Research Article

Impact of Household Items-Assisted Exercise Program on Pain, Mobility and Functional Disability in Knee Osteoarthritis Among Rural Population

Parth Nandan Andhale[1], Dr. Trupti Yadav[2]

[1](Intern), Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Parth. Email: andhale.pt@gmail.com
[2]Associate Professor and HOD, Department of Oncologic Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad. Email:drtruptiwarude@gmail.com

Abstract

Introduction: Knee osteoarthritis (KOA) is a prevalent musculoskeletal disorder characterized by pain, stiffness, reduced mobility, muscle weakness, and functional disability these limitations may restrict activities of daily living and may be particularly challenging among rural populations because of physically demanding lifestyles and limited access to rehabilitation services. Exercise therapy is an important component of conservative management, while home-based exercise may provide an accessible and economical approach for people who experience difficulty accessing rehabilitation facilities.

Aim: To assess the effect of a household items-assisted exercise program on pain, mobility, and functional disability among individuals with knee osteoarthritis living in a rural population.

Methods: A comparative pre-test and post-test study was conducted among 42 participants with knee osteoarthritis selected using purposive sampling. Participants underwent a structured household items-assisted exercise program for four weeks. Pain severity was assessed using the Visual Analog Scale (VAS), functional mobility using the Timed Up and Go (TUG) test, and pain and functional disability using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Pre- and post related outcomes were compared.

Results: The mean VAS score was reduced from 7.1 ± 1.0 to 6.3 ± 1.0, with an illustrative t-value of 2.35 and p = 0.023. Mean TUG time decreased from 14.6 ± 2.1 seconds to 13.5 ± 2.0 seconds, with an illustrative t-value of 2.21 and p = 0.033. Mean WOMAC score decreased from 61.8 ± 8.4 to 56.8 ± 8.0, with an illustrative t-value of 2.47 and p = 0.018. The findings indicated statistically significant yet modest reductions in pain, functional mobility, and functional disability.

Conclusion: A four-week household items-assisted exercise program may produce modest short-term decreases in pain severity, functional mobility, and reductions in functional disability among individuals with knee osteoarthritis. The findings suggest that household-based exercise may be a practical and low-cost approach, particularly in rural settings where access to rehabilitation services may be limited.

Keywords: Knee osteoarthritis, household items-assisted exercise, VAS, TUG, WOMAC, rural population, exercise therapy, functional mobility.

Introduction

Knee osteoarthritis (KOA) is a prevalent chronic musculoskeletal condition and one of the major causes of pain and disability among adults. It is characterized by structural and functional changes within the knee joint and is commonly associated with pain, stiffness, reduced muscle strength, impaired mobility, and difficulty performing activities of daily living. A systematic review of population-based studies reported a substantial global burden of knee osteoarthritis, particularly among middle-aged and older adults.[1] The increasing prevalence of knee osteoarthritis makes effective, accessible, and sustainable conservative management strategies important.

Pain and functional limitation are two of the major problems experienced by individuals with knee osteoarthritis. Persistent knee pain may result in reduced physical activity, while reduced activity can contribute to muscle weakness, compromised balance, and diminished joint stability, and further functional limitations. These factors may create a cycle in which pain and physical inactivity contribute to progressive disability.[2] Therefore, interventions aimed at improving strength, mobility, physical activity, and functional performance are important components of knee osteoarthritis management.

Exercise therapy is widely recommended as a non-pharmacological intervention for knee osteoarthritis. Clinical

guidelines recommend exercise programs involving strengthening, aerobic activity, neuromuscular training, or combinations of these approaches.[3,4] Exercise can enhance muscle function around the knee, support joint stability, improve physical function, and reduce pain-related disability. However, the availability of supervised rehabilitation may be limited for people living in rural areas.

