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Original Article

Association of Home-Based Exercise Interventions on Pain, Physical Function, and Quality of Life in Individuals with Knee Osteoarthritis: A Cross-Sectional Survey

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ABSTRACT

Background: Knee osteoarthritis (KOA) is a prevalent degenerative joint disease that significantly impairs physical function and diminishes quality of life. While traditional management includes pharmacological and surgical interventions, exercise-based treatments have shown promise for alleviating symptoms and improving patient outcomes. Home-based exercise programs, in particular, offer a practical approach that may enhance accessibility and adherence.
Objective: The objective of this study was to assess the effectiveness of a home-based exercise regimen on pain reduction, improvement of physical function, and enhancement of quality of life in individuals with knee osteoarthritis.
Methods: A cross-sectional study involving 127 participants with clinically diagnosed KOA was conducted. Participants engaged in a prescribed home-based exercise program over a period of 12 weeks. Outcome measures included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for pain and physical function, the Visual Analog Scale (VAS) for pain intensity, the Timed Up and Go (TUG) test, the 6-Minute Walk Test (6MWT), and the Short Form-36 (SF-36) for quality of life. Data analysis was performed using SPSS version 25, employing independent t-tests and ANCOVA to compare pre- and post-intervention results.
Results: Post-intervention assessments demonstrated significant reductions in pain, with the WOMAC pain subscale scores decreasing from 12.3 ± 3.4 to 9.4 ± 2.1 ($p < 0.001$), VAS scores from 5.2 ± 2.1 to 3.7 ± 1.5 ($p = 0.002$), and NRS scores from 5.8 ± 2.0 to 4.0 ± 1.3 ($p < 0.001$). Improvements in physical function were notable, with WOMAC physical function scores improving from 35.6 ± 9.7 to 28.4 ± 8.2 ($p = 0.001$) and 6MWT distances increasing from 280.4 ± 48.7 meters to 320.5 ± 52.3 meters ($p < 0.001$). Quality of life, as measured by the SF-36, showed significant enhancements in both physical (39.2 ± 8.4 to 45.3 ± 7.8, $p = 0.004$) and mental component scores (42.8 ± 9.1 to 48.6 ± 8.0, $p = 0.006$).
Conclusion: The study provides strong evidence supporting the efficacy of home-based exercise programs in managing knee osteoarthritis. These findings suggest that such interventions can significantly reduce pain, enhance physical function, and improve quality of life, making them a viable alternative to more conventional treatments.

INTRODUCTION

Diabetes Osteoarthritis (OA) is a degenerative joint disease that represents a significant global health burden, particularly affecting the elderly population. It is characterized by joint pain, stiffness, and reduced function, which severely impact the quality of life of affected individuals. Knee osteoarthritis (KOA), the most prevalent form of OA, has seen an alarming increase in incidence over recent decades (1). The management of KOA typically involves a combination of pharmacological, non-pharmacological, and surgical interventions. Among these, exercise is recognized as a cornerstone of non-pharmacological management due to its proven benefits in improving pain, physical function, and overall quality of life (2, 3).

In recent years, home-based exercise interventions have gained prominence as a practical approach to managing KOA. These interventions offer the advantage of convenience and the potential to reduce healthcare costs associated with traditional clinical visits, especially important during times of limited access like the COVID-19 pandemic (4, 5). Moreover, home-based programs can be tailored to individual needs, promoting sustained engagement and adherence (6,7). However, despite their growing popularity and apparent benefits, comprehensive studies evaluating the effectiveness of home-based exercise programs specifically for individuals with KOA are sparse (2, 5).

Conflict of Interest: None

This cross-sectional study was designed to fill this gap in the literature by assessing the impact of home-based exercise interventions on pain, physical function, and quality of life among 127 individuals diagnosed with KOA. The study aimed to provide empirical evidence to support or refute the efficacy of these interventions in a real-world setting. By evaluating the outcomes associated with home-based exercises, the study contributes valuable insights into the optimal strategies for managing KOA, thereby informing healthcare professionals and policymakers on integrating these interventions into standard care practices for KOA (8,9). Through meticulous data collection and analysis, this research also highlights the potential of individualized home-based exercise as a viable alternative to more traditional therapeutic approaches, particularly in scenarios where access to conventional healthcare resources is limited (10,11).

MATERIAL AND METHODS

The cross-sectional study was designed to investigate the impact of home-based exercise interventions on pain, physical function, and quality of life in individuals diagnosed with knee osteoarthritis (KOA). The study recruited 127 participants who met the inclusion criteria: a diagnosis of KOA based on the American College of Rheumatology (ACR) clinical criteria, age 40 years or older, and the ability to perform exercises independently at home. Participants with a history of knee replacement surgery, other significant orthopedic conditions affecting mobility, or severe comorbidities that could interfere with exercise were excluded from the study.

Participants were sourced from various outpatient clinics specializing in orthopedic and geriatric care. All participants provided written informed consent before enrollment in the study. The research protocol was reviewed and approved by the institutional ethics committee, adhering to the principles outlined in the Declaration of Helsinki.

Data collection involved detailed demographic surveys, which captured information on age, gender, body mass index (BMI), employment status, marital status, and duration of diagnosed KOA. Clinical assessments were conducted to evaluate the primary outcomes of the study. Pain levels were measured using the Visual Analog Scale (VAS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale. Physical function was assessed through the WOMAC physical function subscale and the Timed Up and Go (TUG) test. Quality of life was evaluated using the Short Form-36 (SF-36) health survey. All assessments were carried out at baseline and after the 12-week intervention period.

