

Efficacy of Aerobic Exercise on Exercise Capacity and Quality of Life in Hypothyroidism Females: An Interventional Study

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ABSTRACT

Background and Purpose: Hypothyroidism is an endocrine disorder prevalent globally and its more common in women. It affects muscular endurance and exercise capacity. Engaging in aerobic exercise impact health by influencing wellbeing, mortality, morbidity, hence quality of life. In aerobic activities walking is a widely practiced and effective for which further research is needed to establish the optimal duration and intensity.

Methodology: The study was conducted on 70 Hypothyroidism females aged 20-65 year who divided in Group A (Experimental n=35) and Group B (Control n=35). Four weeks of Aerobic exercise programme was given in Group A and Regular walking was given in Group B which is control group. Six Minute Walk Distance and SF 12 were assessed in both the group before and after intervention.

Results: Shapiro-Wilk test shows normal distribution so parametric tests Paired t-test and Unpaired t-test were applied for within group analysis and between group analysis respectively. Group A Shows significant difference in 6MWD ($p < 0.001$). While Group B shows no any significant difference in 6MWD ($p = 0.300$). In Group A, PCS and MCS shows significant difference ($p < 0.001$). While in Group B, PCS ($p = 0.221$) and MCS ($p = 0.778$) shows no any statistically difference in within group analysis. In between group analysis pre and post intervention there was statistically difference in 6MWD ($p < 0.001$) and PCS and MCS ($p < 0.001$).

Conclusion: Aerobic exercise with Brisk walking shows significant improvement in Exercise capacity and quality of life in hypothyroidism females.

Keywords: Aerobic exercise, Exercise Capacity, 6MWT, Quality of life, Hypothyroidism, Brisk walking

INTRODUCTION

Hypothyroidism is an endocrine disorder occurs when the thyroid gland doesn't produce enough thyroid hormones T4 and T3, is prevalent worldwide including India which affects the health significantly.^{1,2,3,4}

The prevalence of hypothyroidism in people in India is between 3.9 % to 10.95% in which 3.47% were previously undetected. The prevalence of this condition was higher in women, that is 11.4%, compared to men, with a prevalence of 6.2%.⁵ The prevalence

of hypothyroidism is higher in people aged 46-54 years (13.1 %) compared to people aged 18-35 years (7.5%).⁶

Recent research suggest that thyroid hormones have an impact on the alteration of the lipid profile, which in turn affects muscular activity and endurance and exercise capacity. This influence can be influenced by factors such as lifestyle, physical activity, and disease progression.⁷

The 6MWT is considered a safe and practical tool for evaluating daily physical performance, providing insights into a patient's ability to perform everyday tasks and exercise capacity. The American Thoracic Society has published guidelines for conducting the test. The purpose of this test is to assess the maximum distance a patient can cover by walking briskly on a level and firm surface in 6 minutes.^{8,9}

It is widely recognized that hypothyroidism is linked to adverse health consequences. It exerts a significant impact on the overall quality of life.¹⁰ Previous research has shown that people with hypothyroidism often experience a significant impact on their HRQoL due to excessive worry caused by weight gain and heightened awareness of their illness. Fatigue is frequently linked to hypothyroidism and is also correlated with decreased HRQoL.^{11,12}

In the past, various tools have been created to assess the quality of life in terms of health for the general population. Currently, the SF-12 and SF-36 questionnaires have been translated into numerous languages and have been determined to be valid and trustworthy for use with both the general population and older persons. Compared to SF-36, SF-12 is a more appropriate choice for big health surveys because to its shorter length, greater simplicity, and reduced interview time.^{13,14}

Aerobic exercise are the activities that use oxygen to fuel the muscles, enhancing blood circulation, muscle strength, and cardiovascular and respiratory functions. Research suggests that aerobic exercise can

influence metabolic and endocrine processes, affecting hormone levels and blood flow dynamics.¹⁴ Brisk walking is a highly recommended form of physical activity, aligning with the World Health Organization's guidelines for achieving at least 150 minutes of moderate-intensity exercise per week. Walking offers numerous health benefits, including reduced mortality risk, improved cardiovascular health, better mental and cognitive health, and decreased risk of falls.^{14,15}

Various studies have shown the positive influence of aerobic exercises on fitness and body composition but also asked the question of whether various models of aerobic exercises will have the same influence on various physical parameters. Walking programs can be beneficial for individuals with chronic health conditions. However, further research is needed to tailor walking programs to specific populations. The aim of this research was to determine the effects of an aerobics exercise program with Brisk walking on the Pulmonary functions and Exercise capacity hypothyroidism females.^{15,16}

