

How to Cite:

Jyothi, J., Sireesha, V. J. B., & Deepa, A. S. (2022). Reverse six minute walk: A simple pulmonary exercise to improve aerobic capacity and endurance. *International Journal of Health Sciences*, 6(S5), 4922–4927. <https://doi.org/10.53730/ijhs.v6nS5.9684>

Reverse six minute walk: A simple pulmonary exercise to improve aerobic capacity and endurance

Dr. Jyothi

Associate Professor, Department of Pulmonary Medicine, The Oxford Medical College Hospital and Research Centre, Bangalore.

Corresponding author email: jyothisuresha@gmail.com

Dr. Vadlamudi. J.B. Sireesha

Assistant Professor, Department of Pulmonary Medicine, The Oxford Medical College Hospital and Research Centre, Bangalore.

Dr. A.S. Deepa

Assistant Professor, Department of Pulmonary Medicine, Bangalore Medical College and Research Institute, Bangalore.

Abstract---Introduction: Exercise helps to combat many health conditions and diseases. Walking is a simple way of exercise to increase aerobic capacity. To provide even greater health benefits we studied backward walking on flat surface. Aims and Objectives: To compare the difference in heart rate when walking forward and walking backward for 6 minutes on a flat surface. Methods: Healthy subjects above 18 years with no comorbidities were recruited for the study. Pre test and post test vitals and distance walked was measured in both 6 Minute Walk Test (6MWT) and Reverse 6MWT. Results: The mean distance walked in 6MWT and Reverse 6MWT was 505.3 meters and 381.7 meters respectively ($p=0.00$ Statistically significant). The mean Heart Rate (HR) after 6 MWT and Reverse 6MWT was 115.52 and 127.70 respectively ($p=0.00$ Statistically significant). Conclusion: Reverse walking improves aerobic capacity more than forward walking.

Keywords---Six minute walk test, Forward walking, Reverse walking, Aerobic capacity.

Introduction

Exercise has proved to improve overall well being of a person both physically and mentally. American Heart Society recommends moderate exercise for 150 minutes

a week, is essential for overall health, well being, disease prevention and quality of life. Walking is most common and safe form of exercise. Walking has cardio vascular benefits. It improves aerobic capacity and endurance of a person¹. It is also beneficial for neurocognitive and musculoskeletal system. Six minute walk test is the most simple field test used to assess aerobic capacity and endurance. In general, exercise training at high intensity (e.g., 60-80% of maximal work load) leads to greater gains in aerobic fitness than lower-intensity exercise (<50% of maximal work load)². Heart rate and oxygen consumption has been shown to be higher during backward walking than forward walking on tread mill³. As of now, there are studies on backward walking and forward walking for testing on gait and balance ability. Few studies are done on thread mill to test on aerobic endurance testing. There are not many tests done on level ground. Thread mill and other gym equipments may not be feasible for everyone.

Aims and objectives: Our study aims to compare the difference in heart rate when walking forward and walking backward for 6 minutes on a flat surface.

Materials and Methods

Our study is a one group forward and reverse walking comparative study conducted in the Department of Pulmonary Medicine at a tertiary care teaching institute, The Oxford Medical College Hospital and Research Centre, Bangalore, India with a duration of 1 month in February 2022. Institutional scientific committee and ethical committee approval was taken. Informed consent was taken from the participants before enrolling in the study.

Inclusion criteria:

- Healthy subjects above 18 years of age.
- Individuals willing to participate in the study.

Exclusion criteria:

- Subjects with neuromuscular disease, metabolic disorder, cardio thoracic disease and psychiatric illness.
- Physical disability that could interfere with forward and backward walk test.
- Long term oral /parental corticosteroid therapy and anabolic steroids.
- Recent history of surgery or hospitalization in the past 6 months.

Procedure

The purpose of the study was communicated to the subjects who were recruited based on predetermined inclusion-exclusion criteria and their participation in research was voluntary. The baseline evaluation of biophysical profile, basal oxygen saturation, Heart rate (HR), Respiratory rate (RR) and Blood pressure(BP) was recorded. The subjects were then subjected to 6 Minute Walk Test (6MWT) according to ATS guidelines⁴. Post test saturation, HR and distance walked was recorded. After a rest period of 15 minutes, the subjects were recruited for Reverse 6MWT. Post test saturation, HR and distance walked were recorded.

Six Minute Walk Test

A 30 meters corridor in the hospital was used for the test. An arrow was pasted at the end to indicate the direction in which the patient has to turn. Subjects were instructed to walk from end to end at their self-selected pace, while attempting to cover as much distance as possible in the 6 minutes. They were given standardized encouragement at 1, 3, and 5 minutes during the walk: "You're doing a good job" (minute 1), "You're halfway done" (minute 3), "You have 1 minute to go" (minute 5).

Distance walked was recorded in meters.

Adequate precautions were taken to ensure safety of the participant during tests.

