

EXERCISE AS AN EMERGING FACTOR EFFECTING CARDIOVASCULAR HEALTH (AN EXPERIMENTAL APPROACH)

Abstract

This research study was basically carried out for the purpose to assess the effect of moderate intensity exercise on cardiovascular health. Ten (10) participants were voluntarily selected and thus they were randomly divided into two (02) groups i.e. (Experimental Group (EG)=05+ Control Group (CG)=05. A written informed consent was taken from each subject before participation in the study. All participants were informed about the benefits and risk factors of the study. After fulfilling all the ethical protocols, eight weeks self-made moderate intensity exercise protocol was applied on all the subjects. Pre and post test data were collected through Harvard Step Test. The collected data were tabulated and analyzed by using various statistical tools. On the basis of analysis the researcher arrived at conclusion that exercise has a significant effect on cardiovascular health.

Key Terms: Moderate, Exercise, Cardiovascular, Health

BACKGROUND OF THE STUDY

Body need to get involved in different bodily movements or activities for its development and maintenance. Regular exercise as well as balance diet is considered important for bodily growth and development. In addition it helps us to stay healthy by improving cardio respiratory endurance, muscular fitness, bone health, cardiovascular and metabolic health biomarkers [1]. Similarly lacking of regular exercise and balance diet may cause inactiveness among the children.

Numerous terms used for cardiovascular health such as cardiorespiratory fitness, maximal capacity and cardiovascular fitness etc. Literally cardiovascular health refers to the inclusive functioning of cardiovascular and respiratory system during vigorous physical exercise. During exercise a body to utilize more or maximum oxygen uptake is required and thus VO_2 Max is considered the best indicator of cardiovascular health [2].

VO_2 max is the maximum intake of oxygen during exercise. It is determined by liters/min as an absolute value or in milliliters /kg/min as relative VO_2 max. VO_2 can be measured through direct and indirect method. Walking/running tests followed by cycling and step tests are commonly used methods for measuring VO_2 maximum [3]. In addition it can be also measured through predication equations' rather than direct method because it is easily approachable in term of cost [3,4,5].

Physical fitness is ability of a person to do more work in the cost of less energy and also having ample energy to meet unforeseen emergency demands. Fitness with reference to cardiovascular

health refers to the state of the body when you heart as well as all allied organs work properly. Strength, speed, endurance, flexibility, and body composition all are the basic components of physical fitness [6].

For promoting cardiovascular health it is also suggested for a person to participate in regular exercise session [7, 8, 9].As a medical point of views, obesity is one among the series health complications among the peoples. Lacking of aerobic fitness also cause cardiovascular health problems. Likewise regular exercise significantly contribute to cardiovascular health [9, 10, 11, 12, 13, 14].Exercise promote health and reduce health consequences among the masses. Exercise with low volume and intensity promote cardiovascular health among the overweight peoples [15, 16,17].

From the above critical discussion of various researchers, now we can says that exercise promote health .How and what type of exercise promote health. To discover the fact the researcher initiated this particular resaerch study under the title “Exercise as an Emerging Factor Effecting Cardiovascular Health (An Experimental Approach)

OBJECTIVES OF THE STUDY

The main objective of this particular resaerch study was to examine the effect of moderate intensity exercise on cardiovascular health

METHODS & MATERIALS

Design of the Study

As the current study was associated with exercise and cardiovascular health. Therefore an experimental approach was carried out.

Study Participants

Ten (10) participants were voluntarily selected and thus they were randomly divided into two (02) groups i.e. (Experimental Group (EG)=05+ Control Group (CG)=05.The subjects were included in the study through the below inclusion criteria.

- The subjects aging more than 20 years and less than 30 years
- The subjects using no medication
- The subjects have no chronic health problems
- The subject who voluntarily partipcate in the study.

Ethical Consideration

A written informed consent was taken from each subject before participation in the study. Ethical approval was taken from Ethical Review and Resaerch Board, University of the Punjab Lahore Pakistan. All participants were informed about the benefits and risk factors of the study. After fulfilling all the ethical protocols, eight weeks self-made moderate intensity exercise protocol was applied on all the subjects.

