ISSN: 2321-5690
IJOPT
INDIAN JOURNAL OF PHYSICAL THERAPY
AN INTERNATIONAL JOURNAL
INDIAN JOURNAL OF PHYSICAL THERAPY
AN INTERNATIONAL JOURNAL
editor.ijopt@gmail.com

TO ASSESS THE EFFECTIVENESS OF CIRCUIT TRAINING ON CARDIOVASCULAR ENDURANCE IN COLLEGE GOING STUDENTS -AN EXPERIMENTAL STUDY

Pala keerthy[1*], Rajesh Brundavanam[2]

[1,2] NRI College of Physiotherapy, NRI Academy of Medical Sciences, Guntur, Andhra Pradesh, India

***Corresponding Author:** palakeerthy24@gmail.com

ISSN: 2321-5690
DOI: https://doi.org/10.63299/ijopt.060452

ABSTRACT

Objective: The main objective of the study was to find out the effectiveness of circuit training on cardiovascular endurance in College going students.

Methods: 100 Students between the ages of 18 to 25 years were screened for PAR -Q and 50 students were selected for the study. The treatment program was conducted for 12 weeks, scheduled for 32 sessions. The outcome measures were six minutes walk test and Three minutes step test which were recorded before and after treatment sessions

Results: There was increase in cardiovascular endurance after 12 weeks circuit training program (p value < 0.001) which was statistically significant.

Conclusion: On the basis of results of our study we concluded that circuit training exercises are effective in improving the cardiovascular endurance in college going students

Keywords: cardiovascular endurance, circuit training, College going students, physical fitness.

INTRODUCTION

It is essential for an individual to be physically fit in order to lead a happy and prosperous life. Physical fitness makes an individual perform the assigned responsibilities efficiently and effectively. She/he is mentally sharper and more physically active . Simply it is the capacity of a person to carry out daily routine assignments without undue fatigue [1]. It makes an individual Health related physical fitness enables an individual to show resistance to various kinds of diseases and illnesses because it improves the immune system of the body. An individual is more productive[2]. It makes a from various sorts of psychological problems like anxiety, depression etc.; it creates self-confidence and emotional stability in a person[3]. Cardiovascular endurance is the component of health-related fitness[4]. It is the ability of the heart, lungs and blood vessels to deliver the adequate quantity of oxygen (O2) and nutrients to cells of working muscles. In the cells of working muscles, energy is produced from the nutrients in the presence of O2[5]. The energy is used by the working muscles to carry on the task/activity for a longer time without undue fatigue . Respiratory system and cardiovascular systems of the body play an important role in achieving the quality of cardiovascular endurance. More O2 is inhaled into the lungs, and carbon dioxide(CO2) is exhaled during physical activity. The heart also pumps more oxygenated blood into the tissues of the body for

