

A QUASI-EXPERIMENTAL STUDY TO ASSESS THE EFFECTIVENESS OF ISOMETRIC EXERCISES ON PAIN AND FUNCTIONAL CAPABILITIES AMONG PEOPLE WITH OSTEOARTHRITIS IN SELECTED OLD AGE HOMES OF METROPOLITAN CITY

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Abstract :

INTRODUCTION: Osteoarthritis is a progressive degenerative joint disorder that leads to pain, swelling, stiffness, and reduced mobility. As the global population ages, the prevalence of osteoarthritis continues to rise, with typical onset in the late 40s to mid 50s. It is one of the leading causes of disability worldwide, particularly affecting the knee joints, a quasi-experimental study was conducted to evaluate the effectiveness of isometric exercises on pain and functional capability among elderly individuals with osteoarthritis residing in selected old age homes in a metropolitan city. **METHODOLOGY:** A quantitative research approach with a quasi-experimental design was adopted for the study. Non-probability purposive sampling was used to select participants for both the experimental and control groups. The experimental group received daily isometric exercise sessions for four weeks, while the control group did not receive any intervention. Baseline observations were recorded on Day 1, after which the experimental group underwent morning and evening isometric exercise sessions. Post-intervention assessments were conducted on Day 30 to evaluate changes in pain and functional capability using the Numerical Pain Scale and the Modified Functional Capability Scale. **RESULTS:** The results showed that pain and functional capability differed significantly between the experimental and control groups after the intervention. In the control group, the mean pain score increased from 7.3 to 8.0, indicating worsening pain without intervention, while functional capability remained almost unchanged (38.4 to 38.65). In contrast, the experimental group showed a significant reduction in pain, with the mean score decreasing from 7.9 to 5.0 after 30 days of isometric exercises ($t = 6.87, p = 0.001$). Functional capability also improved markedly in the experimental group, increasing from 34.4 to 59.5 ($t = 10.51, p = 0.001$). Baseline comparisons showed no significant differences between groups for both pain and functional capability, confirming that improvements were due to the intervention. Overall, isometric exercises were highly effective in reducing pain and enhancing functional ability among older adults with osteoarthritis. **CONCLUSION:** The study demonstrated that isometric exercises significantly reduce pain and improve functional capability among elderly people with osteoarthritis. Overall, isometric exercises are an effective, low-cost, and non-invasive intervention for managing osteoarthritis-related pain and mobility issues. Incorporating these exercises into routine nursing care can enhance quality of life, reduce dependence on pain medications, and promote better mobility and independence among older adults.

Keywords: Isometric exercises, Osteoarthritis, Pain management, Functional capabilities, Quasi-experimental study, old age homes.

INTRODUCTION

Osteoarthritis is a progressive degenerative joint disorder that primarily affects the knees, hips, spine, and hands, leading to chronic pain, stiffness, swelling, and reduced mobility. It is one of the most common causes of disability among older adults, with its prevalence steadily rising due to ageing, obesity, and lifestyle changes. In India, osteoarthritis affects between 22% and 39% of the population, and women experience the condition more frequently than men. As the global elderly population grows, the burden of osteoarthritis is expected to increase, significantly impacting physical independence and overall quality of life.

The background of the study highlights that older adults commonly face limitations in daily activities due to joint pain, muscle weakness, fatigue, and reduced functional mobility. Research indicates that therapeutic exercises, particularly isometric exercises, are effective in reducing joint pain, improving muscle strength, enhancing endurance, and promoting better functional capability without causing stress to the joints. International recommendations, including those from OARSI, emphasize non-pharmacological interventions such as structured exercise programs, weight management, and health education as essential components of osteoarthritis management.

The need for the study arises from the high prevalence of osteoarthritis in Maharashtra and the severe impact it has on the daily functioning of older adults. Studies from the region indicate that nearly 70% of affected individuals experience moderate to severe pain, leading to restrictions in mobility and reduced quality of life. Although evidence strongly supports the benefits of isometric exercises, their consistent implementation in old-age homes and institutional care settings is limited. Therefore, there is a pressing need to evaluate the effectiveness of structured isometric exercise programs in reducing pain and improving functional capabilities among older adults residing in such facilities.