Instruments and Instrumentations

After fulfilling all the ethical protocols, eight weeks self-made moderate intensity exercise protocol was applied on all the subjects. Pre and post test data were collected through Harvard Step Test.

Data Analysis

The collected data were processed through statistical package for social sciences (SPSS, version 24) and thus mean, standard deviation and t score were applied as statistical tools.

PRESENTATION & ANALYSIS OF DATA

Table 1. Shows Pre-test Anthropometric Measurement of EG

Code	Age	Weigh/Kg	Height/Cm	BMI	B/T	A/T/SEC	RHR	HRR	CVF	STEPS	Cat
A1	22	65	172.72	21.78	1	125	95	190	32.89	60	poor
A2	21	82	170.18	28.31	2	65	70	175	18.57	35	Poor
A3	22	70	167.64	24.90	2	123	105	177	34.74	70	Poor
A4	21	60	170.18	20.71	1	120	121	195	30.76	60	Poor
A5	21	59	170.18	20.73	1	242	90	230	52.60	110	Poor
Average	21.4	67.2	170.18	23.28		135	96.2	193.4	33.91	67	Poor

The above table depicts that mean in term of age was 21.4 years, the mean in term of weight of the was 67.2 kg, mean in term of height was 170.18cm, the mean in term of BMI was 23.28, the mean in term of activity time was 135 sec, mean in term of resting heart rate was 96.2, and heart recovery rate was 193.4, the mean in term of cardiovascular was 33.91, the mean in term of steps was 67. Hence this anthropometric characteristics shows that all the subjects were fall in Poor Zone.

Table 2. Shows Post-test Anthropometric Measurement of EG

Code	Age year	Weight Kg	Height Cm	BMI	B/T	A/T SEC	RHR	HRR	CVF	STEPS	CAT
A1	22	63	172.72	21.1	1	242	85	135	89.62	120	G
A2	21	78	170.18	26.9	2	180	83	118	76.27	72	AV..
A3	22	65	167.64	23.1	1	170	87	125	68	67	AV..

A4	21	58	170.18	20.0	1	175	81	135	61.11	65	LA
A5	21	58	170.18	20.0	1	163	78	119	68.48	69	AV..
Average	21.4	64.4	170.18	22.2		186	82.8	126.4	72.6	78.6	

The above table depicts that mean in term of age was 21.4 years, the mean in term of weight of the was 64.4 kg, mean in term of height was 170.18cm, the mean in term of BMI was 22.2, the mean in term of activity time was 186 sec, mean in term of resting heart rate was 82.8, and heart recovery rate was 126.4, the mean in term of cardiovascular was 72.6, the mean in term of steps was 78.6. Hence this anthropometric characteristics shows that all the subjects were fall in Average Zone.

Table 3. Shows Pre-test Anthropometric Measurement of CG

Code	Age year	Weight Kg	Height Cm	BMI	B/T	A/T SEC	RHR	HRR	CVF	STEPS	CAT
B1	24	92	185.42	26.75	2	71	79	147	24.14	37	Poor
B2	23	78	175.26	25.39	1	132	102	170	38.82	60	Poor
B3	22	90	170.18	31.07	2	75	87	142	26.40	35	Poor
B4	23	75	185.88	21.70	1	144	101	167	43.11	56	Poor
B5	23	65	162.56	24.59	1	60	74	100	30	26	Poor
Average	23	80	175.86	25.9		96.4	88.6	145.2	32.49	42.8	Poor

The above table depicts that mean in term of age was 21.4 years, the mean in term of weight of the was 80 kg, mean in term of height was 175.86cm, the mean in term of BMI was 25.9, the mean in term of activity time was 96.4 sec, mean in term of resting heart rate was 88.6, and heart recovery rate was 145.2, the mean in term of cardiovascular was 32.49, the mean in term of steps was 42.8 Hence this anthropometric characteristics shows that all the subjects were fall in Average Zone.

