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Effectiveness of Participatory Quadriceps Strengthening Exercise Programme on Osteoarthritis among Adults in Karad Taluka

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ABSTRACT

Introduction: Knee osteoarthritis leads to increased pain and instability, but it also significantly hampers daily activities and overall well-being due to a reduced range of motion and decreased functional capacity.

Aim: To assess the effectiveness of participatory quadriceps strengthening exercise programme on osteoarthritis

Materials & Methods: A quasi-experimental design was conducted to study the Effectiveness of Participatory Quadriceps Strengthening Exercise Programme on Osteoarthritis among adults**.** Participants were selected using a Purposive sampling technique from a rural area. A total sample size of 100 (50 in the experimental group and 50 in the control group) suffering from osteoarthritis was included in the study. Descriptive and inferential statistics were used for data analysis.

Results: In the experimental group pre-test score was subjects 0 (0 %) having mild knee pain, 50 (100 %) having moderate knee pain and none of the subjects had severe knee pain whereas in the control group pre-test score of 24 (48 %) mild, 26 (52%) moderate and no severe knee pain among subjects. After the intervention of quadriceps exercise for 15 days in the experimental group post-test score was 36 (72%) mild, with 14 (28%) having moderate and no severe knee pain whereas in the control group post-test score of 46 (92%) had moderate knee pain and 4 (8%) subjects are having severe knee pain.

Conclusion: Quadriceps exercises effectively reduce knee joint pain and improve function and quality of life for adults. Therapeutic exercise should be utilized to alleviate pain and stiffness while enhancing physical function in adult patients.

Keywords: *Effectiveness, participatory, quadriceps strengthening exercise, osteoarthritis, adults.*

1. INTRODUCTION

Osteoarthritis of the knee is a prevalent form of lower limb arthritis, particularly among older adults. Those affected often endure pain, stiffness, and reduced mobility, leading to increased healthcare costs. In India, knee osteoarthritis is especially common. Patients who struggle with activities like running, standing up from a seated position, squatting, walking on uneven surfaces, or climbing stairs typically visit the outpatient department for help. Physiotherapy has proven to be a highly effective treatment option in these cases. Incorporating additional modalities into traditional physiotherapeutic practices has been shown to enhance health outcomes and alleviate pain for individuals with knee osteoarthritis. (1)

The KT technique was recommended by physical therapists (PTs) for the rehabilitation of knee osteoarthritis due to its inconsistent outcomes, which include decreased motor function and muscular performance and increased torque in the quadriceps and pain management. (2) Knee pain (KP) is one of the most common musculoskeletal disorders and a significant cause of disability among individuals over 50. (3,4)

The KOOS evaluates various aspects of knee health, including pain (nine items), other symptoms (seven items), daily living function (17 items), sport and recreation function (five items), and knee-related quality of life (four items). A score of 0 reflects severe symptoms, while a score of 100 indicates no knee issues. As a detailed patient-reported measure, the KOOS is valuable for assessing changes in knee pathology over time, regardless of treatment. [5]

Currently, approximately 250 million people worldwide are affected by osteoarthritis (OA). Among the elderly, the chronic musculoskeletal disorder has long been recognized as a significant public health concern with nearly 10 to 20% of individuals over 65 experiencing knee OA to some degree. The prevalence and incidence of OA are rising, largely due to the rapid growth of the ageing population and the increasing rates of obesity, which are major risk factors for the condition. [6,7,8]

The purpose of providing these enhanced physical therapist-led exercise sessions was to explore their potential to improve pain and function related to knee osteoarthritis. This was the objective of the BEEP (Benefits of Effective Exercise for Knee Pain) study. [9] Research indicates that as individuals walk, the load applied to the joint increases, while quadriceps strength tends to decrease. [10]

To assess the patient's knee issues, the Knee Injury and Osteoarthritis Outcome Score (KOOS) was utilized. This assessment can be enhanced by focusing on improving balance and muscle strength. [12, 13,14] Osteoarthritis (OA) is a condition that causes pain and restricts patients' functional movement. Although numerous clinical practice guidelines exist for its treatment, they all highlight the importance of non-pharmacological approaches, especially exercise therapy. [15,16,17,18] In a study by Pollard et al., 413 individuals completed self-report measures assessing impairment (symptoms), activity limitations in mobility and activities of daily living (ADLs), and participation, on average one month before undergoing hip or knee replacement surgery. [19,20] In addition to quadriceps muscle weakness, patients with knee osteoarthritis (KOA) also exhibit greater hip muscle weakness compared to individuals without KOA. [21,22,23]

Materials & Methods: This study utilized a quantitative approach, employing a one-group pretest-posttest research design. The study was conducted on 50 subjects experimental and 50 control group subjects from rural populations by using the Purposive sampling technique. Comparison between Pre-test and Post-test KOOS scale score levels of adults from experimental and control groups suffering from osteoarthritis.

