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OPTIMIZING CARDIOVASCULAR FUNCTION AND MITIGATING FATIGUE IN THE ELDERLY: A COMPARATIVE ANALYSIS OF CHAIR-BASED VERSUS FIELD-BASED AEROBIC INTERVENTIONS

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ABSTRACT

In conjunction with the anatomical and physiological changes encountered with ageing, older adults are more predisposed to tiredness and reduced aerobic capacity. Training in aerobic exercise enhances physiological responses in all age groups. This approach is aimed at improving cardiac endurance in elderly people by giving aerobic exercise. The conducted comparative study at Physiotherapy outpatient department and involved a simple random sample of 30 individuals aged 55 to 65 years. Over an 8-week period, with activities conducted five days a week, participants were partitioned into two equal groups: Group A received chair-based aerobic exercise, while Group B underwent field-based aerobic exercise. Pre- and post-test values for cardiac endurance and fatigue were measured using the

6-minute walk test and FACIT fatigue scale. Inclusion criteria encompassed stable vital signs for both male and female participants within the specified age range. Exclusion criteria were applied to individuals outside the age bracket, uncooperative patients, those with uncontrolled hypertension, cardiovascular dysfunction, unstable vital signs, or recent chest/abdominal surgery. 6 min walk test, FACIT fatigue scale were used as outcome measures to assess the prior and post-test values. On analyzing group A with chair based aerobic exercise pre test, and group B with field based aerobic exercise pre test values shows equivalent, whereas the post treatment results of group A post test mean value shows highly significant than group B. This study concludes that the chair based aerobic exercise is effective than field based aerobic exercise by improving cardio vascular endurance and controlling fatigue.

Keywords: Fatigue, Aerobics, Cardiovascular Health, Cardiopulmonary Endurance, Six Minute Walk Test

INTRODUCTION

Naturally ageing is a gradual condition accompanied by physiological, social, and physical changes. The world's oldest population is expanding at the fastest rate **[1]**. Seniors who exercise regularly have been linked to health advantages like a lower risk of cardiovascular demise. The brain territories responsible for regulating executive control may benefit from exercise as well. In order to attain a high level of cardio respiratory fitness it is recommended to be physically active **[2]**. Consistent engaging in physical activity preserves elderly individuals' ambulation and provides independency through bettering their mental and physical function and inverting some of the consequences of chronic disease. It may be suggested to older adults to raise their level of activity **[3]**. Exercise has a preventative maintenance impact against a variety of chronic conditions, such as heart disorders. Getting involved in aerobic activity may enhance cardiovascular health. bolster the airways and lungs along with improving routine endurance **[4]**. Physical activity in old age consists of recreational activities, displacements, programmed exercise in older to improve cardio respiratory function and to reduce the risk of depression, cognitive and falls. The promotion of physical activity is a key element to achieve healthier old people **[5]**.

Elderly individuals may choose chair-based aerobic exercise, which is a settled down, organised, and gradual fitness regimen that utilises the use of a chair for aiding **[6]**. It has been demonstrated that this exercise helps elderly adults preserve or elevate their independence as well as mobility **[7]**. With chair-based aerobic exercise, senior citizens have the opportunity to participate in secure, simple to understand, and family permissible physical activities **[8]**. It

ought to be promoted as an family permissible and straightforward workout for building up and sustaining strength **[9]**. It is advised to get elderly individuals with immune systems that are compromised and restricted mobility in a convenient and comfortable way **[10]**.

The peak performance endurance potential gets enhanced with the help of this workout. It is intended to stimulate and sustain an accelerated heart rate for a predetermined amount of time. It enhances cardiopulmonary endurance **[11]**. Aerobic labour on the pitch assists in strengthening the respiratory system and airways, enhance the efficiency of the heart, and promotes the daily basis stamina **[12]**. The circulatory system, which affects functional capacity, the musculoskeletal system, and joint flexibility are all enhanced as a result of this form of exercise.