The conceptual framework of this study is guided by Kolcaba's Comfort Theory, which emphasizes the importance of enhancing physical, psychological, and environmental comfort to promote health-seeking behaviours. Within this study, isometric exercise functions as a non-pharmacological nursing intervention designed to improve physical comfort by reducing pain and enhancing mobility. This framework supports the development of evidence-based nursing practices that can be integrated into routine geriatric care, thereby improving independence, functional health, and overall well-being among older adults with osteoarthritis.

The aim of the study is to assess the effectiveness of isometric exercises on pain levels and functional capabilities among older adults with knee osteoarthritis residing in selected old-age homes, and to contribute evidence that supports the integration of structured, non-pharmacological exercise interventions into routine geriatric care for improving comfort, independence, and quality of life.

Objectives:

1. Assess the level of pain in the experimental and control group among people with osteoarthritis before the intervention in a selected old age home of a metropolitan city.
2. Assess the level of functional capabilities in the experimental & control group among people with osteoarthritis before the intervention in a selected old age home of a metropolitan city.
3. To assess the level of pain in the control group and experimental group among people with osteoarthritis after the intervention.
4. Assess the level of functional capabilities in the control and experimental group among people with osteoarthritis after the intervention.
5. Compare the pre-test and post-test level of pain and functional capabilities among the experimental & control group.
6. To find out the association of the level of pain and functional capabilities among people with osteoarthritis with demographic variables.

Hypothesis:

H₀: There will be no significant difference between pre-test and post-test levels of pain and functional capabilities among osteoarthritis patients of selected old age homes at 0.05 level of significance.

H₁: There will be a significant difference between the pre-test and post-test levels of pain and functional capabilities among osteoarthritis patients of selected old age homes at 0.05 level of significance.

Methodology:

Research Design: A quantitative, a quasi-experimental, pre test – post test control group design, was used to evaluate the effect of isometric exercises on pain and functional capability.

Setting: The study was conducted in two selected old-age homes—Om Sai Old Age Home (Mumbai), and Gargi Old Age Home (Mumbai)—from October 2023 to January 2024.

Population:

Target population – Old age people with knee osteoarthritis

Accessible population – People with osteoarthritis residing in old age homes

Variables:

Independent variable – Isometric exercises

Dependent variable – Level of pain and functional capabilities

Sample Size

The sample size was calculated by a statistician using the mean-difference formula. Based on primary variables—prevalence of osteoarthritis (35.88%) and pain-related problems (66.50%)—and a clinically relevant difference of 30.62%, the minimum required sample size was computed using the formula:

$$N = (Z_{1-\alpha} + Z_{\beta})^2 [P_1(1-P_1) + P_2(1-P_2)] / (P_2 - P_1)^2,$$

where $Z_{\alpha} = 1.96$ (5% Type I error) and $Z_{\beta} = 0.84$ (20% Type II error).

The calculated sample size was **46**, and after considering a **10% dropout rate (5 participants)**, the final feasible sample size was **40**, which was used for the study.

Sampling Technique: Non-Probability Purposive

Sampling Criteria:

Inclusion Criteria: People who are....

- Between 55 to 75 years of age group.
- Those who have limited joint mobilization and pain in the knee joints.
- Those who are present at the time of data collection.
- Those who are willing to participate in the study.
- Those who are not taking any pain medication.

Exclusion Criteria: People who are having....

- Bone fracture and/or ligament tear
- Bedridden persons
- Persons who have undergone orthopedic surgery within 1 year.
- Persons who attend the Yoga program in an old-age home.
- Neurological disorders like dementia, Alzheimer's, Parkinson's, etc.

