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Original article

Effect of Moderate Intensity Aerobic Exercises on Vital Capacity And Quality of Life on Asymptomatic Subjects With Sedentary Lifestyle

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ABSTRACT

Background: The present study is designed to determine if vital capacity can predict quality of life as well as document the effect of aerobic exercise on vital capacity. **Materials And Methods:** An experimental study. Participants were selected from different offices, call centres and IT sectors in Jaipur (Rajasthan). Incentive Spirometer was used to measure vital capacity and WHOQOL was used to measure quality of life. **Results:** The results of present study indicate that three weeks intervention of moderate intensity aerobic exercises training improves the vital capacity and quality of life in the asymptomatic individuals with sedentary lifestyle. However the aerobic training was more effective in physical domain of quality of life. **Conclusion:** The present study concluded that there is a significant increase in vital capacity and physical domain of health related quality of life in asymptomatic individuals with sedentary lifestyle as an effect of moderate intensity aerobic exercises i.e treadmill running for 3 weeks.

KEYWORDS: Aerobic Exercises (AE), Godin Leisure-Time Exercise Questionnaire (GLTEQ), Health Related Quality of Life (HRQOL), Sedentary Lifestyle (SE), Vital Capacity (VC).

INTRODUCTION

A sedentary lifestyle is defined by excessive amount of daily sitting.[1] According to Marc Hamilton a man who sits 60 hours at a desk job but works out for 45 minutes a day 5 times a week still has a sedentary lifestyle.[2] Sedentary lifestyle with physical inactivity is now a global non-communicable disease and has a greater risk of lifestyle related chronic diseases as predicted.[3,4] Review of research has shown that obesity combines with sedentary lifestyle has a direct effect on function of respiratory system by altering lung volume and respiratory muscle strength.[5]

Vital capacity is strong indicator of lung function which decline due to sedentary lifestyle. A study indicates that men who remained in active lifestyle during the follow up showed 70ml improvement in their forced vital capacity (FVC) whereas the subjects who remained in sedentary lifestyle has 20ml reduction in their forced vital capacity(FVC).[5,6] Many studies shows that an increase in vital capacity and lung volumes has positive effect on increasing work capacity and power output.[7] The measurement of vital capacity is therefore a frequently used method in modern anthropological investigation and serves as a good indicator of assessing the living condition, abilities, physical and health condition of individual and populations.[8]

Lung functions especially vital capacity is closely related to the quality of life in symptomatic individuals.[9,10] Based on this theory it can be predicted that vital capacity also affects the individual which may in turn have an effect on their quality of life. Quality of life encompasses the term wellness that is an individual outlook on life including 6 dimensions (e.g- physical, occupational, social, spiritual, intellectual, and emotional) that are interrelated and when balanced provide individual with optimal health and high level of wellness.[11]

Long term moderate intensity and regular aerobic exercises has well known to benefit body health. According to certain research the effect of aerobic training on cardiorespiratory function are positive.[12] This can be predicted that moderate intensity aerobic exercises could help in achieving efficient lung function especially vital capacity which is an essential preventive strategy in this regular physical activity promote quality of life.[13] A novel finding was that adolescents who are physically active over a period of 5

years had a higher health related quality of life than the less active ones.[14]

MATERIALS AND METHODS

An experimental study was conducted on total of 30 asymptomatic subjects with sedentary life style who were included from call centers, IT sectors in Jaipur based on the inclusion and exclusion criteria and they were divided into 2 groups randomly after informed consent was obtained. Group A (Exercise Group N=15), Group B (Control Group N=15). Pre intervention measurement of vital capacity and quality of life using INCENTIVE SPIROMETER and WHOQOL respectively were carried out for each patient. Post intervention reading was taken after 3 weeks. Protocol for group A (Exercise Group): All the participants in this group received Moderate Intensity Aerobic Exercise participants were asked to run on treadmill at intensity of 60% of their maximum heart rate for 2 minutes. This was followed by 90 sec of rest for 4 sets, 3 times per week for 3 weeks. Protocol for group B (Control Group): All the Participants in this group were asked to follow their normal daily lifestyle pattern without any exercises.

Statistical analysis: Data analysis was done using SPSS 16.0 version. Descriptive analysis was done to calculate the mean for age, height, weight and body mass index (BMI). Paired t-test was applied to compare the pre and post-intervention reading of vital capacity and quality of life within groups. Independent t-test was done to compare the pre and post-intervention reading of vital capacity and quality of life between the groups. The statistical significance was set at 95% confidence interval with p-value<0.05 considered to be significant.