It has an ameliorating impact on the functioning of the body in respect to the bodily system mainly the cardiovascular system **[13]**. When associated regarding different medical conditions, workout programmes for the healthy elderly can have a beneficial influence on one's physical function and the diminution of the cardiovascular performance that accompanies physiologic ageing. It is a effective component of cardiac rehabilitation **[14]**. This exercise is effective in improving cardio respiratory fitness in elderly **[15]**.

The six-minute walk test (6MWT) was is an effective tool for assessing functional capacity in patients with cardiovascular and pulmonary diseases. Recognising that it is straightforward to administer and considerably more patient-accepted as opposed to other field tests, it is an established way to monitor the way distinct rehabilitation approaches in cardiovascular and pulmonary ailments are yielding results **[16]**. The six-minute walk test (6MWT) was initially developed for use in detecting cardiovascular endurance and is a clinically established test for cardiopulmonary reserve **[17]**. The patient is guided through the test on a flat, 100-foot corridor **[18]**. The test's principal intention of this analysis is the total distance walked, which is compared to reference criteria for interpretation **[19]**. The individual being tested will be given instructions and motivation throughout the test **[20]**. It is a field test that has been scientifically validated, has been simple to use, safe, inexpensive, and is commonly employed for evaluating the advantages associated with a rehabilitation programme and the functional exercise ability of subjects with chronic cardiac failure (CHF) and chronic obstructive pulmonary disease (COPD) on a consistent routine **[21]**. One of the most common complaints among the elderly is fatigue, which has a significant

correlation to diminished physical activity and a loss of independence. The Functional Assessment of Chronic Illness Therapy (FACIT) Fatigue Scale is one of the questionnaires for self-reported information that has been authorised for use with senior citizens. The 13-item FACIT exhaustion Scale is a quick and simple instrument to use to gauge someone's level of exhaustion while carrying on their usual daily responsibilities. The FACIT tool is available for cross-cultural comparisons and has been translated into more than 45 languages. It was discovered that the FACIT Fatigue Scale has good test-retest reliability along with solid internal validity **[22]**.

MATERIALS & METHODS

Selection of Subjects

The study was designed as a comparative study employing a simple random sampling method, conducted as a pre- and post-test analysis at ACS Medical College and Hospital. A total of 30 participants aged between 55 and 65 years were selected for inclusion. The study spanned 8 weeks, with interventions and observations recorded five days a week. The inclusion criteria were individuals aged between 55 and 65 years, both males and females, with stable vital signs. The exclusion criteria included individuals younger than 50 or older than 65, uncooperative patients, those with uncontrolled hypertension, cardiovascular dysfunction, unstable vital signs, or recent chest or abdominal surgery. The outcomes were measured using the 6-minute walk test (6MWT) and the Functional Assessment of Chronic Illness Therapy (FACIT) fatigue scale

Procedure

A total number of 30 subjects were selected according to the selection criteria and age group. And the subjects were equally divided into two group. They are fully explained about the benefits of the study. All participants provided informed consent prior to enrollment, ensuring their voluntary participation and understanding of the study's procedures in accordance with the ethical standards of the Institutional Review Board and adheres to the principles of the Declaration of Helsinki 1975, amended in 2013. The subjects were screened for eligibility based on the inclusion and exclusion criteria and randomly spilt into 2 categories for executing the exercise protocols. Group-A comprising ,15 Subjects received chair based aerobic exercise for a period of 8week (5 days a week) **[23]** and Group-B comprising, 15 Subjects received field base aerobic exercises for a period of 8 week (5 days a week). The exercise interventions has been designed according to FITT principle and with in the tolerable range of the involved subjects.

Intervention Protocol

A) Group A - Chair Based Aerobic Exercise [Table 1]

1. ***Seated Side Twists***

The patient sat upright with feet flat on the floor and placed their hands on the back of their head. They then twisted their torso to the right, held the position momentarily for 10 seconds and relaxed, and subsequently twisted to the left. This was repeated for 5 repetitions and done in 3 sets. This Enhances flexibility and strength in the core muscles, improves spinal mobility.