MATERIALS & METHODS

The study was conducted on 74 hypothyroidism females aged 25-65 years which were selected by simple random sampling technique (lottery method). Study was conducted in different hospitals (Sainath hospital, Laxmi hospital etc.), various OPD and community area of Ahmedabad city. They were divided in two groups. Group A (Experimental n=37) and Group B (Control n=37). 4 weeks of Aerobic exercise programme in form of Brisk walking along with Conventional medical treatment was given in Group A and Regular walking along with Conventional medical treatment was given in Group B. Pre and post 6 MWD and SF 12 were assessed in both the groups.

Inclusion criteria:

- Age: 20-65 years

- Females diagnosed with Hypothyroidism
- Females having hypothyroidism for at least 1 year

Exclusion criteria:

- Patients who have chronic pulmonary disease, hypertension, diabetes mellitus and chronic kidney disease, cardiac disease, stroke etc.
- Patients with musculoskeletal inability to perform physical exercises
- Cigarette smokers
- Any recent surgery
- Patient having any other systemic illness
- Unwillingness to participate

Sample size calculation

G power software was used to determine the sample size. The sample size required for the study was 74, calculated by using the power of 80 and alpha 0.05.

Treatment intervention

Four weeks of aerobic training programme that is brisk walking was given to experimental group according to FITT principle. Brisk walking included slow walk-warm up, Brisk walk-exercise period and slow walk-cool down. Intensity was decided based on RPE Scale. In first week RPE was 3 or 4 which was progressed gradually up to 7 or 8 based on patient’s level of exertion according to ACSM.¹⁷ While in Group B Regular walking with their own pace and conventional medical treatment was given for 4 weeks.

Table 1: Aerobic Exercise programme

Frequency (F)	Intensity (I)	Type (T)	Time (T)
4-5 days per week Starting with moderate frequency to avoid excessive fatigue based on RPE scale. After building endurance, frequency can be increased	Intensity is based on the Rate of Perceived Exertion (RPE) . Modified borg dyspnea scale 0-10 was used. In first week RPE was 3 or 4 which was progressed gradually up to 7 or 8 based on patient’s level of exertion.	Brisk Walking was given. 5 min-Warm up 20-50 min Brisk Walk (based on RPE scale) 5 min- Cool down	Start with 15-20 minutes and Increase duration up to 45-60 minutes.

Six Minute Walk Test (6MWT)^{8,9}

The American thoracic association (ATS) recommend that the 6MWT is conducted on a 30-m indoor track. In this study, we used 30-m indoor tracks for walking. Plastic cones were placed in both ends to mark the turn around points of the track. Before tests vital signs (HR, RR, BP, SPO2 & RPE

Scale) were taken and then Subject was asked to walk for 6 minutes. The test instructions are as follows: ‘Walk back and forth around the cones as fast as possible for 6 min. You may not jog or run. At the end of the test again vital signs were taken. Distance walked were measured.



Figure 1: Subject performing Six minute walk test

Quality of life measurement:¹³

SF 12 questionnaire was used to measure quality of life. Interpretation was done by SF 12 ortho toolkit. PCS and MCS scores were calculated and compared.

STATISTICAL ANALYSIS

Data were analyzed by using the statistical package for social sciences version 27.0 (SPSS 27.0) and Microsoft Excel 2013. Calculated Sample size was 74. There were 2 dropouts in each group. So final sample size was 70. Prior to statistical tests, data was screened for normal distribution. Tests of normality was done by Shapiro-Wilk test which shows most all the variables are normally distributed so parametric test was applied. Paired t-test was applied for within group analysis. And Unpaired t-test was applied for within group analysis. The baseline data were collected and measurements were repeated after 4 weeks of intervention.

RESULT

Total of 70 participants were evaluated in which they were divided in two groups. 35 participants in each group. Group A (Experimental n = 35), whose Mean \pm SD of age (years) and BMI (kg/m²) were 45.23 \pm 8.66 and 27.41 \pm 5.05, respectively, and Group B (Control n = 35), whose Mean \pm SD of age and BMI were 40.83 \pm 9.78 and

24.60 \pm 3.54, as mentioned in graph 1, were taken. As per data mentioned in Table 1 In Group A 6MWD Pre and post Mean \pm SD were 334.11 \pm 75.51 and 393.37 \pm 72.57 respectively (p<0.001). In Group B 6MWD Pre and post Mean \pm SD were 286.42 \pm 49.08 and 288.62 \pm 46.46 respectively (p =0.300).