energy production to carry on the activity for a longer period of time[6]. Cardiovascular endurance decreases the risks of cardiovascular diseases. It minimizes the chances of obesity and obesity is not a problem itself, but it also paves the way to other health problems like coronary heart diseases, stress and diabetes[7]. There are various factors that affect cardiovascular endurance . Some of the factors are lack of balanced diet, the proper taking of sleep and rest . Lack of physical activity also one of the main factors that have affected cardiovascular endurance . The above mentioned reasons was responsible to reduction of Cardiovascular endurance .Cardiovascular diseases constitute an important cause of morbidity and mortality globally[8]. In India, key risk factors for CVDs in young adults include high cholesterol, obesity, poor diet, and sedentary lifestyle Study of India (LASI) [9]. The pathophysiology of cardiovascular diseases including Atherosclerosis is the major cause of cardiovascular disease. Hypercholesterolemia, hypertension and cigarette smoking are the common risk factors for atherosclerosis. These risk factors unite behind a convergence of mechanism, involving oxidation and inflammation in the artery wall that, with time, gives rise to characteristic fatty-fibrous lesions. Physical trauma and inflammation produce lesion rupture, which can lead to clinical events such as heart attack and stroke, or resolve with plaque growth. Disease progression is marked by the inflammatory indicator CRP (C-reactive protein) [10]. American heart association defined decreased physical activity as the 4th Risk factor cardiovascular disease . Physical activity reduces the psychological problems like stress and anxiety because the body releases endorphins hormones during physical activity. The stated hormones release tension, and promotes mental relaxation[11]. Regular participation in exercise leads to improvement in the capacity of cardiovascular endurance .The American Heart Association recommends at least 150 minutes of moderate-intensity aerobic exercise or 75 minutes of vigorous-intensity aerobic exercise per week to improve cardiovascular fitness and reduce the risk of cardiovascular disease [12]. Circuit training is one of the types of training that comprises different kinds of resistance exercises . It is a sort of resistance training in which body weight or equipment weight is used as resistance . It enhances both strength and endurance[13]. It May be designed for the participants according to their fitness level . It comprises of 9 exercises , and each exercise is performed on time or repetitions basis at a station .It provides the opportunity for more motor engagements in a short time .The duration and frequency of Circuit Training for the current study was 12 weeks and 3 times per week on alternate days , respectively. There was total 9 number of exercises, i.e. lunges , high knee sprints , abdominal , crunches, burpees, squats, squat jumps, plank, press ups, Jumping Jacks [14]. The intensity of exercise was 55% to 65% and 65% to 75% of HRmax for 1 to 6 weeks and 7 to 12weeks, respectively. The Time of warm-up (walk and dynamic stretching exercises) and warm down (walk and static stretching exercises)was each of 10 minutes for every training session . The total time of the training session was 40 to 55 minutes, including the time of warm-up and warmed down. There were two sets of each training[15].

Weeks	Exercise time	Interval between exercise	Rest time between sets	Time of training sessions
1-3	30 seconds	20 seconds	4minutes	40 minutes
4-6	40 seconds	25 seconds	4 minute 20 seconds	45 minutes
7-9	50 seconds	30 seconds	4minute 20 seconds	50 minutes
10-12	01 minute	35 seconds	4 minute 30 seconds	55minutes

SIGNIFICANCE

1.To find out effectiveness of circuit training on cardiovascular endurance in college going students .

2.To improve the cardiovascular endurance by giving circuit training programme in college going students.

3.To improve the physical fitness in college going students

OBJECTIVES

1.To Assess the Effect of circuit training on cardiovascular endurance in college going students

2.To test the Effect of circuit training on cardiovascular endurance in selected eligible subjects.

MATERIALS AND METHODOLOGY

The study was conducted at NRI College of Physiotherapy, Department of Physiotherapy, over a

duration of 12 months. The study design employed was a pre and post-experimental design, involving a sample size of 50 subjects who fulfilled the screening criteria for circuit training program. The materials used included Stopwatch, 12 inches platform , stopwatch , pulse oximeter , metronome , 30 metres walking tract, chair, two small cones, notebook .The participants, comprising boys and girls aged 18-25 years, were asymptomatic individuals who voluntarily agreed to participate in the study. The inclusion criteria consisted of subjects meeting the screening criteria, being within the specified age group, and providing informed consent. Conversely, the exclusion criteria included subjects not meeting the screening criteria, those under 18 years old. Individuals with recent history of trauma and active infection, lower limb fractures, Obtain at two occasions pre and post intervention measurements

- PAR-Q Questionnaire
- 6 minute walk test
- 3 minute step test

1. PAR- Q (Physical Activity Readiness Questionnaire) : It is used to determine the safety or possible risks of exercising based on your health history, current symptoms, and risk factors. It helps to create an ideal exercise prescription for a client.it should be used by anyone planning to start an exercise program .The PAR-Q contains only 7 yes or no questions. These questions are:

1)Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

2)Do you feel pain in your chest when you do physical activity?

3)In the past month , have you had Chest pain when you were not doing physical activity?

4)Do you lose your balance because of dizziness or do you ever lose consciousness?