2. ***Lateral trunk flexion***

The patient sat with feet positioned hip-width apart and arms outstretched above the head. They were instructed to inhale and lean to one side, then exhale and return to a neutral position. The same procedure was repeated on the opposite side. This was repeated for 5 repetitions and done in 3 sets. Lateral trunk flexion exercises primarily target the obliques (internal and external), which are responsible for bending the torso to the side. They also engage the quadratus lumborum and the erector spinae for stability and support.

3. ***Static leg lifts***

The patient was instructed to sit at the edge of a chair with the knees locked fully. The extended leg is lifted upwards through hip by flexing the hip and this is held in the elevated position for 10 seconds before being lowered back down. The procedure was repeated with the opposite leg. This was repeated for 5 repetitions and done in 3 sets. Static leg lifts primarily target the quadriceps and the muscles of the hip flexors. This exercise also engages the lower abdominal muscles for stabilization. The effects of static leg lifts include improved strength in the front of the thighs, enhanced hip flexor function, and increased core stability.

4. ***Static leg extensions***

The patient was instructed to sit at the edge of a chair with feet flat on the floor. One leg was then extended straight out and held for 10 seconds before being lowered back down. The procedure was repeated with the opposite leg. This was repeated for 5 repetitions and done in 3 sets. Static leg extensions primarily target the quadriceps, the muscles at the front of the thighs. This exercise also engages the hip flexors and can help improve lower abdominal stability. The effects include increased strength in the quadriceps, enhanced flexibility and endurance in the leg muscles, and improved overall lower body stability.

Table 1: Tabular Depiction of Exercise Intervention Protocol and Outcome Measures for Group A

GROUP AND INTERVENTION	EXERCISE PROTOCOL	NO OF REPETITIONS	NO OF SETS	OUTCOME MEASURES
GROUP A – CHAIR BASED AEROBIC EXERCISE	*Seated Side Twists*	5	3	6 MWT & *FACIT Fatigue scale*
	Lateral trunk flexion	5	3	
	Static leg lifts	5	3	
	Static leg extensions	5	3	

B) Group B - Field Based Aerobic Exercise [Table 2]

1. *Walking Lunges*

The patient performed lunges by stepping forward with one leg and lowering the body until the front thigh was parallel to the ground and the back knee nearly touched the floor. The torso remained upright throughout the movement. The patient then pushed off with the back leg to return to the starting position and alternated legs with each step. This is repeated for 5 repetitions and 3 sets. Lunges primarily target the quadriceps, hamstrings, and gluteal muscles. This exercise also engages the calves and core for stability. The effects include increased strength and endurance in the lower body, improved balance, and enhanced overall leg function.

2. *Brisk Walking*

Brisk walking is recommended around an open space, at a speed of approximately 3.5 km/h. A typical session involves walking for 20 minutes, covering a distance of 1.5 kilometres. This moderate-intensity exercise helps improve cardiovascular health, strengthen lower body muscles, and enhance joint mobility while remaining low-impact and manageable.

3. *Static Hip Marching*

The patient performed static hip marching by standing with feet hip-width apart and raising one knee towards the chest while maintaining balance, lowering the leg back to the ground. The procedure was then repeated with the opposite leg as in a rhythmic manner of alternating with right and left leg. This is repeated for 30 repetitions for 3 sets. Static hip marching primarily targets the hip flexors and quadriceps. This exercise also engages the core muscles for balance and stability. The effects include improved strength and endurance in the hip flexors, enhanced lower body stability, and better overall balance and coordination.

4. *Side Stepping*

The patient steps laterally by abducting the right hip to the right side and stepping sideways over a distance of approximately 1 meter, maintaining a steady pace of 2 km/h of lateral movement. Similarly, this is further repeated for the left side hip. A typical session involves performing 15 repetitions per side for 3 sets. Side stepping primarily targets the hip abductors, including the gluteus medius and minimus, as well as the adductors. This exercise also engages the quadriceps and calves for stability. The effects include improved lateral stability, enhanced strength in the hip and thigh muscles, and better overall balance and coordination.