In Group A PCS Pre and Post Mean \pm SD were 40.49 \pm 7.73 and 51.30 \pm 4.05 respectively (p<0.001). MCS Pre and post Mean \pm SD were 45.60 \pm 7.09 and 52.32 \pm 5.50 respectively (p<0.001). In Group B PCS Pre and post Mean \pm SD were 42.43 \pm 2.93 and 42.67 \pm 2.98 respectively (p =0.221). And MCS Pre and post Mean \pm SD were 41.68 \pm 2.47 and 41.60 \pm 2.64 respectively (p =0.778).

According to above data analysis Group A Shows significant difference in 6MWD (p<0.001). While Group B shows no any significant difference in 6MWD (p =0.300). In Group A PCS and MCS shows significant difference (p<0.001). While in Group B PCS (p =0.221) and MCS (p =0.778) shows no any statistically difference in within group analysis. In between group analysis pre and post intervention there was statistically difference in 6MWD (p<0.001). PCS and MCS also shows statistically significant difference between two groups (p<0.001).

Graph 1: Demographic data of Group A and Group B

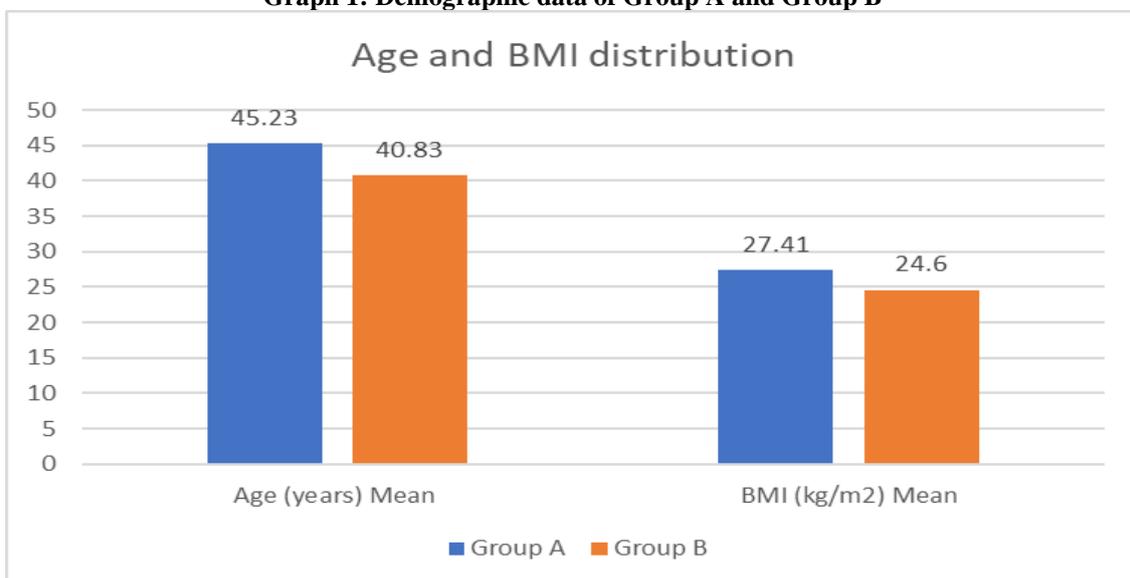


Table 2: Pre and Post-treatment Scores of 6MWD of Paired t-test within group analysis

Outcome measure	Pre Mean \pm SD	Post Mean \pm SD	p Value
Group A			
6MWD (meter)	466.27 \pm 68.88	510.87 \pm 67.46	<0.001
Group B			
6MWD (meter)	485.67 \pm 42.19	486.13 \pm 40.86	0.831