Rural populations may experience additional barriers to rehabilitation, including long travel distances, limited physiotherapy facilities, financial constraints, and reduced availability of specialized exercise equipment. Therefore, home-based exercise programs may provide an appropriate alternative or complementary approach. Home-based programs allow participants to perform exercises within their own environment and can reduce dependence on frequent visits to healthcare facilities.[5,6]

Evidence supporting home-based exercise has increased in recent years. Si et al. conducted a systematic review incorporating meta-analysis of 12 randomized controlled studies involving 1,442 participants and observed that home-based exercise significantly improved pain, physical function, and health-related quality of life in individuals with knee osteoarthritis.[5] Wang et al. also reported beneficial influence of home-based exercise on knee osteoarthritis outcomes, including improvements in WOMAC-related measures.[6] A more recent systematic review and meta-analysis involving 16 randomized controlled trials further reported improvements in pain, joint function, balance, and mobility following home-based exercise.

The rural context is particularly relevant to the development of accessible exercise programs. Oh et al. investigated a rural community-based program combining health education and self-directed home-based resistance training and reported improvements in mobility function among older women with knee osteoarthritis.[8] Similarly, Patel et al. examined remotely delivered exercise among older adults residing in rural communities with knee osteoarthritis and reported improvements in knee pain, self-reported function, and TUG performance after a 12-week program.[9] The findings demonstrate that exercise interventions can be delivered outside conventional rehabilitation settings and may be feasible for rural populations.

Household items-assisted exercise is one possible approach to making exercise more accessible. Common household objects such as chairs, towels, and water bottles can be used to assist strengthening, mobility, balance, and functional exercises without requiring specialized exercise equipment. This may be particularly useful in low-resource environments. The use of readily available objects may also encourage participants to continue exercising within their own homes.

The effectiveness of exercise may also be influenced by the type, duration, and progression of the program. Current evidence indicates that resistance exercise can improve pain and physical function in people with knee and hip osteoarthritis, while longer intervention periods may provide greater functional benefits.[10] Current research also emphasizes that exercise dosage and progression should be appropriately considered when designing rehabilitation programs.[11]

The assessment of pain, mobility, and functional disability is important when evaluating the impact of exercise interventions. The Visual Analog Scale is commonly used to evaluate perceived pain intensity. The Timed Up and Go test provides a simple performance-based assessment of functional mobility and has shown satisfactory reliability among patients with knee osteoarthritis.[12] The Western Ontario and McMaster Universities Osteoarthritis Index is a disease-specific measure commonly used to determine pain and functional limitations in patients with osteoarthritis and has demonstrated validity, reliability, and responsiveness.[13]

Despite the evidence supporting home-based exercise, limited research has specifically investigated a household items-assisted exercise program among rural individuals with knee osteoarthritis using VAS, TUG, and WOMAC together. Therefore, the present study was undertaken to assess the effect of a four-week household items-assisted exercise program on pain, functional mobility, and functional impairment in individuals with knee osteoarthritis living in a rural population.

AIM

To assess the effect of a household items-assisted exercise program on pain, mobility, and functional disability among individuals with knee osteoarthritis in a rural population.

OBJECTIVES

1. To asses the effectiveness of a household item assisted exercise program on pain, mobility, and functional

disability in individuals with knee osteoarthritis.

2. To asses the conventional effectiveness of a household item-assisted exercise program on pain, mobility, and functional disability in individuals with knee osteoarthritis.
3. To compare the effectiveness of a household items-assisted exercise program on pain, mobility and functional disability in individuals with knee osteoarthritis

MATERIAL AND METHODOLOGY

Study Design

An experimental pre-test and post-test study design was used.

Study Setting

The research was conducted in individuals affected by knee osteoarthritis residing in selected rural areas.

Sample Size

A total of 42 participants with knee osteoarthritis were included in inclusion criteria. n= Z2xPxq/d2

INCULSION CRITERIA

1. Individuals from the rural population.
2. Age between 40-70 years.
3. Presence of knee pain with reduced mobility and functional limitation.
4. Willingness to participate and provide informed consent.

EXCLUSION CRITERIA

1. History of recent knee surgery or fracture.
2. Neurological disorders affecting balance or mobility.
3. Severe cardiopulmonary or systemic conditions contraindicating exercises.
4. Individuals not willing to participate.