Table 2: Tabular Depiction of Exercise Intervention Protocol and Outcome Measures for Group B

GROUP AND INTERVENTION	EXERCISE PROTOCOL	NO. OF REPETITIONS	NO. OF SETS	SPEED & DURATION	OUTCOME MEASURES
GROUP B – FIELD BASED AEROBIC EXERCISE	*Walking Lunges*	5	3	-	6 MWT & *FACIT Fatigue scale*
	Brisk Walking	-	-	3.5 Km/Hr For 20 Mins	
	Static Hip Marching	30	3	-	
	Side Stepping	15	3	-	

Outcome Measures

1. *Minute Walk Test (6 MWT)*

In accordance with few research observations, individuals and elderly people with mild to moderate ID are capable of evaluating their cardiorespiratory fitness employing the 6MWT, which is a reliable and reproducible test. The aforementioned is a straightforward low-cost, and legitimate tool that could potentially be used on a broad spectrum of these individuals in evaluating improvements in their physical and functional fitness **[24]**.

2. *FACIT Fatigue scale*

A substantial representative sampling of the German population in general was employed in assessing the FACIT-Fatigue Scale. The unidimensional scale's validity and reliability have been established via psychometric attributes, factorial analyses, and correlations with sociodemographic statistics and corresponding components **[25]**.

Statistical Analysis:

Both descriptive and inferential statistics were used to tabulate and analyse the data that had been gathered. The statistical software for social science (SPSS) version 24 was used to evaluate all the parameters. A 95% confidence interval was set for every analysis, and a significance level of p value less than 0.05($p<0.05$) was applied. The data's normality was assessed using the Shapiro-Wilk test. The data in this study was found to be regularly distributed on the dependent values at ($p>0.05$), according to the Shapiro-Wilk test. Therefore, the parametric test was used. The Independent t-test (Student t-Test) was used to determine the statistical variance between the groups, and the Paired t-test was used to determine the statistical variance within the groups. The baseline demographic data of the subjects involved in both the Control Group and Experimental Group has been provided **[Table 3]**.

Table 3: Baseline Demographic Data Of Both Control Group and Experimental Group

VARIABLES	CONTROL GROUP	EXPERIMENTAL GROUP
Age	59.08±4.76	58.02±4.12
Male	12(40%)	14(46.6%)
Female	18(60%)	16(53.3%)
Heart Rate	78.21±2.61	79.21±3.03
Sp02	98±1.76	98±1.82
Respiratory Rate	14±3.77	14±4.01
Systolic BP	130.45±3.75	131.45±3.76
Diastolic BP	83.56±3.76	84.56±2.58

The mean value has been provided with ± standard deviation and numbers (n) and in percentages (%)