RESULTS

The data was analyzed for 30 subjects, the subjects were categorized into group A and Group B, descriptive statistics was used to analyze demographic data. Mean Age, Height, Weight, and BMI for group A was(24.13±4.53), (116.40±15.23), (61.26±8.10), (22.29±2.37) and group B was(27.33±4.70), (168.73±9.70), (67.80±8.35), (24.00±3.09) respectively.(table 1)

Table 1: Demographic data in the study subjects.

	Mean ± SD	
	Group A	Group B
Age	27.13±4.53	27.33±4.70
Height	166.40±15.23	168.73±9.70
Weight	61.26±8.10	67.80±8.35
BMI	22.29±2.37	24.00±3.09

Vital capacity was evaluated by Incentive Spirometer Voldyane, the score were compared within the group by using Paired T-test, the result show significant increase between pre and post intervention readings for group A and significant decrease for group B (p=0.00) and (p=0.02) respectively. (table 2)

Table 2: Within group comparison of vital capacity in the study subjects.

	Mean ± SD		t	P
	Pre Intervention	Post Intervention		
Group A	1550±264.58	2223.3±299.92	-13.48	.000
Group B	169.69±384.74	1510±325.52	2.432	.029

Independent T-test was used to compare the vital capacity between group A and group B, the result shows significant increase in post-intervention reading for group A and significant decrease in post-intervention reading for group B (p=0.035, p=0.00). (table 3)

Quality of life was evaluated by WHO-QOL. The score were compared within group by using Paired T-test. For physical domain the result shows significant increase in group A for pre and post intervention reading and significant decrease for group B. (p=0.00) and (0.17) (table 4) For psychological domain the result shows significant increase for group A and non-significant for group B. (p=0.00) and (p=0.277). (table 4) Independent T-test was used to compare the WHO-QOL between both the groups. For the physical domain the result showed significant increase for group A and significant decrease for group B (p=0.25) and (p=0.04). (table 5)

Table 3: Between group comparison of vital capacity in the study subjects.

	Mean ± SD		t	P
	Group A	Group B		
Pre Intervention	1550±264.58	1696.7±384.74	-1.217	.235
Post Intervention	2223.3±299.92	1510±325.25	6.245	.000

Table 4: Within the group comparison of quality of life in the study subjects.

		Mean ± SD		t	p
		Pre Intervention	Post Intervention		
Physical	Group A	125.43±18.21	141.67±17.78	-5.249	.000
	Group B	133.33±18.85	128±22.63	1.433	.174
Psychological	Group A	103.75±20.16	114.17±17.59	-3.851	.002
	Group B	105.42±13.54	108.38±11.02	-1.132	.277
Social	Group A	32.083±16.34	32.5±18.33	-.292	.774
	Group B	38.75±13.40	38.333±14.15	.292	.774
Environmental	Group A	146.25±32.37	143.75±34.07	1.382	.184
	Group B	149.17±17.18	147.5±19.59	.718	.484

Table 5: Between the group comparison of quality of life in the study subjects.

		Mean ±SD		t	p
		Group A	Group B		
Physical	Pre Intervention	125.43±18.21	133.33±18.85	-1.168	.253
	Post Intervention	141.67±17.78	128±22.63	1.839	.047
Psychological	Pre Intervention	103.75±20.16	105.42±13.54	-.266	.793
	Post Intervention	114.17±17.59	108.38±11.02	1.079	.290
Social	Pre Intervention	32.083±16.34	38.75±13.40	-1.222	.232
	Post Intervention	32.5±18.33	38.333±14.15	-.976	.338
Environmental	Pre Intervention	146.25±32.37	149.16±17.18	-.308	.761
	Post Intervention	143.75±34.07	147.5±19.59	-.370	.715

DISCUSSION

Increase in lung volumes and capacities depend on workloads and intensities of training programme.[15] Vital capacity is determined by the lung dimensions, compliance and respiratory muscle power.[16] The present study was done to determine the effect of moderate intensity aerobic exercises on vital capacity in asymptomatic individuals with sedentary lifestyle who have regularly exercised for three times a week (Monday, Wednesday, and Friday) for continuously three weeks. In the present study the spirometric measurements of vital capacity were found significantly higher after the three weeks of treadmill running at 60% of their maximum heart rate as compared to the control group in which participants were asked to follow their normal lifestyle pattern and no exercises were administered.

