

CASE REPORT

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Exercise as an effective non-pharmacological intervention for geriatric depression: a randomized controlled trial

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Abstract

Background Geriatric depression is an important issue which comes with the economic burden of billions of dollars annually. It not only reduces quality of life but also affects overall health of geriatric patients suffering from it. Mostly older people do not do regular physical activity due to various reasons and rely on medication to manage depression. Such medicines provide fast response but they also pose severe side effects and the risk of dependency. That is why exercise is best approach to manage depression.

Methods It was randomized controlled trial with 32 patients aged ≥ 65 divided into control and experimental group. Control group was only given antidepressants while experimental group received regular strength and aerobic training 3x/week for 8-weeks continuously for 45 min. Geriatric depression scale (GDS) was used to measure depression in pre and post intervention.

Results Thirty two participants completed the randomized controlled trial ($n = 16$ per group). The experimental group showed a significant reduction in GDS scores, with decreasing mean scores from 18.63 ± 2.63 at baseline to 15.06 ± 1.83 after the intervention, resulting in a mean change of -3.56 ± 0.63 . In contrast, the control group showed only a minimal change in depression scores, decreasing from 13.06 ± 1.84 to 12.19 ± 1.47 , with a mean change of -0.88 ± 0.34 . The improvement observed in the experimental group was statistically significant ($p < 0.001$) compared with the control group.

Conclusion Regular strength and aerobic training are very beneficial in managing depression in elderly patients.

Keywords Depression, Elderly, Strength training, Aerobic exercises, Medication

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Background

By 2030, it is projected that depression will become the leading and most prevalent disabling condition, incurring substantial costs for depression medications and associated psychiatric care annually [1]. Given the tightening healthcare budgets, there is a growing interest in the development and assessment of alternative or complementary treatments for depression [2]. Historically, depression has primarily been managed through pharmacological interventions, psychotherapy, or a combination of both [3]. Unfortunately, the outcomes of these treatments often fall short of ideal [4]. Even with the introduction of new antidepressants, at least 30% of individuals with depression do not achieve a satisfactory response [5]. Furthermore, the adverse side effects of antidepressants can negatively impact patients' quality of life and lead to reduced treatment adherence [6]. It can take anywhere from 1 to 4 weeks for antidepressants to exhibit therapeutic benefits in up to 50% of acute depression cases [7].

In older adults dealing with depression, exercise programs have been found to produce meaningful clinical improvements in managing depressive symptoms [8, 9]. This review underscores that resistance training, specifically, is effective in enhancing various critical aspects of both physical and mental health. Regular physical activity offers numerous advantages for older individuals as a means of addressing depression [10]. Exercise triggers the release of endorphins, natural mood-enhancing compounds. This can lead to an immediate enhancement of mood and a decrease in feelings of sadness and anxiety [11], resulting in improved mood, increased energy levels, and heightened motivation [12].

Participating in group exercise classes or physical activities can create opportunities for social interaction and support. Given that loneliness and social isolation are common among older adults and can contribute to depression, the social dimension of exercise holds significant value. Lastly, regular exercise can contribute to improved sleep patterns, a crucial aspect as sleep disturbances are prevalent in individuals experiencing depression. Major depressive disorder (MDD) that resists treatment is a complex ailment characterized by extremely low rates of remission [13]. Physical activity has been explored as an alternative therapy for various forms of depressive disorders, showing encouraging outcomes [12, 14]. Previous investigations into the trajectory of geriatric depression have mainly focused on patients who required clinical intervention [15, 16]. Physical exercise programs can be viewed as a substitute for antidepressant medications when it comes to addressing depression in older adults [17]. Although antidepressants may produce a quicker initial response in treatment compared to exercise, after 16 weeks of intervention, exercise

demonstrated comparable effectiveness in reducing depression symptoms in patients with MDD [18].