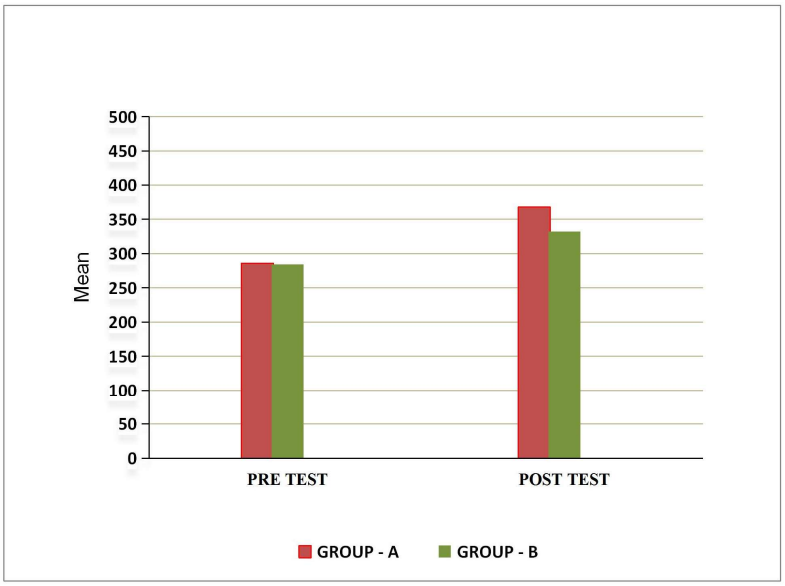
RESULTS

When the mean following the test values of Group A and Group B on the walk test lasting six minutes are juxtaposed, it illuminates a substantial rise among both categories' mean values. Nevertheless, Group A, which involved into chair-based aerobic exercises, has a higher mean value (368.00 ± 31.89) at p≤0.05 than Group B, which gets involved in field-based aerobic exercises (332.66 ± 38.99) at p≤0.05 **[Table 4][Graph I]**. Consequently, the null hypothesis is disproved.

Table 4: Comparison of 6-Minute Walk Test Score Between Group – A and Group - B in Pre and Post Test

TEST	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE TEST	286.66	25.26	284.66	26.42	.212	28	.834*
POSTTEST	368.00	31.89	332.66	38.99	2.76	28	.011**

(*- P > 0.05 - Not Significant) & (- P ≤ 0.05 - Significant)**



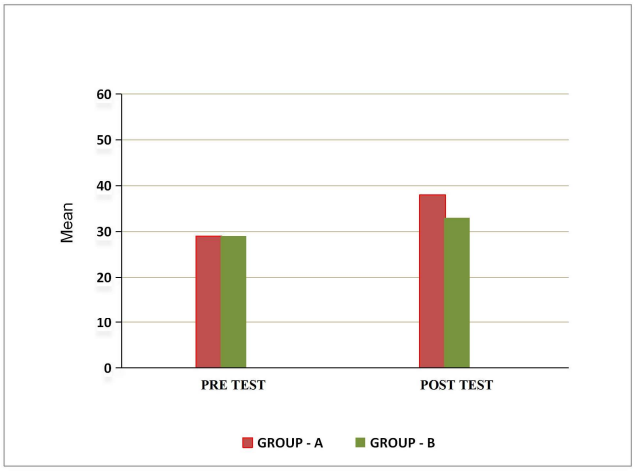
Graph I: Comparison of 6-Minute Walk Test Score Between Group – A and Group - B in Pre and Post Test

When contrasting Group A's and Group B's average scores on the FACIT - Fatigue Scale score, the average following the test values in both groups was boosted substantially. In contrast, Group A's chair-based aerobic exercises, with a mean value of 38.00 ± 1.69 at p≤0.05, are significantly more efficient than Group B's field-based aerobic exercises, with a mean value of 33.60 ± 2.26 at P ≤ 0.05, supporting the enhanced effect of chair based aerobic exercise over field based aerobic exercise. The null hypothesis is thus disproved **[Table 5][Graph II]**.

Table 5: Comparison of FACIT-Fatigue Scale Score Between Group – A andGroup - B in Pre and Post Tes

TEST	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE TEST	29.00	.925	29.13	1.68	-.269	28	.790*
POSTTEST	38.00	1.69	33.60	2.26	6.03	28	.000**

