EFFECT OF DIFFERENT MODES OF PHYSICAL ACTIVITY ON RESPIRATORY EFFICIENCY: A COMPARATIVE STUDY IN YOUNG MALES

Article *in* Annals of Tropical Medicine and Public Health · December 2020

DOI: 10.36295/ASRO.2020.2323146

CITATIONS
0

READS
35

2 authors, including:

Jaman Mohan Harsoda
SUMANDEEP VIDYAPEETH UNIVERSITY ,VADODARA, INDIA
81 PUBLICATIONS **89** CITATIONS

SEE PROFILE

EFFECT OF DIFFERENT MODES OF PHYSICAL ACTIVITY ON RESPIRATORY EFFICIENCY: A COMPARATIVE STUDY IN YOUNG MALES

J M Harsoda*, Dr Geetanjali Purohit**

*Prof. & Head, Physiology, SBKS MI & RC, Sumandeep Vidyapeeth Deemed to be University, Piparia, 391760, Vadodara, Gujarat, India.

** Corresponding Author, Associate Professor, Physiology, Dr MK Shah Medical College & Research Center (By Sumandeep Vidyapeeth), Ahmdabad, Gujarat.

ABSTRACT

Introduction: Moderate level of exercise in daily life has beneficial influences on all body systems. Although evidences are available in literature studied effect of regular exercise in respiratory disease groups, few studies reported effect of physical exercise in sedentary population. Present study was aimed to study the effect of various modes of exercises on respiratory efficiency in sedentary young males.

Methods: Experimental comparative cohort study was conducted in the Department of Physiology. Five different groups were followed different exercise protocol and studied for pre-post effect of exercise. Sixty healthy non-smoking males of 15-25 years were included for exercise training. Participants were studied in five different equal groups. All the groups performed five different modes of exercise protocols for twelve weeks with professional physical trainer. The exercise protocols include whole body exercise, walking exercise, combined exercise, upper and lower limb exercise. Respiratory efficiency were measured before and after the training program in all groups and the parameter studied were FVC, FEV1, FEV1/FVC, FEF0.2-1.2, FEF 25-75%, V max 25%, Vmax50%, Vmax75%, MVV, BHT, 40mmHg and MEP test. Data comparison was done by paired student's t-test.

Result: Respiratory efficiency was found to be significantly improved after whole body, combined and walking exercise for most of the parameters. Upper and lower body exercises were not as beneficial as others. Respiratory efficiency showed improvement after regular exercise training.

Conclusion: Whole body exercise and combined is most effective exercise protocol over other exercise patterns as only upper and only lower body exercise.

Key words: Sedentary males, respiratory efficiency, Vmax, FEF25-75%

How to cite this article: Harsoda JM, Purohit G (2020): Effect of different mode of physical activity on respiratory efficiency: A comparative study in young males, Ann Trop Med & Public Health; 23(S23): SP2323146. DOI: http://doi.org/10.36295/ASRO.2020.2323146

INTRODUCTION

Not any specific way is reported yet to revert to our natural way of life but we may be able to modify our current life style. Knowledge of the body changes and benefits during and after exercise training under various conditions is important for understanding the human Physiology. For improvement in work performance, cardio-respiratory efficiency and functioning of other systems regular physical activity is a known practice. Physical training is also means of testing the individual's physiological responses and physical capabilities to form the basis of overall well-being and good health .[1]

Regular physical activity with a specific protocol improves fitness and reduces morbidity and mortality from numerous chronic ailments. Evidences also suggested that it develops the tolerance, improve the ability to withstand the stress and carry on in the circumstances, where an unfit person cannot.[2,3] Aerobic exercise defined as any activity that uses large muscle groups maintained continuously and is rhythmic in nature. Aerobic exercises as walking, jogging, running, skipping, dancing, swimming, bicycling overloads the cardio-respiratory functioning and causes them to work harder.[4] Healthy subjects are need to do exercise 30 minutes per day five days a week for four to eight weeks to achieve physiological training effect. After a training effect is achieved, regular exercise must be continued or the gains of training will be lost.[5]

Present study was aimed to study the effect of regular exercise respiratory efficiency and compare the effect of different modes of exercises, as mentioned above, on respiratory efficiency in 60 sedentary young males recruited for 12 week exercise training.