The exercise program prescribed to participants consisted of a series of knee-specific exercises designed to improve joint mobility, muscle strength, and overall stability. The exercises were adapted to each participant's capability and were to be performed three times per week. Exercise adherence was monitored through weekly telephonic follow-ups, and participants maintained a log of their exercise sessions.

Statistical analyses were conducted using SPSS version 25. Descriptive statistics summarized the demographics and clinical characteristics of the study population. The primary analysis involved comparing the baseline and post-intervention measures within and between groups using paired and independent t-tests, respectively. ANCOVA models were employed to adjust for any baseline differences between intervention and control groups. All tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant. The results of these analyses provided insights into the effectiveness of home-based exercise interventions in managing the symptoms associated with KOA.

RESULTS

The results of this cross-sectional study elucidate the effectiveness of home-based exercise interventions on individuals with knee osteoarthritis. The findings are presented in a structured tabular format, displaying the outcomes related to pain, physical function, and quality of life before and after the intervention.

Table 1 Demographics of Participants

Variable	Response
Age (years)	65.3 ± 9.4
Gender	Male: 60 (47.2%)
	Female: 67 (52.8%)
BMI (kg/m²)	28.5 ± 4.7
Marital Status	Single: 25 (19.7%)
	Married: 72 (56.7%)
	Divorced: 20 (15.7%)
	Widowed: 10 (7.9%)
Employment Status	Employed: 45 (35.4%)
	Unemployed: 32 (25.2%)
	Retired: 40 (31.5%)
	Student: 10 (7.9%)
Duration of Osteoarthritis Diagnosis (years)	7.2 ± 3.5

Table 2 Pain Outcomes

Outcome Measure	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	p-value
WOMAC Pain Subscale (0-20)	12.3 ± 3.4	9.4 ± 2.1	< 0.001

VAS Pain (0-10)	5.2 ± 2.1	3.7 ± 1.5	0.002
NRS Pain (0-10)	5.8 ± 2.0	4.0 ± 1.3	< 0.001

Table 3 Physical Function Outcomes

Outcome Measure	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	p-value
WOMAC Physical Function Subscale (0-68)	35.6 ± 9.7	28.4 ± 8.2	0.001
Timed Up and Go (TUG) (seconds)	13.4 ± 3.2	11.2 ± 2.8	0.003
6-Minute Walk Test (6MWT) (meters)	280.4 ± 48.7	320.5 ± 52.3	< 0.001

Table 4 Quality of Life Outcomes

Outcome Measure	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	p-value
SF-36 Physical Component Score	39.2 ± 8.4	45.3 ± 7.8	0.004
SF-36 Mental Component Score	42.8 ± 9.1	48.6 ± 8.0	0.006
EQ-5D Index	0.68 ± 0.14	0.75 ± 0.12	0.002

The tables clearly show significant improvements in all measured outcomes following the home-based exercise intervention. Participants reported reductions in pain levels across all pain scales used in the study. Moreover, improvements in physical function were evident, as seen in the increased performance in both the TUG test and 6MWT. Quality of life, as assessed by the SF-36 and EQ-5D, also showed considerable enhancement, underscoring the overall effectiveness of the intervention. These results demonstrate the potential benefits of home-based exercise programs in managing symptoms and improving the quality of life in individuals with knee osteoarthritis.

DISCUSSION

The study findings revealed significant improvements in pain management, physical function, and quality of life among participants following a home-based exercise regimen. These results are consistent with previous research indicating that exercise programs tailored to individual needs can significantly ameliorate symptoms of knee osteoarthritis (12). Notably, the observed reduction in pain scores as measured by the WOMAC Pain Subscale, VAS, and NRS underscores the effectiveness of targeted, home-based interventions, aligning with findings from Smith et al. (13,14), who reported similar improvements in KOA patients engaged in regular physical activity.

The enhancement in physical function, evidenced by the improved scores in the WOMAC Physical Function Subscale and Timed Up and Go test, supports the hypothesis that sustained exercise regimens can enhance mobility and reduce the functional limitations typically imposed by KOA (15,16). The significant increase in the 6-Minute Walk Test scores further highlights the potential of exercise to improve endurance, a critical factor in the quality of life for individuals with chronic conditions. These findings align with those of Jones et al. (17), who noted improvements in both mobility and independence following exercise interventions.

The study also reported notable improvements in the quality of life, as measured by the SF-36 and EQ-5D indices. These results are particularly encouraging, given the chronic nature of KOA and its tendency to disrupt daily living and diminish life satisfaction (18,19). The increase in quality of life scores suggests that home-based exercises not only address physical symptoms but also contribute to psychological well-being, echoing the conclusions of Lee et al. (20).

While the results are promising, the study has several limitations. The reliance on self-reported measures for exercise adherence introduces potential biases, as participants might overestimate their compliance. Furthermore, the lack of a control group solely engaged in non-exercise interventions means that the observed effects cannot definitively be attributed solely to the exercise component. Future studies could incorporate a broader array of controls and objective measures of physical activity to validate these findings further.

The study's strength lies in its real-world application and the direct relevance of its findings to clinical practice. By demonstrating that home-based exercises can be effectively self-administered and produce measurable improvements in outcomes, the study supports the broader implementation of such programs in the management of KOA. It is recommended that healthcare providers consider prescribing structured, home-based exercise programs tailored to individual patient needs as part of the standard management plan for KOA (21).

CONCLUSION

In conclusion, this research contributes valuable insights into the role of home-based exercise in managing knee osteoarthritis, with clear implications for enhancing patient outcomes through accessible and cost-effective interventions. Future research should continue to explore these interventions' long-term effects and seek to optimize exercise regimens to maximize their therapeutic potential.

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