(*- P > 0.05 - Not Significant) & (- P ≤ 0.05 - Significant)**



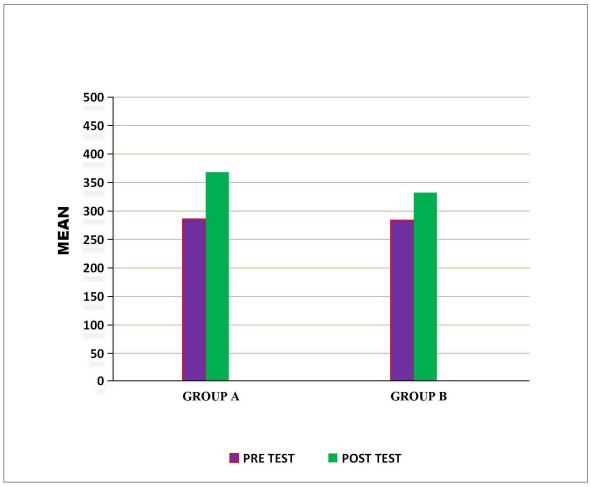
Graph – II - Comparison of FACIT-Fatigue Scale Score Between Group – A and Group - B in Pre and Post Test

The findings indicate a substantial variance in the mean values at $p \leq 0.05$ when comparing the Pre and Post examination outcomes for the 6 Minute Walk Test and the FACIT - Fatigue Scale score that exists between Group A and Group B **[Table *6* & 7] [Graph III & IV]**. The analysis supports the rejection of the null hypothesis, confirming that there is a significant difference between the effects of chair-based and field-based aerobic exercises on the physical fitness and fatigue levels of the participants. These findings suggest that chair-based aerobic exercises are more effective in improving the overall functional capacity and reducing fatigue among the study participants.

Table 6: Comparison of 6-Minute Walk Test Score Within Group A and Group B in Pre and Post Test

GROUPS	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	286.66	25.26	368.00	31.89	-16.38	.000**
GROUP- B	284.66	26.42	332.66	38.99	-5.74	.000**

(- p≤0.05 - Significant)**

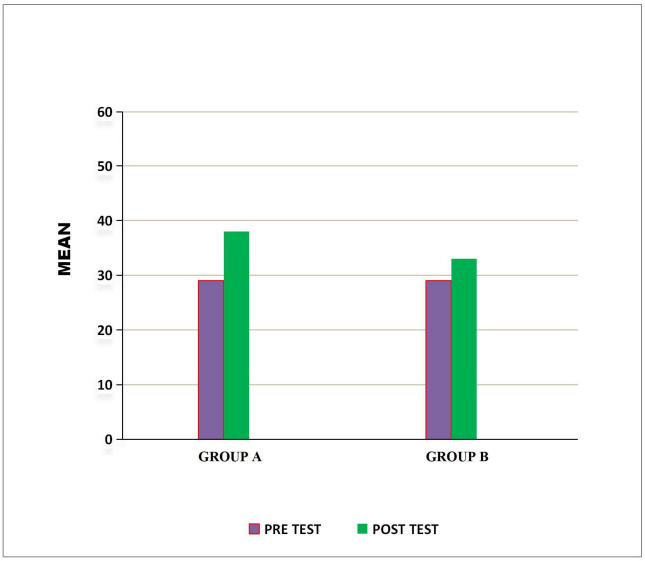


Graph – III- Comparison of 6-Minute Walk Test Score Within Group – A and Group - B Between Pre Test and Post Test

Table 7: Comparison of Facit Fatigue Scale Score Within Group A and Group B Between Pre Test and Post Test

GROUPS	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	29.00	.925	38.00	1.69	-19.23	.000**
GROUP- B	29.13	1.68	33.60	2.26	-8.51	.000**

(- p≤0.05 - Significant).**



Graph IV: Comparison of FACIT Fatigue Scale Score Within Group – A and Group - B Between Pre Test and Post Test

DISCUSSION

Fatigue is an intricate phenomenon that affects the ageing population and the core process underlying weariness remains ambiguous, despite the identification, it encompasses multiple aspects that contribute to it. The principal objective of this research was to adequately contrast the efficaciousness of field-based aerobic exercise against chair-based aerobic exercise for senior citizens. The study brought a significant difference between the chair based aerobic exercise and field based aerobic exercise.