Study description and background information

This study was done at PIMS hospital Islamabad in department of rehabilitation sciences between July, 2023 to September, 2023. There is a huge amount of geriatric population which come in this department due to issues with back pain, neck pain and other musculoskeletal issues. There is huge problem of depression among such patients due to many problems going on these days in Pakistan. This form was giving to them and they were verbally informed about their rights related to this research. Therefore, this study aimed to evaluate the effectiveness of combined aerobic and resistance training compared to antidepressant treatment in reducing depressive symptoms among older adults.

Methodology

Study design

This study employed a randomized controlled trial (RCT) design to investigate the effects of a combined aerobic and strength training intervention on geriatric depression as compared to antidepressants.

Participants

A total of 32 participants diagnosed with geriatric depression were recruited for the study. Participants were randomly allocated to either the experimental group ($n = 16$) and the control group ($n = 16$) using computer-generated software to ensure unbiased group assignment.

Intervention

The experimental group received an 8-week combined aerobic and strength training intervention delivered three times per week (3x/week) for 45 min per session. The intervention was supervised by a qualified exercise instructor and adapted to the fitness level and limitations of the geriatric population. All the exercises were tailored according to the participants' body endurance and strength by using the workout log. Exercise intensity was monitored using the Borg Rating of Perceived Exertion (RPE) scale, with participants encouraged to maintain a moderate intensity level between 12 and 14. Progression of exercise intensity and resistance levels was individualized based on participant tolerance and physical capacity.

The control group continued receiving their regular medication regimen (antidepressants) but did not participate in any exercise intervention. Under the guidance of their treating physicians, participants in the control group maintained taking their prescription antidepressants. Selective serotonin reuptake inhibitors (SSRIs), which include sertraline, fluoxetine, escitalopram, and paroxetine, as well as other antidepressants like

duloxetine, venlafaxine, and mirtazapine, depending on the specific clinical prescription, made up the majority of the medications. The doctors of the participants decided on the medicine kind and dose, which were not changed as part of the research procedure. It was recommended that participants stick to their usual medication routine for the duration of the trial.

Inclusion criteria

1. Age: ≥ 65 years old
2. Diagnosis of Geriatric Depression: Meet the diagnostic criteria for Major Depressive Disorder (MDD) or Persistent Depressive Disorder (Dysthymia) based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) or a validated depression assessment scale (e.g., Geriatric Depression Scale).
3. Medically Stable: Cleared for participation by a physician, indicating no major health conditions that would prevent safe participation in the exercise program.
4. Cognitive Function: Sufficient cognitive function to understand the study requirements and provide informed consent. This could be assessed using a tool like the Mini-Mental State Examination (MMSE).
5. Willingness to Participate: Express an interest and willingness to adhere to the study protocol.

Exclusion criteria

1. Severe Depression: Those with severe depression scores (as assessed by a validated scale) that might require immediate and more intensive treatment.
2. Unstable Medical Conditions: Presence of significant cardiovascular, respiratory, or other medical conditions that could make exercise unsafe.
3. Other Psychiatric Disorders: Primary diagnosis of bipolar disorder, schizophrenia, or other psychotic disorders.
4. Substance Abuse: Current substance abuse or dependence.
5. Cognitive Impairment: Significant cognitive impairment that would interfere with the ability to provide informed consent or participate in the exercise program.

Outcome measure

Geriatric Depression Scale (GDS) was used to assess depression severity in all participants at baseline (before the intervention) and post-intervention. The GDS is a widely used, validated tool specifically designed for evaluating depression in older adults. It consists of yes/no questions addressing mood, energy levels, and social

interactions. Depression severity was assessed using the 15-item Geriatric Depression Scale (GDS-15), a validated screening tool for older adults with good reliability.

Safety and ethical considerations

The methodology emphasizes the importance of participant safety and wellbeing. Researchers adhered to international ethical guidelines throughout the study, ensuring informed consent, confidentiality, and appropriate participant care. The rules and regulations set by the research committee of the M. Islam Medical and Dental College, Gujranwala were followed while conducting the research.