Reverse Six Minutes Walk

A 30 meters corridor in the hospital was used for the test. An arrow was pasted at the end to indicate the direction in which the patient has to turn. Subjects were instructed to walk backwards from end to end at their self-selected pace, while attempting to cover as much distance as possible in the 6 minutes. They were given standardized encouragement at 1, 3, and 5 minutes during the walk: "You're doing a good job" (minute 1), "You're halfway done" (minute 3), "You have 1 minute to go" (minute 5).

Distance walked was recorded in meters.

Adequate precautions were taken to ensure safety of the participant during tests.

Results

The Statistical data was analysed using, SPSS MS Excel 2022.

Qualitative Variables were expressed as frequency, while the Quantitative Variables were expressed as means, Standard deviation. Paired 't' test was used for group Comparison. For all Statistical analysis P value less than 0.05 was considered as statistically significant. 70 subjects were recruited into the study who met inclusion criteria. Of which 33 males and 37 females participated. The mean and standard deviation of the study population with respect to height, weight, body mass index (BMI) is shown in the table 1.

In Pre-6-minute walk test the mean HR was 85.61 and in the post test it was 115.5.(P= 0.000, Significant). No significant desaturation noted in the post test.

In the Reverse Walking, mean Pre-test heart rate was 87.41 and in the Post test Heart rate was found to be 127.7(P=0.000, Statistically significant). No significant desaturation was noted. Paired 't' test Comparison of heart rate, distance walked in 6-minute walk test and Reverse walk test was done.

The distance walked in 6-minute walk test was 505.53±88.48 metres. While the distance walked in Reverse walk test was 381.79±72.99 metres in the same time of 6 minutes (P=0.000, Significant). The mean HR after 6-minute walk test was 115.52, while the mean HR after Reverse 6 -minute walk test was 127.70 (P=0.000, Significant). No significant desaturation was noted in both tests.

Table 1: Comparison of demographic and baseline characteristics of patients

Demographics and baseline characteristics		(n=70) Mean $\pm$ SD
Age		26.18 $\pm$ 6.89
Gender	Female	37(52.9)
	Male	33(47.1)
Height		166.93 $\pm$ 9.43
Weight		64.73 $\pm$ 13.19
BMI		23.13 $\pm$ 3.75

Table 2: Pre and post 6MWT heart rate and saturation

	6MWT		P value
	Pre test (mean $\pm$ SD)	Post test (mean $\pm$ SD)	
Heart rate	85.61 $\pm$ 11.71	115.52 $\pm$ 21.17	0.000
Saturation	97.44 $\pm$ 1.26	96.85 $\pm$ 1.88	0.017

Table 3: Pre and post reverse 6MWT heart rate and saturation

	Reverse walk		P value
	Pre test (mean $\pm$ SD)	Post test (mean $\pm$ SD)	
Heart rate	87.41 $\pm$ 13.66	127.70 $\pm$ 26.54	0.000
Saturation	97.50 $\pm$ 1.13	97.12 $\pm$ 1.15	0.019

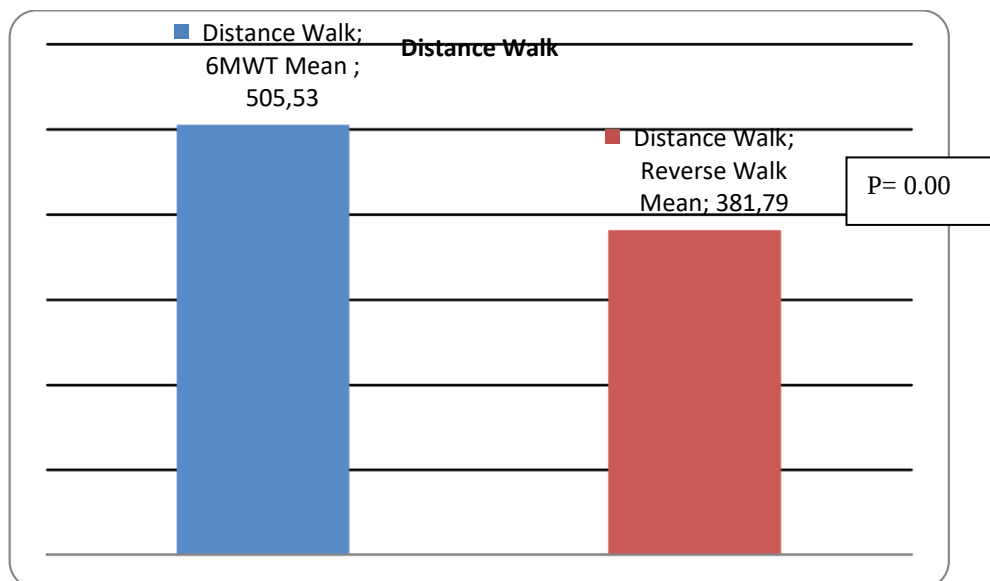


Figure 1: Distance walked in 6MWT and reverse 6MWT.