MATERIAL AND METHODS

Study type: Comparative analytical prospective study.

Participants: This study was conducted on 60 healthy young sedentary male participants. Each subject was examined thoroughly clinically to exclude any organic or cardio-respiratory disease which may affect cardio-respiratory efficiency

Inclusion criteria

- Participants who are willing to participate in the study.
- Sedentary healthy Male
- Participants in between 15-25 years.

Exclusion criteria

- Subjects who are on any medication.
- Already involve with routine physical activity
- Unsatisfactory and incomplete training

Exercise protocols: All Subjects were divided five groups of 12 in each for training. Each group was trained for a period of twelve weeks.

Group-I: Whole body exercise

Group II: Combined Limbs exercise

Group-III: Walking

Group-IV: Upper limb Exercise

Group-V: Lower Limb exercise

All the groups performed their exercises for 12 weeks daily for half an hour under the supervision of trained person.

Interventions: A prior written informed consent was also taken from the participants. Participant Information sheet were also provided to all the participants. Height in centimeters and weight in kilograms were measured and body surface area in square meters was calculated with the help of DUBOIS NOMOGRAM (DUBOIS, 1951).

TABLE 1: Exercise training protocol for all five study groups

Exercise training	Instrument used	Type of exercise	Speed	Tension
Whole body Group A (N=12)	Hero Exer bike	Walking+ Rowing +Pedalling	20 km/hr +10 km/hr +20/ min	Moderate 30 kg.m/s
Combined limb Group B (N=12)	Hero Exer bike	Pedalling +Rowing	20 /min 20km/hr	Moderate 30 kg.m/s
Walking Group C (N=12)	-	Walking	10 km/ hr	-
Upper limb Group D (N=12)	Hero Exer bike	Rowing	20/min	Moderate 30 kg.m/s
Lower limb Group E(N=12)	Hero Exer bike	Pedalling	20km/hr	Moderate 30 kg.m/s

Spirometry was performed in standing posture. Participants were asked to take deep inspiration and then blow out forcefully and completely into the water filled BENEDICT ROTH recording spirometer and FVC maneuvers were recorded. Three to four efforts were recorded and record showing good reproducibility, regularity and maintenance of effort was only considered valid

Parameter studied were

1. FVC & FEV1 (Forced vital capacity & Forced expiratory volume in one second in ml.
2. FEV1/FVC %
3. Mean forced expiratory flow between 200 ml and 1200 ml of FVC in Lt/Sec (FEF(0.2 - 1.2L)

4. Mean forced expiratory flow between 25% and 75 % of FVC in Lt/Sec (FEF 25-75%).
5. Mean forced expiratory 'flow between 50% and 75 % of FVC in Lt/Sec.
6. Maximum expiratory flow at 25%, 50% and 75% of FVC (Vmax 25%, 50% and 75%) in L/S respectively.
7. Maximum voluntary ventilation (MVV) in Lt/min: This test was done by asking the subject to breath as fast and as deeply as possible in to the mouth piece of BENEDICT ROTH RECORDING SPIROMETER for 15 seconds. In mouth piece there is valvular arrangement which allows inhalation from atmosphere and exhalation in the spirometer. The MVV is calculated for one minute. During the measurement nostrils of subjects were closed by nose-clip.
8. Breath holding time (in seconds): This test was done by asking the subjects to hold their breath after normal expiration and the maximum time for which they could hold their breath was recorded.
9. Respiratory endurance test (40 mmHg) in seconds: The subjects were asked to expire as deeply as possible and then to take a deepest possible inspiration. Nose-clip was applied and the subject was asked to blow the mercury up to 40 mmHg in sphygmomanometer and to maintain it steadily at that level. The maximum possible time was noted
10. Maximum expiratory pressure (MEP) in mmHg: After a deepest possible inspiration, nose clip was applied. The subject was asked to blow as forcefully as possible into the tube of sphygmomanometer trying to push up the mercury column steadily as high as possible.