Concordantly in a similar study, evidences indicated that chair-based workout regimens enhance the function of the lower and upper extremities (handgrip strength and 30-second arm curl test; 30 seconds chair stand). At-home workouts and exercises based on the Norwegian Ullevaal Model substantially boosted the participants' level of physical activity and HRQOL. As measured by chair stands, arm curls, and the 6MWT, participants in the HIA group fared significantly better than those in the HB group in terms of physical fitness. The findings indicate that exercise implementation. ought to be a part of the medical attention delivered to elderly individuals who have an elevated risk for declining functionality **[26]**. Ivan bautman *et al*., The 6MWT offers a number of intriguing benefits for assessing

older adults' capacity for exercise. Various writers have provided reference formulas and tables to forecast the 6MWT-distance in aged, healthy participants. A significant amount of the variability in the 6MWT-distance appears to be explained by the subjects' gender, age, weight, and height. Although "apparently healthy" senior people are willing to participate in physical training sessions, their real state of health varies greatly. This is because growing older is typically associated with an increasing burden of pathology **[27]**. This indicates that while many people believe they are capable of engaging in physical activity, not everyone has the same ability for exercise or risk of experiencing problems while exercising. An workout regimen should ideally be customised for each person, proactively taking into account in all angles of his/her health condition.

Similarly, Zeeshan butt *et al*., revealed that the Internal consistency reliability on the FACIT-F was concordantly high, and item-level statistics were equivalent amongst the groups. All of the groups' linkages with their overall performance evaluations were statistically significant. Participants with cancer, stroke, and HIV infection revealed an average to substantial correlation between their fatigue scores and their general quality of life. Low correlations with factors not predicted to correlate with exhaustion provided evidence supporting the hypothesis of divergent validity. The FACIT-F was developed primarily to gauge fatigue associated with cancer, but it can also be used to detect fatigue in other populations, like those with HIV infection and stroke. Soon, FACIT-F feedback can be contrasted to those gathered through the Patient-Reported Outcomes Measurement Information System's tiredness measurements by virtue of ongoing investigations **[28]**.

Hence this study was proposed in order to obtain the beneficial role of chair based aerobic exercise in treating elderly patients. The exercise included in this study were chair raise, neck stretch, side bend, leg lift. The result of this study showed that chair based aerobic exercise had a significant improvement in improving cardio vascular endurance and controlling fatigue amongst elderly people, with field based aerobic falling to produce beneficial effects.

The intended effect of this study was to compare the effects of aerobic activity upon field with chair seated aerobic activity on older participants' levels of fatigue and cardiovascular endurance. Between Group analysis revealed that percentage of improvement in chair based aerobic exercise in Group -A was greater than Group -Field based aerobic exercise. Our data supported alternate hypothesis that chair based aerobic exercise was more effective than Field based aerobic exercise in elderly peoples by

improving cardio vascular endurance and controls fatigue and fear of falling and safest method to improve the cardio vascular endurance. Our data supported alternate hypothesis that chair based aerobic exercise was more effective than Field based aerobic exercise in elderly peoples by improving cardio vascular endurance and fatigue and fear of falling.

CONCLUSION

According to the findings of this study results reveals that the chair based aerobic exercise is effective than field based aerobic exercise by improving cardio vascular endurance and controlling fatigue and fear of falling. As chair based aerobic exercise is safest and effective for elderly people.

Limitations Of The Study

This Investigation was conducted with a smaller sample size and was restricted to participants aged 55-65. Additionally, the study was of short duration, which may limit the generalizability and long-term implications of the findings.

Future Scope Of The Study

It is recommended to analyse a larger sample size, conduct a long-duration study, and taking into account a wider age spectrum to enhance the robustness and applicability of the findings.

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We sincerely thank the senior participants for their enthusiastic involvement in this study. We would like to express my sincere gratitude to my principal**,** profound thanks to my dissertation coordinator and extend my thanks to my statistical analyst**.** We also extend our gratitude to thank the Librarian of my college in providing all the needed books for making this dissertation. Special thanks to the institutional ethics committee for their guidance and approval, as well as to the faculty and colleagues whose support and expertise were invaluable in the successful completion of this research.

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