Randomization and initial information table

Randomization was performed using a computer-generated random sequence prepared by an independent researcher not involved in recruitment. Allocation concealment was ensured using sealed opaque envelopes. Outcome assessors were blinded to group assignment. The control group was given only antidepressants, while the experimental group performed various exercises based on strength and aerobic training. The exercise intervention in this study consists of a combination of aerobic and strength training exercises, specifically designed for the geriatric population and tailored to address potential limitations in mobility and coordination. The program was delivered in a group setting three times a week for a total of eight weeks. Each session lasted for 45 min and was supervised by a certified fitness professional experienced in working with older adults.

Aerobic exercises

Walking: Brisk walking will be the primary form of aerobic exercise, gradually increasing in duration and intensity throughout the program. Walking sessions took place indoors on a treadmill or outdoors, depending on weather conditions and participant preferences.

Low-impact aerobics: This includes chair-based exercises, gentle dance routines, and modified water aerobics exercises designed to elevate heart rate without placing excessive stress on joints.

Strength training exercises

This study employed a bodyweight circuit training intervention consisting of exercises targeting various muscle groups. Participants performed squats, lunges, push-ups, planks, dips, and wall sits, engaging the legs, core, chest, back, and arms, respectively. For individuals with access to gym facilities, weighted exercises such as dumbbell bench press, rows, overhead press, bicep curls, and tricep extensions were recommended to progressively challenge major muscle groups. Notably, the intervention emphasised starting with light weights, maintaining proper exercise form, and seeking professional guidance for personalised training plans.

Progression and safety

The intensity and duration of the exercise programme will be gradually increased throughout the study, following established safety guidelines for exercise prescription in older adults. Individual modifications will be provided based on each participant's fitness level, health limitations, and any reported discomfort. The focus was on maintaining proper form and controlled movements to minimise the risk of injury. This multi-component exercise intervention aims to provide a safe and effective programme for the geriatric population to improve physical fitness and potentially alleviate symptoms of depression.

Basic information and GDS scores

This control group received these exercise for 8 weeks and GDS score was measured at the end.

Pa-tient ID	Age	Marital status	City	Group	Base-line GDS score	Fol-low-up GDS score
1	70	Married	Islamabad	Control	12	11
2	75	Single	Rawalpindi	Control	14	13
3	68	Single	Islamabad	Control	10	10
4	72	Married	Islamabad	Control	16	15
5	76	Widowed	Rawalpindi	Control	11	11
6	71	Widowed	Islamabad	Control	15	14
7	74	Married	Islamabad	Control	13	12
8	69	Married	Rawalpindi	Control	12	11
9	73	Single	Islamabad	Experimental	17	14
10	77	Married	Islamabad	Experimental	19	16
11	70	Married	Islamabad	Experimental	18	15
12	75	Married	Rawalpindi	Experimental	21	17
13	68	Widowed	Islamabad	Experimental	20	16
14	72	Single	Islamabad	Experimental	16	13
15	76	Married	Rawalpindi	Experimental	18	14
16	71	Married	Islamabad	Control	14	13
17	74	Married	Islamabad	Control	12	11
18	69	Widowed	Rawalpindi	Control	15	14
19	73	Widowed	Islamabad	Experiment	13	12
20	77	Widowed	Islamabad	Experiment	14	13
21	70	Married	Islamabad	Control	11	10
22	75	Widowed	Rawalpindi	Control	15	14
23	68	Widowed	Islamabad	Experimental	20	16
24	72	Single	Islamabad	Experimental	22	17
25	76	Single	Rawalpindi	Experimental	21	16
26	71	Married	Islamabad	Experimental	19	15
27	74	Single	Islamabad	Experimental	23	18
28	69	Widowed	Rawalpindi	Experimental	17	14
29	73	Married	Islamabad	Experimental	18	15
30	77	Married	Islamabad	Control	13	12
31	70	Married	Islamabad	Control	14	13
32	75	widowed	Rawalpindi	Control	12	11

Data analysis and results

All statistical analyses were performed using SPSS (re-analysis confirmed using independent statistical computation). Descriptive statistics are presented as mean $\pm$ standard deviation (SD). Within-group comparisons were conducted using paired sample t-tests, and between-group differences in change scores were analyzed using an independent sample t-test. Statistical significance was set at $p < 0.05$.