Graph 2: Pre and Post treatment Mean of 6 MWD in meter of Group A and Group B

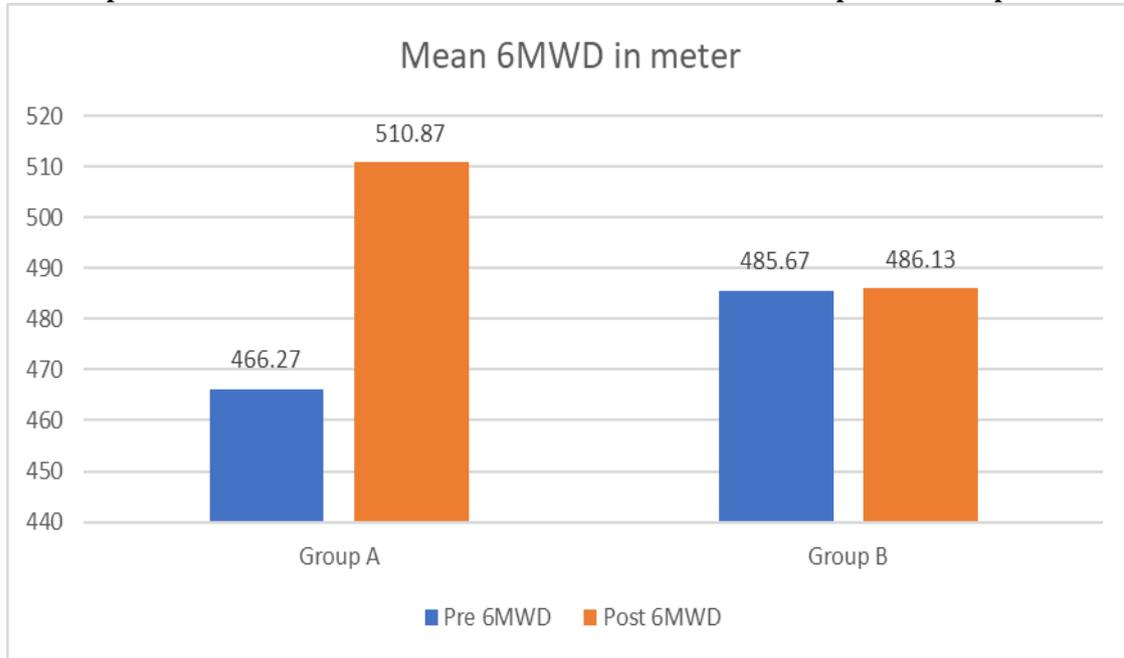
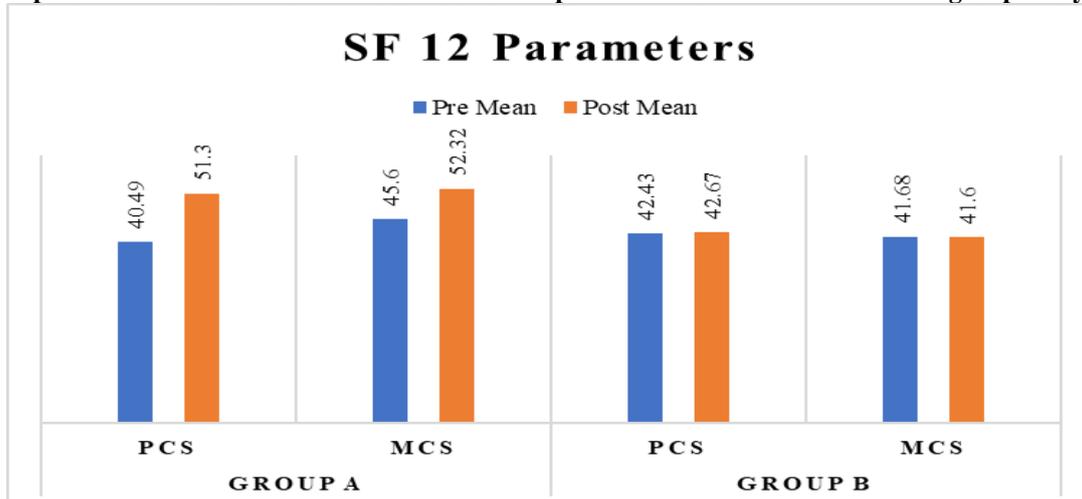


Table 3: Pre and Post-treatment Scores of SF 12 parameters, PCS and MCS of Paired t-test within group analysis

	SF 12 Parameters	Pre Mean \pm SD (% predicted)	Post Mean \pm SD (% predicted)	T value	P value
Group A	PCS	40.49 \pm 7.73	51.30 \pm 4.05	9.918	<0.001
	MCS	45.60 \pm 7.09	52.32 \pm 5.50	6.389	<0.001
Group B	PCS	42.43 \pm 2.93	42.67 \pm 2.98	1.247	0.221
	MCS	41.68 \pm 2.47	41.60 \pm 2.64	0.285	0.778

Graph 3: Pre and Post-treatment Scores of SF 12 parameters of Paired t-test within group analysis



DISCUSSION

Our findings confirm the benefits of brisk walking in improving exercise capacity and Quality of life among hypothyroid women. The significant increase in distance walked and Quality of life observed in the experimental group supports its role as an effective aerobic exercise intervention. Low Exercise capacity is a well-established independent predictor of cardiovascular disease and all-cause mortality making its enhancement through regular brisk walking a valuable preventive measure.

