n=437)

**Notes:** The data were demonstrated as the frequencies and numbers f (n). These frequencies were compared and analyzed between different genders using a: Chi-Square Test. A level of significance value was set (p < 0.05).

## DISCUSSION

Aerobic capacity is one of the most important factors through which we can check or determine any person’s cardiac health, whether he is a normal person, athlete, or diseased person [22]. It is well-established norm we can predict the cardiovascular health level through aerobic capacity of that person. Poor aerobic capacity causes deteriorated cardiovascular health and vice versa [23]. Many studies used 3- minutes steps, along with other methods to measure and check the aerobic capacity and strength of the cardiovascular system [24]. Step tests help us to predict risk factors of heart health which are normal on resting even with the chronic condition, the intensity of impairment associated with disability, and also the prognosis [25]. The study was conducted on 400 plus subjects as per objectives, where we found that majority of participants were females, and less number were males. The mean age of participants was 27.06 ± 6.96 and they were divided into two groups of young and middle-aged adults, major proportion was of the young group as compared to other.

In the present study Mean heart rate in resting as well as post-test is 73.07±10.64 & 91.02 ± 16.08 respectively. Our study agrees with the findings of another study that measured the aerobic capacity and heart rate in young adults aging from 17-

24 years at Jinnah Medical & Dental College Karachi. The results are measured and compared with ours, especially the cardiac resting rate which was  $77.53 \pm 9.81$  [26]. In a study, we found that patients have high cardiac rates in both genders as compared to current study, which may be due to higher mean age and also associated with chronic conditions [27]. Another study was conducted to predict the cardio-respiratory fitness in the geriatric population through the step test, they also check the heart rate which is also higher as compared to our study [28]. In 2015 a similar study was conducted on medical students in India which indicates that male students were more fit as compared to female, this feature of their study is opposite to ours [12]. The current study measured the heart rate in both genders in resting position which is  $72.91 \pm 11.40$  in females &  $73.31 \pm 9.43$  in males. Another study supports to this finding; conducted at Andrews University students, the resting heart rate in the male students was  $73.1 \pm 13.5$  that are similar to our study [29].

In our study, we found that majority of our participants were having excellent & good cardiac conditions while comparatively fewer numbers on average, a very low number in poor category. Along with these statistics, in our study females have an upper hand regarding their aerobic fitness as compared to their counterparts. In a similar study, they checked the cardiac performance of young adults, and the results are contradicted to ours, they found a very less percentage of excellent category while the majority fall in good and average. Females were less fit as compared to men this also does not support our results. The reason behind this conflict of results is might due to a smaller number of participants in another study as well as the mean age which is  $19.49 \pm 1.62$  years as compared to ours which is  $27.06 \pm 6.96$  years [30].

There are a few limitations in our study, the majority of participants were young adults. A study with BMI calculation could provide us with a better picture. Physical activity level, working or study hours, level of education, and job status may provide us with a clearer scenario to us.

## CONCLUSIONS

It is concluded that the cardiac capacity of young and older adults is not affected by the pandemic. Females have better cardiac conditions as compared to men which suggest that females are doing their routine work in the home while males have lack of physical activities due to work from home mode.

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