The probable reason for this could be that following training, there is increased requirement of oxygen in the working muscle. It has been reported that upto10% of oxygen uptake during maximal exercise is being used to service the respiratory muscles.[17]

This increased requirement of oxygen stimulates the chemo-sensitive area located bilaterally in the medulla. This in turn stimulate the dorsal group of nucleus tractus solitarus which sends strong signals to inspiratory group of muscles which cause forceful inspiration and expiration.[15] Sashikala et al and Prateek Kumar et al. showed the same result on inspiratory and expiratory muscles.[18,19]

Zahra Hojati et al in their study shows that there might be increase in maximal shortening of inspiratory muscles as an effect of training which has been shown to improve the lung function parameters. This repeated, forceful and prolonged inspiration and expiration cause increase secretion of surfactant which decreases surface tension in the alveoli and decrease the physiological dead space.[6] Asmussen and Nielsen, Bargeton concluded that during exercise the ratio between dead space and tidal volume falls as the tidal volume increases with increasing exercise intensity.[17]

Douglass G et al. showed the mean vital capacity score of athlete was higher than the non-athletes. The difference in vital capacity score of alveolar tissue is due to hyperplasia of alveolar tissue, formation of new alveoli and also increase in the microcirculation in the lungs.[18] This effect was also seen in swimmers.[19,20]

Due to this repeated inspiration and expiration there is release of catecholamines that tends to open the closed airways and dilate the bronchioles and also there is development of delayed onset of fatigue in respiratory muscles during physical training. Verges S et al. support that there is increase fatigue resistance of respiratory muscles endurance training.[15] Strengthening of respiratory muscles increases the rate and depth of respiration and so improves forced vital capacity, the consumption of oxygen and rate of diffusion.[6]

Zahra Hojati et al stated that the various muscles of respiration aid in both inspiration and expiration which requires change in the pressure within the thoracic cavity. During maximal inspiration contraction of diaphragm downwards and the movements of the ribs upwards and outwards expands the chest cavity.[6]

The result of control group showed that there is a negative effect of physical inactivity and sedentary lifestyle on vital capacity. In support of our result previous studies also showed same results but the mechanism is unclear. Shrinivas et al. depicted that that reduction of forced vital capacity (FVC) indicates a restrictive pattern of defect which may be due to the mechanical limitation of chest expansion through a direct effect or by altering intercostal muscle functions.[20] Shobharani et al. shows that the subjects who were physically active had better forced vital capacity than the physically inactive or sedentary individuals. Similar observations were made by Shivesh et al.[16] Thus, we say that moderate intensity aerobic exercises has a significant effect on vital capacity as compared to the control group.

The finding from the present study showed that aerobic exercises have positive effect on physical domain of quality of life. In support to our result Davis et al in their study found that the combination of no physical activity and high screen time was rated to poor quality of life.

Richard et al in their study depicted that both physical activity and sitting time were independently associated with excellent health and excellent quality of life. They also showed that physical activity and sitting time both showed dose response pattern of influence on the odds of excellent health and quality of life. Participant who were highly active or very highly active were about twice a likely to report excellent health and excellent quality of life as compared to their least active counterparts.[1] Shobha Rani et al also supports clearly to the results.[16]

Rocio et al stated that quality of life improved significantly for inactive subjects who carried out physical activity promotional programmes. The pulmonary function outcomes forced vital capacity (FVC) and forced expiratory volume (FEV) values found statistically significant difference.[22] Bamini Gopinath stated that the positive link between a physically active lifestyle and health related quality of life in long term was primarily driven by better functioning in the physical and social dimension.[14]

Gill J.M have shown that replacing sedentary time with equal amount of light moderate and vigorous intensity physical activity is associated with better physical health and improved overall health benefits. In support to our study Faisal A Barwis et al concluded that there was a significant increase in total wellness score in the intervention group. This wellness score has several dimensions including the physical dimension.[11]

From these studies and from our result we concluded that physical activity has a positive statistically significant effect on physical domain of quality of life.

In the present study there was no significant difference in social, psychological and environmental domain of quality of life. The probable reason behind this could be that the questions included in these domains were appropriate for symptomatic subjects whereas the sample in present study was asymptomatic healthy individuals. In the present study group B which was control group showed no significant effect on any of domain of quality of life. The probable reason could be physical inactivity and prolonged sitting time which provides less opportunity to be physically active.

CONCLUSION

It can be concluded from the present study that there is a significant increase in vital capacity and physical domain of health related quality of life in asymptomatic individuals with sedentary lifestyle as an effect of moderate intensity aerobic exercises i.e treadmill running for 3 weeks.

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