Table 4. Shows Posttest anthropometric measurements of CG

Code	Age Year	Weight Kg	Height Cm	BMI	B/T	A/T SEC	RHR	HRR	CVF	STEPS	CAT
B1	24	92	185.42	26.75	2	67	74	140	23.92	33	Poor
B2	23	78	175.26	25.39	2	65	88	150	21.66	28	Poor
B3	22	90	170.18	31.07	3	73	91	133	27.44	34	Poor
B4	23	75	185.88	21.70	1	67	80	121	27.68	25	Poor
B5	23	66	162,56	24.97	2	63	79	90	35	26	Poor
Average	23	80,2	175.86	25.97		67	82.4	126.8	27.14	29.2	

The above table depicts that mean in term of age was 23 years, the mean in term of weight of the was 80.2 kg, mean in term of height was 175.86 cm, the mean in term of BMI was 25.9, the mean in

term of activity time was 96.4 sec, mean in term of resting heart rate was 82.4, and heart recovery rate was 126.8 the mean in term of cardiovascular was 27.14, the mean in term of steps was 29.2 Hence this anthropometric characteristics shows that all the subjects were fall in Average Zone.

Table 5. Independent Sample T-test indicates the Mean difference between EG and CG in Term of BMI, Activity time, Resting Heart Rate, Heart Recovery Rate, Cardiovascular Fitness, Steps Before and After Treatment.

Testing variable	Testing Groups	N	Means	Std	T	Sig
BMI PRE	EG	5	28.28	3.289	-1.230	.254
	CG	5	25.90	3.430		
BMI POST	EG	5	22.22	2.906	-1.897	.049
	CG	5	25.97	3.340		
AT PRE	EG	5	136.80	64.549	1.201	.264
	CG	5	96.40	38.604		
AT POST	EG	5	186.00	31.929	8.277	.000
	CG	5	67.00	3.741		
RHR PRE	EG	5	96.20	18.833	-.749	.475
	CG	5	88.60	12.660		
RHR POST	EG	5	82.80	3.492	-115	.911
	CG	5	82.40	6.949		
HRR PRE	EG	5	193.40	22.142	3.016	.017
	CG	5	145.20	28.048		
HRR POST	EG	5	126.40	8.294	-.036	.972
	CG	5	126.80	23.123		
CVE PRE	EG	5	33.91	12.209	-.216	.834
	CG	5	32.49	8.152		
CVE POST	EG	5	72.69	10.877	8.490	.000
	CG	5	27.14	5.063		
STEPS PRE	EG	5	67.00	27.294	1.749	.118
	CG	5	42.80	14.549		
STEPS POST	EG	5	78.60	23.289	4.672	.002
	CG	5	29.20	4.086		

The above table shows the Pre and Post test result of both groups i.e. CG and EG (N=10) in term of BMI, Activity time, Resting Heart Rate, Heart Recovery Rate, Cardiovascular Fitness, Steps Before and After Treatment. The data were expressed through Mean and Standard Deviation. No significant difference was found in both EG and CG in term of BMI, $t_8 = -1.230$, $Sig = .254 < \alpha = .05$. No significant difference was found in both EG and CG in term of Activity time, $t_8 = 1.201$, $Sig = .264 > \alpha = .05$ before Treatment. Significant difference was found in both EG and CG in term of activity time $t_8 = 8.277$, $Sig = .000 < \alpha = .05$ after Treatment. No significant difference was found in both EG and CG in term of Resting heart rate $t_8 = .749$, $Sig = .475 > \alpha = .05$ before Treatment. No significant difference was found in both EG and CG in term of Resting heart rate $t_8 = .115$, $Sig = .911 > \alpha = .05$ after Treatment. Significant difference was

found in both EG and CG in term of HRR $t_8 = 3.016$, $\text{Sig} = .017 < \alpha = .05$ before and after Treatment. No significant was found in both EG and CG in term of CVF $t_8 = -.216$, $\text{Sig} = .834 > \alpha = .05$ before Treatment. Significant difference was shown in both EG and CG in term of CVF $t_8 = 8.490$, $\text{Sig} = .000 < \alpha = .05$ after Treatment. No significant difference was found in both EG and CG in term of steps $t_8 = 1.749$, $\text{Sig} = .118 > \alpha = .05$ before Treatment. Significant difference was found in both EG and CG in term of steps $t_8 = 4.672$, $\text{Sig} = .002 < \alpha = .05$ after Treatment