5)Do you have a bone or joint Problem that could be worsened by a change in your physical activity?

6)Is your doctor currently prescribing drugs (for example , water pills) for your blood pressure or heart condition?

7)Do you know of any other reason why you should not do physical activity?PAR-Q results: The answers to these questions can help determine your readiness to begin an exercise program. If you answer yes to one or more PAR-Q questions and it is recommended that you consult a physician If the subject answered no to all PAR-Q questions the subject can be reasonably sure that can exercise safely .

2. 6 minute walk test :

The pre-test data on cardiovascular endurance was collected through the 6 minutes walk test . For this purpose, a 30-metre standardised track was drawn. 6 minutes to cover maximum distance in the mentioned time as far as possible. The walk started and stopped with the whistle. The covered distance of each subject was calculated and recorded in metres.The subject heartbeat is counted for one minute and then noted.

3. 3 minutes step test:

The test is used to measure the cardiovascular endurance . The subject has to step up on and back down from the plat- form . The up and back down process takes two seconds. Thus, a subject has to complete 30 steps per minute and will continue it for 3 minutes .The subject sits down immediately. The subject heartbeat is counted for one minute and then noted.

After the treatment of circuit training to the subjects, the post-test data on cardiovascular endurance of each subject was collected through a 6 minutes walk test and 3 minutes step test as the method adopted for the pre-test.

After taking the pre-test from all subjects who eligible for the inclusion criteria were taken into a group. The treatment protocol was set for 36 sessions for 12 weeks. The pre intervention measurements were noted for each subject .

The circuit training includes the following exercises

- Lunges
- Press ups
- Burpees
- Jumping jacks
- Squats
- Plank
- High knee sprints

- Abdominal crunches
- Squat jumps

PHYSICAL CHRACTERISTICS OF SUBJECTS Table 1 The physical characteristics of age, height, weight of the subjects are presented in below

S.NO	Variables		Mean	Median	SD	Minimum	Maximum
1	Age(years)		22.0	22.0	1.03	19	24
2	Height(cm)		154	155	7.33	132	166
3	Weight(kg)		59.9	59.0	11.3	43	92
4	Gender						
	Female N=36 (86%)	**Male N=14 (14%)**					

Table 2 Parameters of 6 minutes walk test

S.NO	Variables	Mean	Median	SD	Minimum	Maximum	P value
1	Pre distance(cm)	458	480	83.5	200	600	<0.001
2	Post – distance (cm)	586	587	58.6	495	700	<0.001
3	Pre - heart rate(bpm)	118	116	11.4	101	160	<0.001
4	Post – heart rate (bpm)	98.8	98.5	7.95	85	120	<0.001

Table 3 Parameters of 3 minute step test

S.NO	Variables	Mean	Median	SD	Minimum	Maximum	P value
1	Pre-steps	92.4	96.0	20.5	55	142	<0.001
2	Post-steps	125	123	29.5	65	200	<0.001
3	Pre-heart rate	166	164	18.5	135	216	<0.001
4	Post-heart rate	125	123	18.5	86	162	<0.001

Table 1 : The demographic data of the participants showed • The studied group consisted of 50 subjects out of which, the gender distribution with females (n=36) comprising (86%) of the participants and males (n=14) comprising (14%) of the participants . It reveals the mean values of age, height and weight of both groups before the treatment of circuit training to the subjects .

- The mean values of age height and weight of the subjects 22.0 years ,154cm ,59.9kg respectively.
- The median values of age height and weight of the subjects 22.0years ,155cm , 59.0kg respectively.
- The SD values of age height and weight of the subjects 1.03 years ,7.33cm ,11.3 kg respectively.
- The minimum values of age height and weight of the subjects 19 years ,132cm ,43 kg respectively and the maximum values of age height and weight of the subjects 24 years ,166cm ,92kg respectively

Table 2 - The Parameters of 6 minutes walk test of the subjects showed In terms of pre 6 minutes walk test distance in cm