Intervention

The isometric exercise program was designed under the guidance of a certified physiotherapist. It included nine specific exercises: straight leg raising, knee lift, knee rise, supine knee slide, hip adduction, front knee strengthening, back knee strengthening, heel raise, and sit-and-up exercise. Each session lasted 30 minutes, performed twice daily (morning and evening) for four weeks. Participants in the control group continued routine activities and did not receive exercise training.

Data Collection Tools

1. **Numerical Pain Rating Scale (NPRS)** – To assess intensity of joint pain (0 = no pain, 10 = worst pain).
2. **Modified Functional Capability Scale**– To evaluate functional capability (mobility, standing, walking, stair climbing, and daily activities).

Both tools were validated by 14 medical-surgical nursing experts and 2 physiotherapists. Cronbach's alpha coefficient for reliability was 0.85 for Modified Functional Capability Scale.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee of D.Y. Patil School of Nursing (Approval No: DYP/SON/IEC/2023/14). Written informed consent was obtained from all participants. Anonymity and confidentiality were maintained throughout the study.

Data Analysis

Data were analyzed using SPSS v.23. Descriptive statistics (frequency, percentage, mean, SD) were used to describe demographic and baseline variables. Inferential statistics included paired t-test (within-group comparison) and independent t-test (between-group comparison). Significance was set at $p < 0.05$.

Result:

Section I -Demographic Characteristics:

Most participants in both experimental and control groups were between 66–70 years (35%), followed by those aged 71–75 years (25%), and the majority in the experimental group were male (70%). Most were married (80%), had completed high-school education (45%), and previously worked as private employees (50%) or in agriculture (25%). A large proportion had a normal body build (65%), followed both vegetarian and non-vegetarian diets (50%), and had stayed in the old-age home for 3–4 years (20%). The duration of knee pain and joint-movement limitation was commonly 1.1–3 years (50%), indicating a moderate chronicity of osteoarthritis among the participants.

Section II -Distribution of the samples as per the level of pain among the experimental & control group.

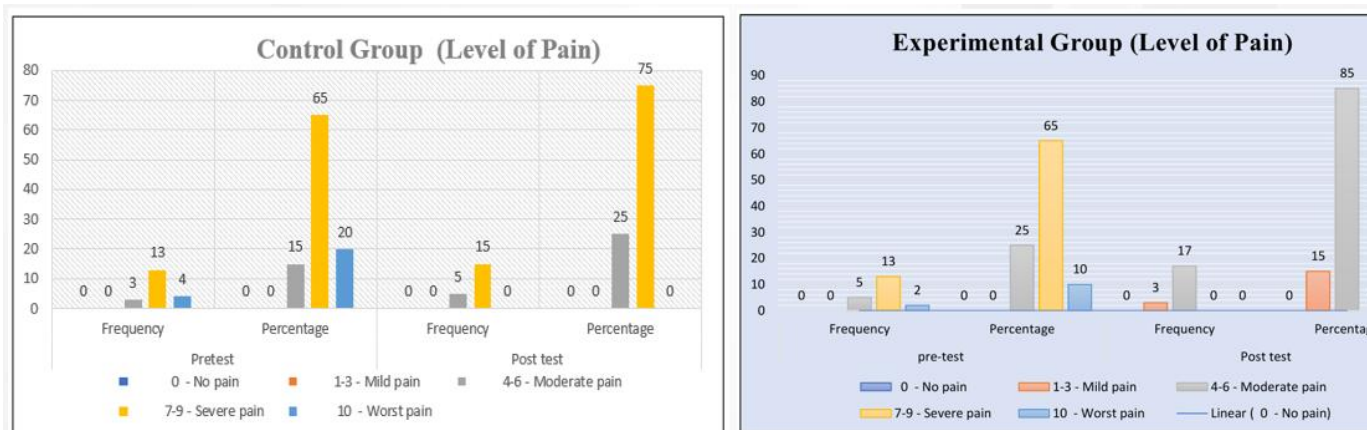


Fig. 1 : Graphical representation of percentage-wise distribution of pain levels in the experimental and control group before and after isometric exercises.