Above respiratory efficiency tests were done in each subject before and after exercise training of 12 weeks.

Statistical analysis: The information obtained was entered into a database developed for the study, using latest SPSS program. Descriptive statistics (mean and standard deviation) were calculated for continuous variables and frequencies and percentages were calculated to summarize qualitative data. Other statistical tests like paired t test for before after comparison. A significance level of 0.05 was used.

RESULTS

TABLE 2: Anthropometric measurements for each group

Data	Whole body	Combined limbs	Walking	Upper limbs	Lower limb
N	(N=12)	(N=12)	(N=12)	(N=12)	(N=12)
Age (Yrs)	17.9±0.6	17.8±0.68	17.93±0.59	17.93±0.59	17.8±.56
Weight (kg)	55.62±8.02	55.33±9.26	56.13±8.04	56.2±5.37	54.47±8.8
Height (cms)	160.55±7.68	172.07±7.27	170.360±10.4	169.47±5.95	167.47±4.52
BSA m^2	1.62±0.15	1.64±0.16	1.64±0.15	1.63±0.09	1.55±0.18

TABLE 3: Effect of different modes of exercises on respiratory efficiency

Parameters	Whole body		Combined limbs		Walking		Upper limbs		Lower limb	
	Before	After	Before	After	Before	After	Before	After	Before	After
FVC (ml)	3698.74±663.74	3977.08 ±466.9*	3953.33 ±490.89	4234.33 ±448.05	3698.33 ±538.80	4039.33 ±446.7*	3650.00 ±435.69	3765.00 ±427.26	3738.33 ±471.02	3869.67 ±447.26
FEV1 (ml)	3216.44±444.04	3464.5± 439.2**	3389.53 ±437.23	3735.00 ±430.1*	3201.67 ±545.06	3548.90 ±467.9*	3096.67 ±351.26	3233.60 ±342.07	3164.80 ±355.60	3339.80 ±363.03
FEV1/FVC %	85.53 ±5.44	87.16 ±03.40*	85.26 +5.77	88.23 ±3.48*	86.28 ±5.09	87.73 ±3.91	85.06 ±5.78	86.02 ±2.66	84.94 ±4.63	86.65 ±3.33
FEF (0.2-1.2L)	4.90 ±1.01	5.47 ±.85***	5.18 ±1.38	6.12 ±0.86*	4.89 ±1.00	5.53 ±0.75	4.65 ±0.92	4.65 ±.92	4.77 ±.69	5.08 ±.60
FEF (25-75%)	4.23 ±0.83	4.33 ±0.66	4.38 ±0.92	4.54 ±0.56	4.62 ±1.09	4.62 ±0.80	4.18 ±0.75	4.20 ±0.58	3.82 ±0.60	3.96 ±0.51
FEF 50-75%(L/s)	3.80 ±0.85	3.76 ±0.60	3.96 ±0.65	4.04 ±0.56	3.26 ±0.80	3.76 ±0.72	3.52 ±0.80	3.69 ±0.61	3.49 ±0.58	3.56 ±0.40
Vmax25% (L/s)	3.83 ±0.82	4.09 ±0.99	4.18 ±0.75	4.79 ±0.63*	3.81 ±0.66	4.85 ±0.66**	3.44 ±0.82	3.31 ±0.82	3.65 ±0.97	3.42 ±0.61
Vmax50% (L/s)	3.81 ±0.63	3.80 ±0.51	4.10 ±0.76	4.11 ±0.62	3.02 ±0.43	3.84 ±0.56	3.48 ±0.36	3.62 ±0.36	3.54 ±0.54	3.61 ±0.27
Vmax75% (L/s)	3.49 ±0.8	3.98± 0.49***	3.38 ±0.78	3.99 ±0.58*	3.74 ±0.58	3.70 ±0.41	3.52 ±0.50	3.92 ±0.38*	3.23 ±0.60	4.26± 0.44***
MVV (L/min)	109.04 ±18.60	116.05 ±18.01*	121.71 ±18.54	134.02± 017.81	102.89 ±15.22	113.08 ±15.85	10.63 ±19.83	103.98 ±10.74	109.95 ±15.38	113.12 ±12.77
BHT in sec	50.28 ±6.50	56.76±05.08***	49.14 ±9.10	60.06± 5.29***	51.23 ±4.33	57.52± 4.98**	49.31 ±7.10	53.65 ±4.23*	50.61 ±5.37	55.82 ±3.80**
40mmHg in sec	47.14 ±7.75	54.44± 5.08***	47.27 ±8.36	56.92± 4.65***	46.10 ±11.37	54.69 ±5.83*	46.28 ±4.41	52.91±3.6±0***	47.76 ±6.82	53.22 ±5.25*
MEP in mmHg	109.13 ±19.57	115.67 ±19.09	114.13 ±21.82	128.13 ±22.14	108.00 ±19.86	116.27 ±17.76	103.27 ±20.01	104.13 □±11.75	110.27 ±20.28	114.13 ±16.74*