Table 6. Independent Sample T-test indicates the Mean difference between EG in term of BMI, Activity time, Resting Heart Rate, Heart Recovery Rate, Cardiovascular Fitness, Steps Before and After Treatment

Testing Groups	Testing Variables	N	Means	Std	T	Sig
Pair 1	BMI PRE	5	3.289	4.662	-010	3.289
	BMI POST	5	2.906			2.906
Pair 2	AT PRE	5	64.549	-1.377	-240	64.549
	AT POST	5	31.929			31.929
Pair3	RHR PRE	5	18.833	1.580	-189	18.833
	RHR POST	5	3.492			3.492
Pair4	HRR PRE	5	22.143	6.049	-004	22.143
	HRR POST	5	8.294			8.294
Pair5	CVF PRE	5	12.209	-4.799	-009	12.209
	CVF POST	5	10.877			10.877
Pair6	STEPS PRE	5	27.294	-669	-540	27.294
	SREPS POST	5	23.287			23.287

The above table shows the Pre and Post test result of EG (N=05) in term of BMI, Activity time, Resting Heart Rate, Heart Recovery Rate, Cardiovascular Fitness, Steps Before and After Treatment. The data were expressed through Mean and Standard Deviation. No significant difference between the pretest and post test score of EG in term of activity time $t_4 = -1.377$, $\text{Sig} = .240 > \alpha = .05$, $\text{RHR}t_4 = 1.580$, $\text{Sig} = .189 > \alpha = .05$, $\text{stepst}_4 = -.669$, $\text{Sig} = .540 > \alpha = .05$ and significant difference found in BMI $t_4 = 4.662$, $\text{Sig} = .010 < \alpha = .05$ $\text{HRR}t_4 = 6.049$, $\text{Sig} = .004 < \alpha = .05$ and $\text{CVF}t_4 = -4.799$, $\text{Sig} = .009 < \alpha = .05$. Hence it shown that moderate intensity aerobic exercise put positive impact on BMI, HRR and CVF in EG.

Table 7. Independent Sample T-test indicates the Mean difference between CG in term of BMI, Activity time, Resting Heart Rate, Heart Recovery Rate, Cardiovascular Fitness, Steps Before and After Treatment

Testing Groups	Testing Variables	N	Means	Std	T	Sig
Pair 1	BMI PRE	5	25.90	3.430	-.200	.851
	BMI POST	5	25.97	3.340		
Pair 2	AT PRE	5	96.40	38.604	1.680	.168
	AT POST	5	67.00	3.7416		

Pair3	RHR PRE RHR POST	5 5	88.60 82.40	12.660 6.949	1.227	.289
Pair4	HRR PRE HRR POST	5 5	145.20 126.80	28.048 23.123	2.537	.064
Pair5	CVF PRE CVF POST	5 5	32.49 27.14	8.152 5.063	1.175	.305
Pair6	STEPS PRE SREPS POST	5 5	42.80 29.20	14.549 4.089	1.8543	.137

The above table shows the Pre and Post test result of CG and (N-05) in term of BMI, Activity time, Resting Heart Rate, Heart Recovery Rate, Cardiovascular Fitness, Steps Before and After Treatment. The data were expressed through Mean and Standard Deviation. No significant difference was found in pretest and post score of AT $t_4 = 1.680$, $\text{Sig.} = .168 > \alpha = .05$, RHR $t_4 = 1.227$, $\text{Sig.} = .287 > \alpha = .05$, steps $t_4 = 1.85$, $\text{Sig.} = .137 > \alpha = .05$, BMI $t_4 = -.200$, $\text{Sig.} = .851 > \alpha = .05$, HRR $t_4 = 2.536$, $\text{Sig.} = .064 > \alpha = .05$, and CVF $t_4 = 1.175$, $\text{Sig.} = .305 > \alpha = .05$. Hence it is depicted that CG was not given any treatment due to which same results were produced by the group in Term of BMI, AT, RHR, HRR, CVF and Steps

RESULT AND DISCUSSION

The current study find out that there is no significant difference in both EG and CG in term of BMI, $t_8 = -1.230$, $\text{Sig.} = .254 < \alpha = .05$. Such emerging findings is supported by the study conducted by [18] by stating that physical activity or exercise closely associated improved body mass index in overweight as well as obese children and adolescents.

