



Original Article

To Compare the Effect of Brisk Walk and Stair Climbing on Cardiopulmonary Endurance in University Students

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ABSTRACT

To evaluate the effectiveness of brisk walking and stair climbing on cardiopulmonary endurance in university students. **Methods:** 28 (male=14, female=14) young healthy adults were recruited for this study. VO_2 max and BMI, baseline measures were taken before the follow up. Participants in stair climbing group were asked to climb 60 stairs (height= 15cm each step) comprises of three flights per bout and a total of 180 stairs per session; three days a week, for a total of 12 training sessions over 4 weeks. In group B participants were asked to walk briskly for least 20 min a day, 3 times a week, for a total of 12 sessions for four weeks. VO_2 max and BMI measures were taken after the follow up. **Results:** Out of a sample of 28 participants, In Group A (Stair Climbing) the age of participants was 21.86 ± 1.45 years, BMI pre was 21.96 ± 3.31 kg/m², which decreased to BMI post was 21.93 ± 3.29 kg/m², VO_2 max pre was 42.45 ± 4.57 (mL.kg⁻¹.min⁻¹) and VO_2 max post was increased to 46.07 ± 4.51 ; mean \pm SD). In Group B (Brisk Walking) the age of participants was 22.92 ± 1.85 years, BMI pre was 22.03 ± 2.75 kg/m², BMI post was 21.53 ± 1.93 kg/m², VO_2 max pre was 42.07 ± 3.52 (mL.kg⁻¹.min⁻¹) and VO_2 max post was increased to 43.84 ± 3.36 ; mean \pm SD). **Conclusion:** It is concluded from the study that stair climbing can improve cardiopulmonary endurance in young healthy university students as compared to the brisk walking.

INTRODUCTION

Cardiopulmonary endurance is termed as the capability of cardiac and pulmonary systems which delivers oxygen (O_2) and adequate nutrients to working muscles without being overly tired [1]. According to a research, elevated levels of cardiorespiratory fitness (CRF) in healthy population including both genders have 43% and 53% lesser chances for mortality rate due to all cause, and 47% and 70% lesser chances of (CVD) mortality, respectively [2]. Contrary to this people with low levels of cardiorespiratory health have a considerably higher risk of mostly CVD events all-cause mortality [2, 3]. The main purpose of the cardiorespiratory function is to transport oxygen (O_2) to the body tissues and removal of carbon dioxide from the physique. While performing exercise muscle activity increases, and there must be an increase in oxygen supply for fulfilling the demands of aerobic metabolism for generating energy [4].

Cardiopulmonary endurance is considered to be fundamental part of physical health as it benefits health and wellness [5]. It increases the chances of life expectancy. It strengthens the heart and lungs which reduces the existence of early fatigue while performing physical activity and also clear the blood vessel which ease the transport of oxygen to the large muscle during vigorous activity. Regular physical activity and exercise are very favorable and advantageous in promoting physical and mental health both in men and women. The lifestyle of contemporary students nowadays mainly consists of sedentary tasks due to their predominantly hectic routine that in its own right consists of endeavors which though accomplishment yet dormant [6]. In a study held in United Kingdom it is discovered that students of university consumed their 8 hours in a day on deskbound activities in

which their activity level is very low for example while studying, gaming, watching television, computer activities, sitting and chatting [8]. The rapidly increasingly serious complication of individuals is difficulty to maintain or improve their cardiorespiratory fitness may be due to absence of opportunity for them to perform exercise in their daily lives. Technology based equipment and modalities such as treadmills and ergometers have been approved by many researchers in promoting physical health and CRF [8]. Walking is a great way in providing many health benefits in improving and maintaining overall health and it also decreases the risk of a variety of chronic health conditions [9]. A American journal stated that brisk walking and jogging decreases the chances of hypertension, diabetes and high cholesterol in blood [10]. It is a safe and simple form of exercise. It can deliver many health benefits, decreasing the risk of a range of chronic health conditions, especially those relating to cardiovascular disease [11, 12]. Stair climbing is an important activity that can have a powerful and healthy impact on functional activities in daily living. There are a lot of public places like universities, schools, restaurants, shops that give a chance to climb stairs in daily life. It is a fundamental activity which requires independent mobility in any community setups Performing stair climbing on regular bases has played an important role in increasing VO₂ max, minimize the risk factors related to CRF and increase the power of lower legs [14, 15]. This study is concerned to compare the effectiveness of stair climbing and brisk walking on cardiopulmonary endurance in young healthy students.

METHODS

Questionnaire: Consent forms were given to participants before participating in the study. After written consent participants were given Physical Activity Readiness Questionnaire [16]. Subjects who did not fulfill the criteria of PAR-Q were excluded from the study. After this their demographic data were taken, which include their name, age, height, gender and weight.