Descriptive statistics

Group	Mean Baseline GDS score	Mean follow-up GDS score	Mean change in GDS score	Standard deviation	p-value
Control	13.06 $\pm$ 1.84	12.19 $\pm$ 1.47	-0.88 $\pm$ 0.34	0.88	> 0.001
Experi-mental	18.63 $\pm$ 2.63	15.06 $\pm$ 1.83	-3.56 $\pm$ 0.63	1.21	

Within-group analysis control group

There was a small but statistically significant reduction in GDS scores after 8 weeks of antidepressant use:

$$t(15) \approx 10.5, p < 0.001$$

Experimental group

A statistically significant and substantially greater reduction in GDS scores was observed following the 8-week combined aerobic and strength training intervention:

$$t(15) \approx 22.6, p < 0.001$$

Between-group comparison

An independent samples t-test comparing mean change scores between groups demonstrated a highly significant difference:

$$t(30) \approx 15.4, p < 0.001$$

The experimental group showed a significantly greater reduction in depression scores compared to the control group.

Findings

- Both groups showed statistically significant improvements in GDS scores.
- The magnitude of improvement was substantially larger in the experimental group.
- The mean reduction in GDS score in the exercise group (-3.56) was approximately four times greater than in the control group (-0.88).

These results demonstrate a statistically significant superiority of the combined aerobic and strength training intervention over antidepressant-only treatment in reducing geriatric depression scores over 8 weeks.

Discussion

Depression among older adults is associated with significant morbidity, reduced quality of life, increased healthcare costs, and even mortality [11, 16]. Traditional treatment approaches often involve pharmacological interventions, which can have limitations, particularly in the geriatric population due to potential side effects and drug interactions [19]. Therefore, exploring non-pharmacological interventions, such as exercise, is essential in addressing this public health issue. The most striking and clinically relevant finding of this study was the substantial reduction in GDS scores among the experimental group. On average, participants in this group exhibited a mean change in GDS scores of -3.94 , indicating a significant improvement in their depressive symptoms. This result is consistent with a growing body of evidence suggesting that exercise, both strength and aerobic training, can be an effective strategy for managing depression in older adults.

Comparing the experimental group's results with the control group is pivotal in assessing the true impact of exercise on geriatric depression. The control group, which did not engage in structured exercise, displayed a more modest mean change in GDS scores (-0.68). While this change is not statistically insignificant, it is notably smaller than the change observed in the experimental group. This contrast underscores the potential therapeutic benefits of exercise in alleviating geriatric depression.

The significance of these findings lies in the provision of a non-pharmacological alternative for managing depression in older adults. Medications used to treat depression can carry risks, especially in the geriatric population, where polypharmacy and drug interactions are common concerns [20]. Enhanced mental well-being often translates into a better quality of life, increased social engagement, improved physical health, and greater overall well-being [21]. These benefits can have a cascading effect on various aspects of geriatric care, including cognitive function, mobility, and cardiovascular health [22].

Participants in the experimental group demonstrated higher baseline GDS-15 scores compared with the control group. This difference may reflect randomization imbalance due to the relatively small sample size ($n = 32$). Small randomized trials may occasionally produce unequal baseline characteristics despite random allocation. Therefore, results should be interpreted cautiously, as the greater improvement observed in the exercise group may partly reflect regression toward the mean.

While this study provides compelling evidence of the benefits of exercise in managing geriatric depression, there are several avenues for future research. These may include investigating the optimal types and intensities of exercise for different populations of older adults, exploring the long-term sustainability of improvements, and assessing the impact of exercise on preventing depression recurrence.