No significant difference was found in both EG and CG in term of Activity time, $t_8 = 1.201$, $\text{Sig.} = .264 > \alpha = .05$ before Treatment. Significant difference was found in both EG and CG in term of activity time $t_8 = 8.277$, $\text{Sig.} = .000 < \alpha = .05$ after Treatment. No significant difference was found in in both EG and CG in term of Resting heart rate $t_8 = .749$, $\text{Sig.} = .475 > \alpha = .05$ before Treatment. No significant difference was found in in both EG and CG in term of Resting heart rate $t_8 = .115$, $\text{Sig.} = .911 > \alpha = .05$ after Treatment. Significant difference was found in both EG and CG in term of HRR $t_8 = 3.016$, $\text{Sig.} = .017 < \alpha = .05$ before and after Treatment. The study conducted by [19] concluded that exercise has many health benefits such as reducing the level of cholesterol, to stay healthy body weight, reducing the risk of bone fractures, reducing the level of illness and strengthen the cardiovascular capacity of the body in term of resting heart rate and heart recovery rate.

No significant difference was found in both EG and CG in term of steps $t_8 = 1.749$, $\text{Sig.} = .118 > \alpha = .05$ before Treatment. Significant difference was found in in both EG and CG in term of steps $t_8 = 4.672$, $\text{Sig.} = .002 < \alpha = .05$ after Treatment. No significant was found in both EG and CG in term of CVF $t_8 = -.216$, $\text{Sig.} = .834 > \alpha = .05$ before Treatment. Significant difference was shown in both EG and CG in term of CVF $t_8 = 8.490$, $\text{Sig.} = .000 < \alpha = .05$

after Treatment. In line of this findings the findings of the study conducted by [20,21] stated that physical activity improve cardiovascular fitness in overweight and obese male.

CONCLUSION

On the basis of data analysis and findings, the researcher arrived at conclusion that moderate intensity exercise significantly alter the various parameters of cardiovascular health such as BMI, Activity time, Resting Heart Rate, and Heart Recovery Rate etc. It means that moderate intensity exercise have a Significant impact upon cardiovascular health.

REFERENCES

1. Gordon-Larsen, Penny, Linda S. Adair, Melissa C. Nelson, and Barry M. Popkin. "Five-year obesity incidence in the transition period between adolescence and adulthood: the National Longitudinal Study of Adolescent Health." *The American journal of clinical nutrition* 80, no. 3 (2004): 569-575.
2. Shephard, Roy J., C. Allen, A. J. S. Benade, C. T. M. Davies, P. E. Di Prampero, R. Hedman, J. E. Merriman, K. Myhre, and R. Simmons. "The maximum oxygen intake: An international reference standard of cardio-respiratory fitness." *Bulletin of the World Health Organization* 38, no. 5 (1968): 757.
3. Leger, Luc A., Daniel Mercier, C. Gadoury, and J. Lambert. "The multistage 20 metre shuttle run test for aerobic fitness." *Journal of sports sciences* 6, no. 2 (1988): 93-101.
4. Verma, S. S., and J. Sen Gupta. "Regression Models for Estimation of Maximal Aerobic Power in Man." *Defence Science Journal* 40, no. 3 (1990): 293.
5. Liu, Chin-Mou, and Kuei-Fu Lin. "Estimation of $\dot{V}O_{2max}$: a comparative analysis of post-exercise heart rate and physical fitness index from 3-minute step test." *JOURNAL OF EXERCISE SCIENCE & FITNESS* 5, no. 2 (2007): 118-123.
6. Jourkesh, Morteza, I. Iraj Sadri, Ali Ojagi, and Amineh Sharanavard. "Comparison of Physical fitness level among the students of IAU, Shabestar Branch." *Annals of Biological Research* 2, no. 2 (2011): 460-467.
7. Pate, Russell R., Michael G. Davis, Thomas N. Robinson, Elaine J. Stone, Thomas L. McKenzie, and Judith C. Young. "Promoting physical activity in children and youth: a leadership role for schools: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Physical Activity Committee) in collaboration with the Councils on Cardiovascular Disease in the Young and Cardiovascular Nursing." *Circulation* 114, no. 11 (2006): 1214-1224.
8. Matsudo, Sandra Mahecha, Victor Rodrigues Matsudo, Timoteo Leandro Araujo, Douglas Roque Andrade, Erinaldo Luiz Andrade, Luis Carlos de Oliveira, and Glauca Figueiredo Braggion. "The Agita São Paulo Program as a model for using physical activity to promote health." *Revista panamericana de salud pública* 14 (2003): 265-272.