Participants: Twenty-eight healthy young adults (male=14, female=14) of age 20-29 volunteering for this study were recruited from the University of Lahore (UOL) Chenab campus. Participants were allocated to either the brisk walking protocol group (n=13) and the stair climbing protocol group (n=15) by using Non-probability convenient sampling technique. Participants were not involved in any regular exercise training program and all were non-obese, non-smoker, and free of any known cardiovascular diseases. No one had any musculoskeletal disorder or deformity and any fractures of limb. Contributors were educated to refrain from any other exercise or physical

activity which effect their heart rate during study participation.

Measures: Before starting the exercise protocols VO₂max and BMI were assessed in the laboratory. BMI was calculated by using their weight and height values. VO₂ max was assessed using the RWT of one mile. Participants were asked to walk a complete 1 mile on treadmill starting from the 3.5miles/hour speed to 5.8miles/hour. After completing the walk, heart rate was immediately obtained by counting their pulse. Then by using the Rockport 1 Mile Walking Test equation VO₂max were calculated [17]. These measurement values were taken before and after the exercise protocols. VO₂ max norms for 20-29-year-old men and women are given by ACSM's Guidelines [18].

Interventional Groups: Two exercise groups were designed: Group A=Stair Climbing, Group B=Brisk Walking

Exercise Protocols: Brisk walking exercise protocol was designed after the previous study by E. Leslie et al. [19] Participants was asked to walk briskly for 20 minutes on a smooth surface. Members were told to walk fastly as they have to catch the bus (100 steps per minute) a day for least 20 min 3 times a week, for a total of 12 session for four weeks. The "snacks" stair climbing protocol was designed followed by the previous study by Allison et al. [20] that involved 3x60-s 'all-out' sprints scattered with 2 minutes of recovery. For the present study participants were asked to climb 60 stairs (height=15cm each step) comprises of three flights per bout and a total of 180 stairs per session. Per session included three bouts. Participants in stair climbing group reported to perform, three days in a week, which collectively made a total of 12 exercise sessions over 4 weeks.

RESULTS

The results have been obtained by analyzing the pre and post data collected from 28 participants.

Data was entered and analyzed by SPSS version 23. Mean \pm standard deviation were calculated for descriptive analysis of quantitative data. Frequency and percentages were applied for descriptive analysis of qualitative data. For the significance, paired t-test and independent t-test were used for the pre and post data.

Variables	Protocol Groups	
	Group A (Stair Climbing)	Group B (Brisk Walking)
	Mean \pm S.D	Mean \pm S.D
Age (Years)	21.86 \pm 1.45	22.92 \pm 1.85
BMI Pre kg/m ²	21.96 \pm 3.31	22.03 \pm 2.75
BMI Post kg/m ²	21.93 \pm 3.294	21.53 \pm 1.93
VO ₂ max pre (mL.kg ⁻¹ .min ⁻¹)	2.45 \pm 4.57	42.07 \pm 3.52
VO ₂ max post (mL.kg ⁻¹ .min ⁻¹)	46.07 \pm 4.51	43.84 \pm 3.36

Table 1: Demographic Characteristics of Participants in both Groups

Table 1 shows demographic Characteristics of Participants in both Groups. In Group A (Stair Climbing) the age of participants was (21.86 ± 1.45) years, BMI pre was 21.96 ± 3.31 kg/m², BMI post was 21.93 ± 3.29 kg/m², VO₂ max pre was 42.45 ± 4.57 (mL.kg⁻¹.min⁻¹) and VO₂ max post was increased 46.07 ± 4.51 ; mean \pm SD). In Group B (Brisk Walking) the age of participants was (22.92 ± 1.85) years, BMI pre was 22.03 ± 2.75 kg/m², BMI post was 21.53 ± 1.93 kg/m², VO₂ max pre was 42.07 ± 3.52 (mL.kg⁻¹.min⁻¹) and VO₂ max post was increased 43.84 ± 3.36 ; mean \pm SD).

Protocol Groups	Variables	Paired Differences	t	df	P-value
		Mean \pm S.D			
Group A (Stair Climbing)	BMI Pre kg/m ² - BMI Post kg/m ²	0.025 \pm 0.02	9.255	14	.000
Group B (Brisk Walking)	BMI Pre kg/m ² - BMI Post kg/m ²	0.49 \pm 1.54	1.166	12	.266
Group A (Stair Climbing)	Vo ₂ max pre (mL.kg ⁻¹ .min ⁻¹) - VO ₂ max post (mL.kg ⁻¹ .min ⁻¹)	-3.63 \pm 0.99	-14.126	14	.000
Group B (Brisk Walking)	VO ₂ max pre (mL.kg ⁻¹ .min ⁻¹) - VO ₂ max post (mL.kg ⁻¹ .min ⁻¹)	-1.76 \pm 0.43	-14.927	12	.000

Table 2: Between group analysis

P-value was calculated by paired samples t-test

In above Table 2, for within group analysis, Paired samples t-test was used. In group A (Stair Climbing), statistically significant difference was present in BMI and VO₂ max with $(0.025 \pm 0.02$; P-value ≤ 0.001 , -3.63 ± 0.99 ; P-value ≤ 0.001) respectively. In Group B (Brisk Walking) statistically significant difference was not present in BMI with $(0.49 \pm 1.54$; P-value ≤ 0.226) while statistically significant difference was present in VO₂ max with $(1.76 \pm 0.43$; P-value ≤ 0.001) respectively.