DISCUSSION

Present study was aimed to evaluate and compare the before and after effect of various modes of exercises as whole body exercise, walking exercise, combined limb, upper and lower limb exercise on respiratory efficiency in sedentary young males. Literature reported earlier that physical training with a specific and regular protocol improves the mental and physical fitness, respiratory efficiency, cardiac competence of a healthy person. Moreover it also helps the clinicians as evaluation of cardio-respiratory diseases and its pathophysiology, assessment of treatment and exercise prescription for rehabilitation.[6-9] Studies assessed effect of exercise are available but limited with number of subjects, regularity, duration and specific exercise protocol. Previous similar study in sedentary males reported that whole body and combined limb exercise is most beneficial for the improvement of cardiorespiratory efficiency, where major concern was to study the cardiac efficiency parameters.[10]

Study found that normal range of FVC for healthy adult males is 3 to 5 Ltr with an average is 4.6 Ltr. FVC depends upon contraction of lungs, expansion and elasticity of respiratory joints, increased power of respiratory muscles and total compliance. Since the walking and whole body exercises involve most of the skeletal muscle mass, the effects of these exercises are significant on FVC. Similar studies stated that running may help in developing a reduced resistance to expiration and greater endurance in respiratory muscles. Daily living activities can facilitated with improved ventilation muscle endurance.[11] Studies found no improvement in FVC after exercises might be due to diseased group or less duration of the exercise duration. [10]

Lung compliance, airway resistance and power of respiratory muscle can be assessed by the standard pulmonary function parameter FEV1. Present study found that FEV1 increased significantly in whole body, combined and walking exercise group males after 12 weeks of exercise training. Statistically significant rise in FEV1 can be explained by the fact that improved elasticity of respiratory joints leads to a greater expansion and increased recoil of thoracic cage. Evidence found that FEV1 showed improvement after exercise in asthmatic patients.[12] Study conducted in healthy male welders reported significant rise in FEV1 and FVC after regular physical training, which supports our results. Earlier study reported that respiratory exercise program improves all measured pulmonary parameters.[13-14]

Mean FEV1% represents contraction power of expiratory muscles and recoil tendency of lungs, is found to be 84% in present study. FEV1% increased significantly in response to whole body and combined limbs exercise group males. Whole body and combined limbs exercise training increases contraction power of expiratory muscle and also increases elastic recoil tendency of lungs. Study mentioned that physical training improves respiratory muscles

endurance and running training during growth may help in developing a reduced resistance to expiratory muscles and increased endurance in respiratory muscles.[11]

FEF 0.2-1.2L is significantly improved in response to combined limbs and whole body exercise in present study showed that above mentioned exercises decrease airway resistance, raise the contraction power of expiratory muscles and increases elasticity of lungs and thorax. Studies found that physical training improves respiratory muscles endurance, decreased airway resistance and improves elasticity of lungs and thorax.[15] Similar observations were found for Vmax25% which improves significantly after combined and walking and Vmax75% which improves significantly after all exercises except walking, postulated that above exercises are much effective in opening bronchioles and smaller bronchi, hence expiratory muscles activity improves.