Section III: Distribution of the samples as per the functional capability among the experimental & control group.

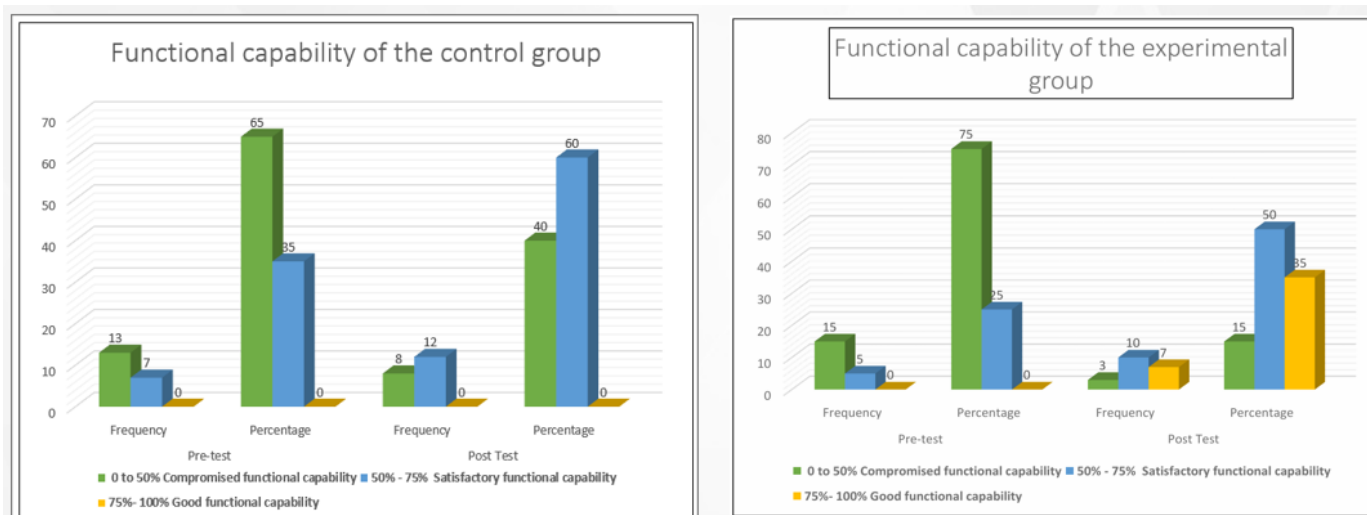


Fig. 2 : Graphical representation of percentage-wise distribution of functional Capability in the experimental and control group before and after isometric exercises.

Section IV: Evaluate the effectiveness of isometric exercises among the experimental & control group.

Table no. 1: Inter-group Comparison of Pre-test and Post-test Pain Scores and Functional Capability Scores among experimental and control groups before and after the intervention.

Parameter	Group (n=20)	Test	Mean	SD	t-value	d.f.	P-value	Remarks
Pain Score	Control	Pre-test (Day 1)	7.3	1.3				-Pain level high at baseline
		Post-test (Day 30)	8.0	0.86				-Pain worsened without intervention
	Experimental	Pre-test (Day 1)	7.9	1.2	0.60	38	0.55	-High pain before intervention;
		Post-test (Day 30)	5.0	0.91	6.87	38	0.001	-Significant pain reduction after isometric exercise
Functional Capability	Control	Pre-test (Day 1)	38.4	16.1				-Functional ability low at baseline
		Post-test (Day 30)	38.65	5.98				-No improvement without intervention
	Experimental	Pre-test (Day 1)	34.4	15.7	-0.79	38	0.43	-Functional ability low at baseline.
		Post-test (Day 30)	59.5	6.52	10.51	38	0.001	-Significant improvement in functional ability after isometric exercise

Interpretation:

At baseline (pre-test), both control and experimental groups had high pain scores and low functional capability, with no significant differences between groups. By Day 30, the control group showed no improvement in either pain or functional capability. In contrast, the experimental group, which performed isometric exercises, demonstrated a significant reduction in pain (from 7.9 to 5.0, $p = 0.001$) and a significant improvement in functional capability (from 34.4 to 59.5, $p = 0.001$). This indicates that isometric exercises were effective in decreasing pain and enhancing functional ability among participants.