- The mean was 485 ,SD=83.5,with a median of 480
- The pre 6minute walk test distance ranges from 200 to 600
- In terms of post 6 minutes walk test distance in cm
- The mean was 586 ,SD=58.6,with a median of 587.the post 6minute walk test distance ranges from 495 to 700
- In terms of pre 6 minutes walk test heart rate in BPM the mean was 118 ,SD=11.4,with a median of 116.the pre 6minute walk test heart rate ranges from 101 to 160
- In terms of post 6 minutes walktest heart rate in BPM the mean was 98.8 ,SD=7.95,with a median of 85.the post 6minute walk test heart rate ranges from 85 to 120

Table 3 - The Parameters of 3minute step test of the subjects showed

- In terms of pre 3minutestep test the steps the mean was 92.4 ,SD=20.5,with a median of 96.0.the pre 3 minute step test steps ranges from 55 to 142
- In terms of post 6 minutes step test the steps the mean was 125,SD=29.5,with a median of 123.the post 3 minute step test the steps ranges from 65 to 200

- In terms of pre 3 minutes step test heart rate in BPM the mean was 166 ,SD=18.5,with a median of 164.the pre 3 minute step test heart rate ranges from 135 to 216
- In terms of post 3 minutes step test heart rate in BPM the mean was125 ,SD=18.5,with a median of123 .the post 3 minute step test heart rate ranges from 86 to 162.

Parameters of 6minute walk test and 3 minute step test

Parameters of pre and post 6minute walk test and 3 minute step test was showed. The p value of all variables showed <0.001. it was the level of significance.

LIMITATIONS OF THE STUDY

The atmospheric temperature was not checked during the treatment and the food habits and lifestyle were not part of the study . The heredity differences were also beyond the control of the researcher.

FUTURE RECOMMENDATIONS

As it was concluded on the basis of the analysis of data that circuit training improves cardiorespiratory endurance of the college students hence, it is recommended to the government that it may be made part of their regular schedule so that they (students) may be able to enhance the stated quality of health-related physical fitness. The exercises of Circuit Training are simple. They may be made part of the curriculum of Health and Physical education for the students at all level. The exercises of Circuit Training may be performed without equipment. These may be adopted by the Government and non-Governmental organizations for the enhancement of cardiorespiratory endurance which is one of the key components of health-related physical fitness.

It is also recommended to the media to create awareness among the citizens about the benefits of Circuit Training with reference to the improvement of cardiorespiratory endurance.

CONCLUSION

It was concluded on the basis of the results of the study that the circuit training program of 12 weeks has a positive effect on cardiovascular endurance which is one of the key component of health-related physical fitness.

REFERENCE

1. Sahoo JK, Vatve M, Sahoo KD, Patil VV. Effect of specific" Yogasanas" on cardiovascular autonomic function test.

2. Jan B, Dar MI, Choudhary B, Basist P, Khan R, Alhalmi A. Cardiovascular Diseases Among Indian Older Adults: A Comprehensive Review. Cardiovascular Therapeutics. 2024;2024(1):6894693.

3. Paoli A, Pacelli QF, Moro T, Marcolin G, Neri M, Battaglia G, Sergi G, Bolzetta F, Bianco A. Effects of high-intensity circuit training, low-intensity circuit training and endurance training on blood pressure and lipoproteins in middle-aged overweight men. Lipids in health and disease. 2013 Dec;12:1-8.

4. Schmidt D, Anderson K, Graff M, Strutz V. The effect of high-intensity circuit training on physical fitness. The Journal of sports medicine and physical fitness. 2015 May 5;56(5):534-40.

5. McGavock JM, Anderson TJ, Lewanczuk RZ. Sedentary lifestyle and antecedents of cardiovascular disease in young adults. American journal of hypertension. 2006 Jul 1;19(7):701-7.

6. Scott J. Pathophysiology and biochemistry of cardiovascular disease. Current opinion in genetics & development. 2004 Jun 1;14(3):271-9.