MVV is significantly improved in response to whole body exercise training. Similar results have been reported by various studies mentioned that by improving MVV more oxygen will be available for active muscles during strenuous physical work. Present study found improvement in BHT and 40mmHg test after all modes of exercises. Similar findings were observed by one study, mentioned that exercise training decreased arterial PCO2 and might alter the responsiveness of medullary and/or systemic arterial chemoreceptor's with consequent prolongation of breath holding time.[16]

CONCLUSION:

Present study can conclude that regular physical exercise training is beneficial in sedentary males to improve the respiratory efficiency. Different modes of aerobic exercises studied, the whole body and combined limb exercise found to be most beneficial followed by walking exercise of 12 weeks. Aerobic exercise also maintains the physical health component and endurance. Health promotion and respiratory rehabilitations need to add such exercise protocols for betterment. Regular exercise and assessment of such parameters will generate awareness regarding lifestyle modification and will help in acquiring a healthy habit of being active.

REFERENCES:

1. Harsoda JM, Purohit G. Comparative study of change in physical activity on exercise performance and mental well being. International Journal of Applied Exercise Physiology 2014; 3(1):36-43
2. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM. American College of Sports Medicine. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. Med Sci Sports Exerc. 2011;43:1334–59.
3. Harsoda JM , Purohit G. Effect Of Different Modes Of Aerobic Exercise On Cardio-respiratory Efficiency And Exercise Performance In Sedentary Males. Int. Jn. Basic Applied Physiology 2014;2(1): 72-78

4. Guidelines for Exercise Testing and Prescription. American College of Sports Medicine- Lea and Fabiger 1988:168-69.
5. Casaburi R (1992). Principles of exercise training. CHEST, (Supplement)1992;101(5):262S-267S.
6. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM. American College of Sports Medicine. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. Med Sci Sports Exerc. 2011;43:1334–59.
7. Fletcher GF, Balady GJ, Amsterdam EA, Chaitman B, Eckel R, Fleg J. Exercise standards for testing and training: An statement for healthcare professionals from the American Heart Association. Circulation. 2001;104:1694–740.
8. Mezzani A, Agostoni P, Cohen-Solal A, Corra U, Jegier A, Kouidi E. Standards for the use of cardiopulmonary exercise testing for the functional evaluation of cardiac patients: a report from the Exercise Physiology Section of the European Association for Cardiovascular Prevention and Rehabilitation. Eur J Cardiovasc Prev Rehabil. 2009;16:249–267.
9. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. N Engl J Med. 2002;346:793–801.
10. Lake FR, Henderson K, Openshow J, Musk W. Upper limb and lower limb exercise training in patients with chronic air flow obstruction. CHEST 1997;5:1077-81
11. Lakhera SC, Kain TC, Bandopadhyay P. Lung function in middle distance adolescent runners. Indian J. 1994. Physiol Pharmacol. 38(2):117-120.
12. Gimenez M, Predine E, Marchand M, Servera E, Ponz J L, Polu J M. Implication of upper and lower limbs training in patients with chronic airway obstruction. CHEST 1992;101(5): 279-88.
13. El-Batanouny MM, Amin Abdou NM, Salem EY, El-Nahas HE. Effect of exercise on ventilatory function in welders. Egyp J Bronchol 2009;3:67-73.
14. Ali AT, Badr NM, Batanony MM, Seri ZMH. Ventilatory functions response to respiratory exercise program in workers of Tourah Cement Factory. A doctoral thesis, Faculty of physical therapy, Cairo University, 2002;168.
15. Chatterjee S (1993-94). Sports, Exercise, lung function tests Their utility in national level. Proc. 81st Ind. Sc. Cong. Part II : Presidential address.
16. Mc Connell A K and Semple E S G (1989). Ventilatory sensitivity to CO2 at rest and during exercise in ndurance trained and non endurance trained humans Cardiff meeting 16-17 December, Journal of Physiology; 412 :39 p.

ACKNOWLEDGMENT: I acknowledge my guide for this innovative idea and guidance. I also acknowledge Dr. Geetanjali Purohit, Associate Professor, Physiology for preparing the manuscript.