9. Rimmer, James H., Barth Riley, Edward Wang, Amy Rauworth, and Janine Jurkowski. "Physical activity participation among persons with disabilities: barriers and facilitators." *American journal of preventive medicine* 26, no. 5 (2004): 419-425.
10. Lu Y, Hajifathalian K, Ezzati M, Woodward M, Rimm EB, Danaei G. Metabolic mediators of the effects of body-mass index, overweight, and obesity on coronary heart disease and stroke: a pooled analysis of 97 prospective cohorts with 1.8 million participants. *Lancet* 2014;383: 970–83.
11. Carnethon MR, Gulati M, Greenland P. Prevalence and cardiovascular disease correlates of low cardiorespiratory fitness in adolescents and adults. *JAMA* 2005;294:2981–8.
12. Kodama S, Saito K, Tanaka S, Maki M, Yachi Y, Asumi M, et al. Cardiorespiratory fitness as a quantitative predictor of all-cause mortality and cardiovascular events in healthy men and women: a meta-analysis. *JAMA* 2009;301:2024–35.
13. Wang CY, Haskell WL, Farrell SW, Lamonte MJ, Blair SN, Curtin LR, et al. Cardiorespiratory fitness levels among US adults 20–49 years of age: findings from the 1999–2004 National Health and Nutrition Examination Survey. *Am J Epidemiol* 2010;171:426–35.
14. Donnelly JE, Blair SN, Jakicic JM, Manore MM, Rankin JW, Smith BK. American College of Sports Medicine Position Stand. Appropriate PA intervention strategies for weight loss and prevention of weight regain for adults. *Med Sci Sports Exerc* 2009;41:459–71
15. Castro, Eliane Aparecida, Ana Belén Peinado, Pedro Jose Benito, Mercedes Galindo, Marcela González-Gross, Rocío Cupeiro, and PRONAF Study Group. "What is the most effective exercise protocol to improve cardiovascular fitness in overweight and obese subjects?." *Journal of sport and health science* 6, no. 4 (2017): 454-461.
16. Gibala, Martin J., Jonathan P. Little, Maureen J. MacDonald, and John A. Hawley. "Physiological adaptations to low- volume, high- intensity interval training in health and disease." *The Journal of physiology* 590, no. 5 (2012): 1077-1084.
17. Westcott, Wayne L. "Resistance training is medicine: effects of strength training on health." *Current sports medicine reports* 11, no. 4 (2012): 209-216.
18. Kelley, George A., Kristi S. Kelley, and Russell R. Pate. "Exercise and BMI in overweight and obese children and adolescents: a systematic review and trial sequential meta-analysis." *BioMed research international* 2015 (2015).
19. British Columbia Specific Information. Exercise and Physical Activity Ideas. Retrieved from healthlinkbc.ca/health-topics/aa165656.
20. Castro, Eliane Aparecida, Ana Belén Peinado, Pedro Jose Benito, Mercedes Galindo, Marcela González-Gross, Rocío Cupeiro, and PRONAF Study Group. "What is the most effective exercise protocol to improve cardiovascular fitness in overweight and obese subjects?." *Journal of sport and health science* 6, no. 4 (2017): 454-461.

21. Fan, Lampson M., Adam Collins, Li Geng, and Jian-Mei Li. "Impact of unhealthy lifestyle on cardiorespiratory fitness and heart rate recovery of medical science students." *BMC public health* 20, no. 1 (2020): 1-8.

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