Variables	t-test for Equality of Means					
	t	df	P-value	Mean Difference	95% Confidence Interval of the difference	
					lower	Upper
BMI Pre kg/m ²	-0.061	26	0.952	-0.07077	-2.45643	2.31489
BMI Post kg/m ²	0.385	26	0.704	0.40082	-1.74182	2.54347
VO ₂ max pre (mL.kg ⁻¹ .min ⁻¹)	0.240	26	0.812	0.37497	-2.83387	3.58382
VO ₂ max post (mL.kg ⁻¹ .min ⁻¹)	1.468	26	0.154	2.23559	-0.89548	5.36666

Table 3: Independent Sample t-Test for Equal Variance

In above Table no 3 data were analyzed within groups by using Independent Sample t-Test for Equal Variance. It was analyzed from the test that there was no statistically significant difference between BMI Pre kg/m² and BMI Post kg/m² values with $(t(26) = -0.061, p = 0.952, t(26) = 0.385, p = 0.704)$ respectively. It was analyzed from the test that there was no statistically significant difference between VO₂ max pre (mL.kg⁻¹.min⁻¹) and VO₂ max post (mL.kg⁻¹.min⁻¹) with $(t(26) = 0.240, p = 0.812, t(26) = 1.468, p = 0.154)$.

DISCUSSION

The aim of this study was to evaluate the comparison of the

effectiveness of brisk walking and stair climbing on cardiopulmonary endurance in university students. This study revealed that stair climbing is more effective exercise in increasing maximal oxygen uptake VO₂ max as compared to brisk walking but there was a slight decrease in BMI after performing brisk walking for four weeks but the change was not so obvious i.e. stair climbing (VO₂max; 42.45 ± 4.57 mL/kg per min to 46.07 ± 4.51 mL/kg/min) while in brisk walking (VO₂max; 42.07 ± 3.52 mL/kg per min to 43.84 ± 3.36 mL/kg/min) Enhancement in VO₂max can be because of metabolic changes, such as increased blood delivery and amplified oxidative volume inside the muscles, and the positive variations of the CVS that improves blood and oxygen supply to the dynamic functional muscles throughout the workout. Contrary to this in a study conducted in young adults by Min Jeong Cho et al. there was no changes in VO₂ max were observed in both exercise groups i.e. brisk walking: (VO₂max; 37.46 ± 5.21 to 38.33 ± 6.73 mL.kg/min), stair climbing (VO₂max; 35.47 ± 7.83 to 37.03 ± 8.26 mL/kg/min, $p = 0.726$) after two weeks of exercise. This study identifies after following stair climbing protocol as sprint interval training for four weeks, the changes produce are positive. It indicates that stair climbing can increase maximal oxygen uptake after performing it three times in a week for a total of four weeks. These answers are in accord with other studies conducted by Allison et al. [20]. to find the efficiency of climbing the stair training. In which they carried out a study in young sedentary women to determine the effectiveness of brief intense stair climbing. They followed the two protocols of stair climbing in their study one was the 3×20 s continuous ascent model and the other was 3×60 s models of getting on and off. In participants there was an increase of 7% in VO₂ max after following 3×60 s model. In present study the 3×60 s models of getting on and off were followed but this study was only conducted in female population. Contrary to this, present study is conducted in both males and females. This study use the VO₂ max as a parameter for the estimation of cardiopulmonary endurance. It is considered one of the most representing measuring tool for calculating the cardiac fitness level and cardiac output. The measurement values for VO₂ max are classified by ACSM. Several methods are used for the estimation of the VO₂ max for example astrand treadmill test, RWT, six minute walk test, three minute step test and many more. This study used the rockport one mile walk test for estimation of the VO₂ max in young university students. The rockport one mile walk predicts the aerobic fitness levels of almost all ages. Another study conducted by Kounkim et al. [17]. used this test in young adults to estimate the VO₂ max but they also measured the Respiratory function including maximal inspiratory

pressure, forced expiratory volume, and forced vital capacity. This study suggest that stair climbing has more positive effect on cardiopulmonary endurance by increasing VO₂ max then brisk walking in young healthy university students. Therefore, null hypothesis was rejected and alternate hypothesis was proved because stair climbing has more effective then brisk walking.

CONCLUSION

Findings of the present study illustrated the comparison of the effects of brisk walk and stair climbing on cardiopulmonary endurance in university students. It was seen from the study that Stair climbing has more positive effects on cardiopulmonary endurance as compared to Brisk Walking in university students while brisk walking shows positive change in BMI. Hence, it is concluded from the study that stair climbing can improve cardiopulmonary endurance in university students.

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