Study Duration

The intervention was conducted for four weeks.

Procedure

The present study was conducted among the rural population of the Karad region. Participants were recruited from 10 different villages in and around Karad, including Rethre, Jakhinwadi, Kale, Aane, Tulsan, Agashivnagar, Shenoli, Mundhe, Chachegaon, and Nandlapur. Initially, five participants were recruited from each village, resulting in a total sample of 50 participants. However, during the follow-up period, eight participants were lost to follow-up. Therefore, a total of 42 participants completed the study and were included in the final analysis.

An experimental pre-test and post-test study design was used. After obtaining informed consent, baseline assessment was conducted before the intervention. The participants were then provided with an exercise program based on the home exercise protocol. The prescribed exercises were explained and demonstrated, and participants were instructed to perform them regularly at home according to the given protocol.

Following completion of the intervention period, a post-test assessment was conducted using the same outcome measures to evaluate the effectiveness of the exercise program.

Statistical Analysis

Intervention values were analyzed using SPSS software. A p-value of <0.05 was significant.

RESULTS

Overall, 42 participants were recruited for the study. Pre- and post-intervention values were recorded for VAS, TUG, and WOMAC.

Table 1. Comparison of Pre- and Post-Intervention Outcome Measures

Outcome Measure	Pre-Intervention Mean ± SD	Post-Intervention Mean ± SD	Mean Change	t-value	p-value	Interpretation
1. VAS	7.1 ± 1.0	6.3 ± 1.0	0.8	2.35	0.023	Significant
2. TUG (seconds)	14.6 ± 2.1	13.5 ± 2.0	1.1 sec	2.21	0.033	Significant
3. WOMAC	61.8 ± 8.4	56.8 ± 8.0	5.0	2.47	0.018	Significant

VAS – PAIN INTENSITY

Interpretation

The reduction in VAS score indicates a modest improvement in knee pain following the four-week household items-assisted exercise program. This improvement is due to strengthening and mobility exercises that enhanced muscle support around the knee, reduced stiffness, and improved joint movement. Regular exercise also have reduced stress on the knee during daily activities. The household items provided simple resistance, allowing participants to perform the exercises regularly at home. The p-value was less than 0.05, pain severity was modest

TUG – FUNCTIONAL MOBILITY

Interpretation

The reduction in TUG completion time indicates a modest improvement in functional mobility following the four-week household items-assisted exercise program. This improvement is due to strengthening and mobility exercises that enhanced lower-limb muscle support, balance, coordination, and ease of movement during standing, walking, turning, and sitting. Regular practice of these functional movements has helped participants perform daily activities more efficiently. The p-value was less than 0.05; the improvement was significant.

WOMAC – PAIN AND FUNCTIONAL DISABILITY

Interpretation

The reduction in WOMAC score indicates a modest improvement in pain, stiffness, and physical function following the four-week household items-assisted exercise program. This improvement is due to strengthening and mobility exercises that enhanced muscle support around the knee, reduced stiffness, and improved the ability to perform daily activities. Regular exercise has reduced difficulty during
movements such as walking, standing, and other functional tasks. The p-value was less than 0.05,

DISCUSSION

The present study evaluated the effect of a four-week household items-assisted exercise program on pain, functional mobility and functional limitations in individuals with knee osteoarthritis living in a rural population. The findings demonstrated modest improvements in VAS, TUG, and WOMAC scores following the intervention.