2. SAMPLE SIZE

- A Study Conducted By Walaa Hassan Abd Alfatah In 2016 Sample Size For My Study Is -

$$n = \frac{(Z_a + Z_B)^2 \times (S_1^2 + S_2^2)}{(M_2 - M_1)^2}$$

$$n = \frac{(1.96 + 1.64)^2 \times 2.17^2 + 4.11^2}{(5.49 - 7.31)^2}$$

$$n = 84.53$$

n = 85 Total sample Size- – 100 for my study

Intervention Details:

After one week of training from the physiotherapy department intervention started to participants. These exercises are aimed at strengthening the quadriceps muscles. Each exercise is accompanied by step-by-step instructions and illustrations or diagrams demonstrating the proper technique. The exercises included in this are :

- Static Quadriceps Exercise
- Straight Leg Raising
- Hamstring Set
- Bridging
- Single Leg Bridging
- Prone Leg Curl Exercise
- Stability Ball Leg Curl
- Straight Leg Raising (Sitting)

- Leg Stretch

For each exercise, the booklet guides proper body positioning, movement technique, and breathing patterns. The researcher introduced herself to the participants and explained the study's purpose, ensuring them that confidentiality would be maintained. The data collection phase was six months, from February 2024 to the end of July 2024. The quadriceps exercise program was demonstrated both manually and through a Marathi booklet and self-demonstration to the study group of 50 adults, with one session conducted weekly each month. The program consisted of four sessions, each lasting about 15-20 minutes. Subjects were instructed to perform the quadriceps exercises at home for 15 to 20 minutes, 2 to 3 times a day. The exercise program included both stretching and strengthening exercises for the quadriceps muscles. The program outlined the types of exercises, their duration, and instructions for implementation. A handout was provided to the study group to support the exercise regimen.

3. RESULT

Table No.1: Distribution of subjects is according to socio-demographic variables

	Experimental group		**Control group**	
Age				
	Frequency	**%**	**Frequency**	**%**
40-45 years	11	22	18	36
46-50 years	10	20	6	12
51-55 years	8	16	11	22
56-60 years	5	10	2	4
61 and above	16	32	13	26
Gender				
Males	9	18	7	14
Females	41	82	43	86
Religion				
Hindu	47	94	48	96
Christian	3	6	2	4
Educational status				
Illiterate	11	22	12	24
Primary	16	32	17	34
Secondary	11	22	19	38
Graduate and above	12	24	2	4
Occupation				
Housewife	33	66	39	78
Farmer	2	4	3	6
Own business	6	12	3	6
Job	9	18	5	10
Type of family				
Joint family	42	84	44	88

Nuclear family	8	16	6	12
Income				
Less than Rs.2,000	4	8	10	20
Rs. 2000- Rs. 4000	9	18	9	18
Rs. 4001- Rs. 6000	7	14	14	28
Rs. 6001 and above	30	60	17	34
Place of living				
Rural	41	82	49	98
Urban	9	18	1	2
Type of diet				
Veg	4	8	3	6
Non veg	41	82	47	94
Mixed	5	10	0	0

Table-1 : indicates In the experimental group, 32% of participants were aged 61 years and older. In control group 36% of participants aged 40-45 years and older. Gender distribution revealed that 82% of the experimental group were female, compared to 86% in the control group. In both groups, 94% in the experimental group and 96% in the control group was Hindu religion. along with a small proportion of Christians. Regarding educational status, 31% of the experimental group had completed primary education, while 38% of the control group had secondary education. Regarding occupation 66% in the experimental group and 78% of the control group were housewives and 84% of both groups living in joint families. Income distribution showed that 60% of the experimental group had incomes exceeding Rs. 6,000, while only 34% of the control group reported the same. In terms of residence, 82% of the experimental group lived in rural areas, compared to 98% in the control group. Dietary preferences indicated that 82% of the experimental group were non-vegetarian, while the control group had 94% identifying as non-vegetarian.