7. España-Irla G, Gomes-Osman J, Cattaneo G, Albu S, Cabello-Toscano M, Solana Sanchez J, Redondo-Camós M, Delgado-Galen S, Alviarez-Schulze V, PachónGarcía C, Tormos JM. Associations between cardiorespiratory fitness, cardiovascular risk, and cognition are mediated by structural brain health in midlife. Journal of the American Heart Association. 2021 Sep 21;10(18):e020688.

8. Gellish RL, Goslin BR, Olson RE, McDONALD AU, Russi GD, Moudgil VK. Longitudinal modeling of the relationship between age and maximal heart rate. Medicine and science in sports and exercise. 2007 May 1;39(5):822-9.

9. Urbina E, Alpert B, Flynn J, Hayman L, Harshfield GA, Jacobson M, Mahoney L, McCrindle B, Mietus-Snyder M, Steinberger J, Daniels S. Ambulatory blood pressure monitoring in

children and adolescents: recommendations for standard assessment: a scientific statement from the American Heart Association Atherosclerosis, Hypertension, and Obesity in Youth Committee of the council on cardiovascular disease in the young and the council for high blood pressure research. Hypertension. 2008 Sep 1;52(3):433-51.

10. ADAMSON G. CIRCUIT TRAINING. Adamson GT. Circuit training. Ergonomics. 1959 Feb 1;2(2):183-6.

11. James Scott, Pathophysiology and biochemistry of cardiovascular disease, Current Opinion in Genetics & Development, Volume 14, Issue 3,2004,Pages 271279,ISSN 0959-437X,https://doi.org/10.1016/j.gde.2004.04.012.

12. https://www.sciencedirect.com/science/article/pii/S0959437X04000589

13. Sonchan W, Moungmee P, Sootmongkol A. The effects of a circuit training program on muscle strength, agility, anaerobic performance and cardiovascular endurance. International Journal of Sport and Health Sciences. 2017 Apr 1;11(4):176-9.

14. Nabi T, Rafiq N, Qayoom O. Assessment of cardiovascular fitness [VO2 max] among medical students by Queens College step test. Int j Biomed adv res. 2015 May;6(5):418-21.

15. Hydren JR, Cohen BS. Current scientific evidence for a polarized cardiovascular endurance training model. The Journal of Strength & Conditioning Research. 2015 Dec 1;29(12):3523-30.

Corresponding Author email address: palakeerthy24@ail.com

Funding: No funding was received from any organization or external sources for the study

For study protocol: NRI Academy of Medical Sciences, College of Physiotherapy approved the research protocol involving the human participants

Conflict of interest: No conflicts of interest

ACKNOWLEDGMENTS :

First and foremost, I pay my homage and bow before the almighty God who had helped me to complete the study

My sincere gratitude to Prof Dr. B. RAJESH, Ph.D. MPT (SPORTS), Principal and chief physiotherapist, NRI college of Physiotherapy & General hospital, for his teaching, support and motivation.

I am extremely grateful and indebted to my guide Prof Dr. B. RAJESH, Ph.D. MPT (SPORTS), Principal and chief physiotherapist, NRI college of Physiotherapy & General hospital, for contributing his valuable time, patience and expertise, for his inspiring timely suggestions and his support, guidance and mentorship helped me to reach my full potential. I thank him for the countless hours he spent relentlessly to share his ideas to format this study & encouraging me with new thoughts in completion of this endeavor successfully.

I would like to thank and express my profound gratitude to my parents and friends. My special thanks to all participants who participated in this study and willingly contributed their valuable time and energy for my study as subjects.

Authors contribution statement:

1. Drafting of the manuscript: P.Keerthy

2. Agreed to be accountable for all aspects of the work : P.Keerthy

3. Review of the final version to be published : P.Keerthy

4. Substantial contributions to concept and design: B.Rajesh

5. Acquisition, analysis, or interpretation of data: B.Rajesh

6. Critical review of the manuscript for important intellectual content: B. Rajesh

7. Supervision: B.Rajesh

Data sharing statement: All data relevant to the study are included in the article