Melam et al. (2016) demonstrated that combining aerobics with diet was more effective in reducing BMI and waist-to-hip ratios than brisk walking alone. Despite these findings, brisk walking remains a practical and accessible option, particularly for populations with limited exercise experience or resources.¹⁸

In contrast to our findings, Yadav et al. (2022) found that resistance training was more effective than aerobic exercise in improving thyroid function among hypothyroid patients. This divergence highlights the importance of tailoring exercise protocols to target specific outcomes, such as hormonal regulation versus cardiovascular fitness. Furthermore, combining aerobic and resistance training may provide synergistic benefits and also warrants future exploration.¹⁹

J. Mustedanagić, M. Bratić et.al. (2016) have studied the effect of aerobic exercise program on the cardiorespiratory fitness and body composition of female college students. The results of this study support previous findings regarding the benefits of aerobic exercise when performed at the right intensity, length, and time. They realized aerobic exercise model might be suggested as a component of the program to help female college students lose body mass.²⁰

The improvements in Exercise capacity observed in this study are attributed to the enhancement of aerobic power through increased stroke volume, improved oxygen delivery to activate tissues, and a reduction in peripheral resistance.¹⁰ Brisk walking

stimulates cardiovascular and respiratory systems, leading to better oxygen utilization and overall energy efficiency during physical activity. These adaptations are particularly beneficial for hypothyroid individuals, who often experience reduced metabolic and cardiovascular function.

Shivaprasad C, Rakesh B et.al. (2020) studied that patients with hypothyroidism commonly experience reduced HRQoL in conjunction with fatigue and behavioural/emotional abnormalities. Patients may experience psychological distress due to elevated titres of thyroid peroxidase antibodies, potentially resulting in a reduced quality of life.²¹ S. El Gayar, et al. (2023) investigated how aerobic exercise affected the thyroid function and depression in women receiving treatment for hypothyroidism. Previous research has demonstrated that aerobic exercise has no appreciable impact on thyroid hormone levels, which runs counter to the current research findings.²² Mayada Samy Soffar et al. (2024) examined that doing Pilates exercises for had a greater impact on QoL and functional ability than either aerobic exercise or medicine alone.²³

Brisk walking offers numerous advantages, including its simplicity, low cost, and minimal risk of injury. It aligns with the World Health Organization's recommendation of 150 minutes of moderate-intensity physical activity per week to reduce mortality risk and improve overall health.^{15,24} However, its effects may be less pronounced compared to structured aerobic or resistance training when targeting specific fitness or metabolic outcomes. Incorporating other exercise modalities like aerobics or resistance training may enhance the overall benefits.¹⁸

Future recommendation: The structured and progressive brisk walking protocol used in this study effectively improved exercise capacity and quality of life in hypothyroid women. Future studies should investigate the impact of longer intervention durations,

varied intensities, and combined exercise modalities to optimize outcomes.

Limitations: Effect of medicine is not taking in consideration. This study was limited by its short intervention duration and geographic restriction to Ahmedabad city. These factors may limit the generalizability of the findings. Future research should address these limitations by including a more diverse sample population and extending the intervention period.

CONCLUSION

Brisk walking significantly improves exercise capacity and quality of life in hypothyroid females, reinforcing its role as a practical and effective exercise modality. This accessible form of aerobic exercise supports global health recommendations and also provides a foundation for further research into its broader applications for managing hypothyroidism-related fitness impairments.

Declaration by Authors

I hereby declare that the research work submitted for publication is my original work. This article has not been published previously, nor is it under consideration for publication elsewhere. Any sources used or cited have been appropriately acknowledged. I affirm that there are no conflicts of interest regarding the publication of this article. All data presented are true and authentic to the best of my knowledge. I have complied with all ethical standards required for this research. I also confirm that all co-authors, if any, have read and approved the final version of the manuscript and have agreed to its submission to your journal.

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