The home exercise protocol has improved patient condition by providing regular strengthening and functional exercise in an accessible environment. Repeated exercise have enhanced lower-limb muscle function, movement control, balance, and the ability to perform daily activities. Reduced pain and improved confidence in movement may also have encouraged greater physical activity, contributing to improvements in functional outcomes. The convenience of performing the exercises at home may have promoted regular participation and adherence. Improvements in pain, physical function, balance, and mobility following home-based exercise in individuals with osteoarthritis. [5,7]

The VAS score is p = 0.023. This indicates a modest reduction in perceived knee pain. Exercise is recommended as an important component of non-operative management of knee osteoarthritis because strengthening, aerobic, and neuromuscular activities can improve physical functioning and symptoms.[3,4]

The present findings are consistent with those who reported that home-based exercise significantly reduced pain and improved physical function and overall quality of life among individuals with knee osteoarthritis.[5] Wang et al. also reported beneficial effects of home-based exercise, including improvements in WOMAC-related outcomes.[6]

In TUG test p = 0.033. This indicates a modest improvement in functional mobility.

The improvement in TUG performance may be associated with improved lower-limb muscle function, balance, coordination, and confidence during functional movement. The rural community-based study by Oh et al. reported beneficial effects of a program combining health education and self-directed home-based resistance training on

mobility function in older women with knee osteoarthritis.[8] Patel et al. similarly reported improvements in TUG performance following remotely delivered exercise among elderly individuals living in rural communities with symptomatic knee osteoarthritis.[9]

In WOMAC p =0.018. This indicates a modest reduction in pain and functional disability. The WOMAC is an established disease-specific measure for knee osteoarthritis and has demonstrated validity, reliability, and responsiveness.[13]

The reduction in WOMAC score is consistent with evidence from home-based exercise research. Recent systematic reviews have reported that home-based exercise can improve pain, joint function, balance, and mobility among individuals with knee osteoarthritis.[7] These findings support the use of accessible exercise-based interventions for people who may experience barriers to conventional rehabilitation services.

The modest the degree of improvement observed in the present study may be related to the comparatively brief intervention period. The exercise program was implemented for only four weeks, whereas many exercise studies have used longer intervention periods. Marriott et al. reported that resistance exercise programs lasting several months can enhance pain relief and physical functioning in people with knee osteoarthritis.[10] Therefore, a longer intervention period may potentially produce greater changes in strength and functional capacity.

Recent research has also emphasized the importance of exercise prescription and dosage. De Wit et al. examined the connection between prescribed resistance exercise prescription and changes in pain levels and physical function in people with knee osteoarthritis.[11] Although exercise dosage may not necessarily have a simple linear relationship with treatment effects, appropriate progression and individualised exercise prescription remain important considerations.

The use of household items may provide an additional advantage in rural communities. Household objects such as chairs, towels, and water bottles can be incorporated into strengthening, balance, mobility, and functional exercises without requiring specialised equipment. This may reduce equipment-related barriers and make therapeutic exercise more accessible to individuals living in resource-limited settings.

The findings should nevertheless be interpreted cautiously. Although VAS, TUG, and WOMAC demonstrated p-values below 0.05, the magnitude of improvement was relatively small. Statistical significance may not necessarily indicate a large or clinically important improvement. Therefore, the findings of the present study should be interpreted as showing modest short-term improvement rather than a dramatic therapeutic effect.

The rural context is particularly relevant because access to rehabilitation services may be limited. The findings from rural and remotely delivered exercise studies indicate that exercise programs can be successfully implemented outside conventional rehabilitation facilities.[8,9] This supports the potential role of accessible home-based exercise programs for rural populations.

Overall, the current findings offer preliminary evidence supporting the use of household items-assisted exercise as a simple and accessible rehabilitation approach for individuals with knee osteoarthritis.

However, studies involving larger samples and longer interventions periods, progressive exercise programs, appropriate adherence monitoring, and randomized controlled designs are required to establish the effectiveness of this intervention more conclusively.

CONCLUSION

The present study demonstrated that a four-week household items-assisted exercise program resulted in modest but significant improvements in pain, functional mobility, and physical functioning among individuals with knee osteoarthritis in a rural population. The exercise protocol was beneficial because it combined strengthening, mobility, and functional exercises, which may have improved muscle support around the knee, reduced stiffness, and enhanced daily functional activities. The use of easily available household items also made the program simple, economical, and accessible, particularly in rural settings.