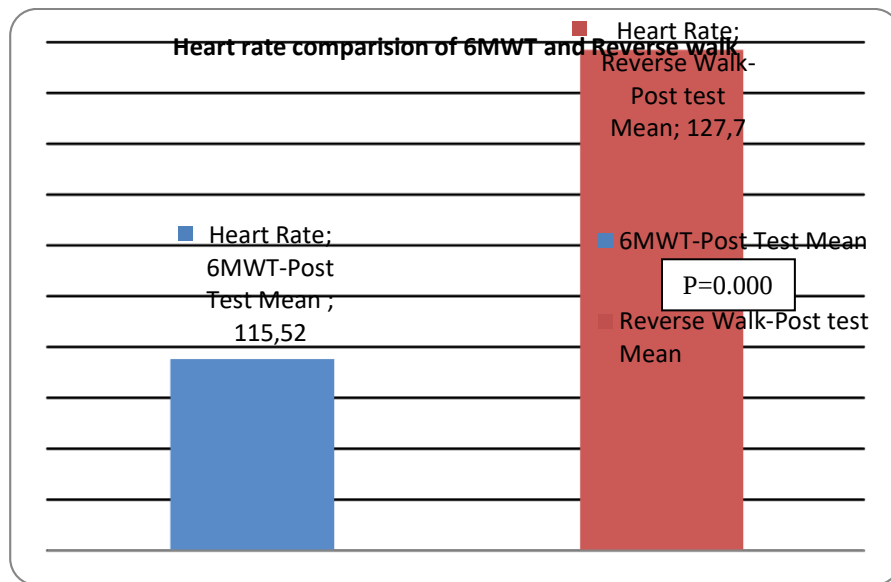


Figure 2 : Post test comparison of heart rate of 6MWT and Reverse 6MWT.

Discussion

The study results showed that there was a significant difference in heart rate in both Six minute walk test and Reverse six minute walk test. However in the Reverse 6MWT the mean increase in HR was significantly higher with the shorter distance walked. ($p=0$). The study conducted by Hyun Gyu Cha et al revealed backward walking positively affected gait and balance when compared to forward walking group on a slope⁵. Shaji John Kachanathu et al reported that both forward walking and backward walking improved anaerobic performance significantly but in the latter it was significantly better. The study concluded that backward walking training in rehabilitation can be considered more effective than forward walking at improving anaerobic performance⁶. Flynn TW et al reported during forward walking the muscle action of the knee extensors is largely eccentric and concentric, while during backward walking it is isometric and concentric.⁷

Schwane et al. reported that a new motor task increases motor unit recruitment, thereby increasing metabolic activity.⁸ In backward walking large number of motor units recruitment occurs, greater skeletal muscle activity occurs resulting in increased energy utilization⁶.

Limitations

The present study did not include patients who are obese, overweight and patients with respiratory impairment. The drawback of backward walking in rehabilitation programme is that it is difficult to implement on people with locomotor disability as they may need assistance. There are no validated formulas to calculate VO_2 max (maximum rate of oxygen consumption measured during exercise) in reverse walking test.⁹ More studies are required to elicit on reverse walking in respiratory impairment patients.

Conflicts of interest- none

Financial support- none

References

1. Paul M. Coen, 1,2 Sharon A. Jubrias et al. Skeletal Muscle Mitochondrial Energetics Are Associated With Maximal Aerobic Capacity and Walking Speed in Older Adults. *J Gerontol A Biol Sci Med Sci*. April 2013;68(4):447–455.
2. Morris NR, Walsh J, Adams L, Alison J. Exercise training in COPD: What is it about intensity? *Respirology*. 2016;21:1185-1192.
3. Ashwini A. Kale, Sunita D. Chavan. Effect of forward and backward walking on aerobic capacity and endurance *International Journal of Recent Trends in Science and Technology* .June 2014;11(2):176-179
4. ATS Statement: Guidelines for the Six-Minute Walk Test. *Am J Respir Crit Care Med*. 2002;166:111–117.
5. Hyun-Gyu Cha, PT, Tae-Hoon Kim, PT, Myoung-Kwon Kim, PT. Therapeutic efficacy of walking backward and forward on a slope in normal adult. *The Journal of Physical Therapy science*. 2016; 28: 1901.
6. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. *International Journal of Health Sciences*, 6(1), i-v. <https://doi.org/10.53730/ijhs.v6n1.5949>
7. Shaji John Kachanathu, PT, Aqeel M Alenazi et al. Effect of Forward and Backward Locomotion Training on Anaerobic Performance and Anthropometrical Composition *J. Phys. Ther. Sci*. 2004;26: 1879–1882.
8. Flynn TW, Soutas-Little RW. Mechanical power and muscle action during forward and backward running. *J Orthop Sports Phys Ther*. 1993;17:108–112.
9. Giri, M. K. W. (2019). Immunological side in overtraining exercise. *International Journal of Health & Medical Sciences*, 2(1), 1-6. <https://doi.org/10.31295/ijhms.v2n1.52>
10. Schwane JA, Johnson SR, Vandenakker CB et al. Delayed-onset muscular soreness and plasma CPK and LDH activities after downhill running. *Med Sci Sports Exerc*. 1983;15: 51–56.
11. Karampreet Kour Buttar et al. A review: Maximal oxygen uptake (VO₂ max) and its estimation methods. *International Journal of Physical Education, Sports and Health*. 2019; 6(6): 24-32.