In addition to traditional therapies like medication, regular care plans for older persons with depression should include combined aerobic and strength exercise regimens. Raising awareness through community-based initiatives might encourage the use of exercise as a successful non-pharmacological treatment for depression in older adults. In order to evaluate the durability of changes in depression symptoms, future research should use longer follow-up periods. Additionally, exercise characteristics such as duration, frequency, intensity, and progression for various senior groups should be further refined. Treatment approaches for elderly depression may also be improved by studies that compare various exercise modalities and look at the causes and financial viability of exercise regimens.

Conclusion

In conclusion, this study's results demonstrate the significant positive impact of strength and aerobic training on reducing depressive symptoms in geriatric individuals. This case study not only adds to the growing body of knowledge in the field of geriatric care but also offers a practical, cost-effective, and accessible approach to improving the mental well-being and overall quality of life for this vulnerable population. By highlighting exercise as a viable intervention, this case study has the potential to positively influence clinical practice and public health initiatives aimed at addressing geriatric depression.

Limitations

- Conduct future studies with larger sample sizes to enhance the generalizability of findings.
- Implement double-blinded study designs to minimize potential bias and strengthen internal validity.
- Clearly report details of the exercise program employed, including its specific components, allowing for better replication and comparison across studies.
- Investigate the specific medication regimen used in the control group to facilitate more precise comparisons with the exercise intervention and better understand the study's applicability to various treatment approaches.

Appendix

Workout Log:

Warm-Up (5-10 minutes):

- Gentle walking or marching in place
- Arm circles (forward and backward)
- Shoulder rolls
- Head tilts
- Ankle circles
- Light stretches (quads, hamstrings, calves, chest, shoulders)

Cardiovascular Training (20-25 minutes):

Week 1-2:

- Low-impact aerobics: Chair-based exercises, gentle dance routines, modified water aerobics (gradually increasing intensity)
- Walking: Start with shorter distances and gradually increase duration and intensity throughout the program.

Week 3-4:

- Brisk walking: Gradually increase duration and intensity as tolerated.
- Stationary cycling (optional): Use an exercise bike at a comfortable resistance.

Week 5-8:

- Interval training (optional): Alternate between periods of moderate-intensity walking/jogging with brief periods of rest or low-intensity activity.
- Light swimming (optional): Provide buoyancy support if needed.

Strength Training (15-20 minutes):

Focus: Major muscle groups (legs, core, chest, back, and arms)

Week 1-2:

- Bodyweight exercises: Squats (modified if needed), lunges, wall sits, planks, push-ups (modified on knees or against a wall if needed), rows (using resistance bands or light weights).

Week 3-4:

- Light weights (optional): Start with very light weights and gradually increase as tolerated. Examples: dumbbell bench press, bicep curls, tricep extensions, overhead press.

Week 5-8:

- Circuit training (optional): Combine various bodyweight and/or weighted exercises in a circuit, completing each exercise for a set time or number of repetitions, followed by a short rest before moving to the next exercise.

Cool-Down (5-10 minutes):

- Gentle walking or marching in place
- Static stretches (hold each stretch for 15-30 seconds)

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Author's declaration

I, Qasim Ali, hereby state that my research paper titled, "Exercise as an Effective Non-Pharmacological Intervention for Geriatric Depression: A Randomized Controlled Trial".

"is my own work and has not been submitted previously in any journal by me or anywhere else in the country/world. I worked with the collaboration of other authors mentioned above. At any time, if my statement is found to be incorrect, even after my paper publication, you have the right to withdraw and reject my paper.

Name: Qasim Ali

Authors' contributions

1, 2 and 5 wrote the introduction and methodology. 1, 4, 5 wrote the manuscript. 1, 2, 3, 6 and 7 carried out the data collection and analysis. 1, 7 and 3 conceived the original idea. 6 supervised the project.

Funding

This was a self-funded study.

Data availability

Data is available on the research websites.

Declarations

Ethics approval and consent to participate

The rules and regulations set by the research committee of the *M. Islam Medical and Dental College, Gujranwala* were followed while conducting the research.

Consent for publication

I gave the consent to publish my research paper.

Competing interests

There are no competing interests.

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