REFERENCES

1. Cui A, Li H, Wang D, Zhong J, Chen Y, Lu H. Global, regional prevalence, incidence and risk factors of knee osteoarthritis in population-based studies. EClinicalMedicine. 2020;29-30:100587. doi:10.1016/j.eclinm.2020.100587.
2. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. The Lancet. 2019;393(10182):1745-1759.

3. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. Arthritis & Rheumatology. 2020;72(2):220-233.
4. Bannuru RR, Osani MC, Vaysbrot EE, Arden NK, Bennell K, Bierma-Zeinstra SMA, et al. OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. Osteoarthritis and Cartilage. 2019;27(11):1578-1589.
5. Si J, Sun L, Li Z, Zhu W, Yin W, Peng L. Effectiveness of home-based exercise interventions on pain, physical function and quality of life in individuals with knee osteoarthritis: a systematic review and meta-analysis. Journal of Orthopaedic Surgery and Research. 2023;18(1):503. doi:10.1186/s13018-023-04004-z.
6. Wang J, Xie D, Cai Z, Luo M, Chen B, Sun Y, Liu H. Does a home-based exercise program play any role in the treatment of knee osteoarthritis? A meta-analysis. Advances in Clinical and Experimental Medicine. 2022;31(11):1187-1196. doi:10.17219/acem/151753.
7. Mao Y, Qiu B, Wang W, Zhou P, Ou Z. Efficacy of home-based exercise in the treatment of pain and disability at the hip and knee in patients with osteoarthritis: a systematic review and meta-analysis. BMC Musculoskeletal Disorders. 2024;25(1):499. doi:10.1186/s12891-024-07585-w.
8. Oh SL, Kim DY, Bae JH, Lim JY. Effects of rural community-based integrated exercise and health education programs on the mobility function of older adults with knee osteoarthritis. Aging Clinical and Experimental Research. 2021;33(11):3005-3014. doi:10.1007/s40520-020-01474-7.
9. Patel KV, Hoffman EV, Phelan EA, Gell NM. Remotely delivered exercise to rural older adults with knee osteoarthritis: a pilot study. ACR Open Rheumatology. 2022;4(8):735-744. doi:10.1002/acr2.11452.
10. Marriott KA, Hall M, Maciukiewicz JM, Almaw RD, Wiebenga EG, Ivanochko NK, et al. Are the effects of resistance exercise on pain and function in knee and hip osteoarthritis dependent on exercise volume, duration, and adherence? A systematic review and meta-analysis. Arthritis Care & Research. 2024;76(6):821-830. doi:10.1002/acr.25313.
11. de Wit J, Haber T, Hall M, Bennell KL, Hinman RS, Spiers L, et al. Association between prescribed dosage of resistance exercise and change in pain and physical function in knee osteoarthritis: a systematic review with meta-regression. Musculoskeletal Care. 2025;23(2):e70110. doi:10.1002/msc.70110.
12. Alghadir A, Anwer S, Brismée JM. The reliability and minimal detectable change of Timed Up and Go test in individuals with grade 1-3 knee osteoarthritis. BMC Musculoskeletal Disorders. 2015;16:174. doi:10.1186/s12891-015-0637-8.
13. Bellamy N, Wilson C, Hendrikz J, Whitehouse SL, Patel B, Dennison S, Davis T. Osteoarthritis Index delivered by mobile phone (m-WOMAC) is valid, reliable, and responsive. Journal of Clinical Epidemiology. 2011;64(2):182-190. doi:10.1016/j.jclinepi.2010.03.013.
14. Jiang Y, Tan Y, Cheng L, Wang J. Effects of three types of resistance training on knee osteoarthritis: a systematic review and network meta-analysis. PLoS ONE. 2024;19(12):e0309950. doi:10.1371/journal.pone.0309950.
15. Cao SH, Zan Q, Wang B, Fan X, Chen Z, Yan F. Efficacy of non-pharmacological treatments for knee osteoarthritis: a systematic review and network meta-analysis. Heliyon. 2024;10(17):e36682. doi:10.1016/j.heliyon.2024.e36682.