Section V: Association of the level of pain among people with osteoarthritis with demographic variables.

Table No. 2. Association of the level of pain and functional capability among people with osteoarthritis with demographic variables in respondents of both the experimental and control group.

Demographic Variable	level of pain		level of functional capabilities	
	χ^2 -value	p-value	χ^2 -value	p-value
Age	6.105	0.0322 Significant	9.757	0.013 Significant
Gender	5.124	0.001 Significant	11.174	0.001 Significant
Marital Status	4.478	0.0357 Significant	11.047	0.001 Significant
Educational Status	7.045	0.0411 Significant	12.085	0.038 Significant
Occupation (before coming old age home)	6.778	0.043 Significant	10.017	0.001 Significant
Duration of stay in the old age home	5.357	0.001 Significant	11.007	0.001 Significant
Body build	7.547	0.001 Significant	9.021	0.001 Significant
Food pattern	8.997	0.05 Significant	10.607	0.005 Significant
Duration of having knee pain	8.089	0.031 Significant	10.776	0.045 Significant
Duration of having joint movement limitation.	8.708	0.043 Significant	9.744	0.004 Significant

The data indicate that knee osteoarthritis pain is strongly influenced by age, gender, education, occupation, lifestyle, and body build, with older adults—especially those aged 66–70 years—showing greater pain due to prolonged joint stress, higher body weight, and long-standing knee problems, while dietary habits and reduced joint mobility further intensified discomfort. Functional capability was also significantly associated with these demographic variables: males, married individuals, those with higher education, normal body build, longer duration of stay in old age homes, and vegetarian food patterns demonstrated better functioning, whereas individuals with knee pain for more than five years and those with moderate joint movement limitations showed poorer functional outcomes. Overall, both pain and functional status in osteoarthritis are shaped by physical, social, and lifestyle factors, highlighting the need for early, individualized interventions.

Discussion

The findings indicate that a structured isometric exercise program significantly reduces pain and improves functional ability in elderly individuals with osteoarthritis. The results corroborate the work of Holden et al. (2023), who found that therapeutic exercises enhance quadriceps strength and reduce pain intensity in knee OA. Similarly, Davey & Mathes (2016) observed a marked decrease in WOMAC pain scores following a 12-week isometric program.

Pain reduction in OA is attributed to improved muscular support, reduced mechanical load on the joint, and increased endorphin release due to muscle activity. Enhanced functional capability is linked to improved quadriceps strength and joint stability, which facilitate smoother movements and reduce stiffness.

The results emphasize the role of nurses as rehabilitation facilitators in geriatric care. Nurse-led isometric exercise sessions can be easily incorporated into the daily routine of old-age homes and rehabilitation centers. These interventions not only manage physical symptoms but also improve psychological well-being and social interaction.

Conclusion

This study concludes that isometric exercise is an effective, non-invasive, and low-cost intervention for managing osteoarthritis among elderly individuals. It significantly reduces joint pain and enhances functional capability, promoting independence and quality of life. Integrating such evidence-based interventions into nursing practice can greatly enhance comfort, mobility, and self-care ability among aging populations.

Recommendations:

- Replicate the study with a larger sample for better accuracy and generalization.
- Evaluate isometric exercise effects on other joints like the hip or ankle.
- Conduct long-term studies to assess sustained benefits.
- Include community-based elderly to test feasibility in home settings.
- Examine the impact of exercises on psychological well-being and social participation.

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Declaration of Interest:

The author declared that there are no conflicts of interest regarding the conduct of this study. This research was carried out independently, without any financial support, sponsorship, or influence from pharmaceutical companies, organizations, or other parties. All procedures and analyses were conducted solely for academic purposes as part of the M.Sc. Nursing dissertation requirement.

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