Table No. 2: Classification of adults in the experimental group and control group suffering from osteoarthritis on the pre-test level of the KOOS scale

Level of Pre-test KOOS scale	**Score**	**Frequency**	%
Experimental group			
Mild	1-46	0	0
Moderate	47-93	50	100
Severe	94-140	0	0
Control group			
Mild	1-46	24	48
Moderate	47-93	26	52
Severe	94-140	0	0

In the pre-test assessment of the KOOS scale for adults suffering from osteoarthritis, the experimental group showed that 100% had a moderate level of score, with no individuals categorized under mild or severe levels. Conversely, in the control group, 48% of adults had a mild level of score, 52% had a moderate level, and none had a severe level.

Table No. 3: Classification of adults in the experimental group and control group suffering from osteoarthritis on post-test level of KOOS scale

Level of Pre-test KOOS scale	**Score**	**Frequency**	%
Experimental group			
Mild	1-46	36	72
Moderate	47-93	14	28
Severe	94-140	0	0
Control group			
Mild	1-46	0	0
Moderate	47-93	46	92
Severe	94-140	4	8

Table 3 Depicts that in the post-test assessment of the KOOS scale for adults with osteoarthritis, the experimental group showed that 72% of adults had a mild level of score, 28% had a moderate level and none had a severe level after participating in the quadriceps strengthening exercise program. In the control group, 92% of adults had a moderate level of score, 8% had a severe level, and none had a mild level.

Table No. 4: Comparison between Pre-test and Post-test KOOS scale score levels of adults from experimental and control groups suffering from osteoarthritis

Group	**Intervention**	**Mean**	**S. D.**	**Wilcoxon W statistics**	**p-value**
Control	Pre-test	55.00	11.50	6.38	**< 0 .001**
	Post-test	84.04	8.15		
Experimental	Pre-test	81.22	3.83	6.89	**< 0.001**
	Post-test	46.48	2.52		

A normality check was performed on the total pre-test and post-test KOOS scale scores of adults with osteoarthritis from both experimental and control groups using the Shapiro-Wilk test. The results indicated that the data did not follow a normal distribution. Consequently, the non-parametric Wilcoxon signed-rank test was used to compare the KOOS scale scores between the pre-test and post-test. For the control group, the mean KOOS scale pre-test score was 55.00, while the mean post-test score increased significantly to 84.04 ($p < 0.05$), indicating a significant improvement. In contrast, for the experimental group, the mean KOOS scale pre-test score was 81.22, but the mean post-test score decreased significantly to 46.48 ($p < 0.05$), suggesting a significant decline in scores.

4. DISCUSSION

Knee joint pain is a chronic disease which includes progressive destruction of articular cartilage and a reduction of synovial fluid that lubricates those joints. With usual signs and symptoms, it progresses slowly and limitation of the range of motion[24]. It affects 22-39% population in India. Above 60 years, 60-70% of the population causes disability[25]. With age, the severity of the pain increases and a greater percentage has pain associated with disability[26].

In this study, the experimental group included adults aged 56-60 years (22%) and those aged 61 and above (32%). Notably, 41 (82%) of the participants were female. Whereas in the control group 18 (36%) adults aged between 40-45 years and 43 (86%) females. A similar study by **Leila Ahmed Abdu, Amal Mohamed Ahmed,** et al. (2021) Knee osteoarthritis among women more than men. The study concludes that 50% of both the study and control groups were over the age of 50. The majority of the participants were female, 76.7% in the study group and 60% in the control group. [(27)] In the present study among the experimental group, 47(94%) Hindu and 3 (6%) were adults with the Christian religion, and in the control group, 48(96%) adults were Hindu religion.

In the present study, regarding education, the experimental group had 16 (31%) adults who completed primary education, while the control group included 19 (38%) adults with secondary education. A study by **Walaa Hassan Abd Alfalah, Heba Mohamed et al**. (2022), [28] study reported that 33.3% of participants had secondary education. Study by **Magda M. Mohsen**, and Nabila E. Sabola et al. (2021) majority of the control group was illiterate or had only rudimentary reading and writing skills (44%).

Conversely, 40% of cases and 22% of the control group had either secondary education or a technical diploma. [26] In a present study about Occupation in the experimental group, 33 (66%) whereas in the control group, 39 (78%) were housewives, Similar study by **Walaa Hassan Abd Alfalah 1, Heba Mohamed et**.al (2022) showed that70.7%, 61.3%) were housewives [28]

In a present study regarding Type of Family in the experimental group, 42 (84%) adults were living in a joint family, whereas in the control group, 42 (84%) were in a joint family. In a study by **Magda M. Mohsen[1,] and Nabila E. Sabola[2] et.al** (2021)[29] in marital status, 68% of control and 72% of cases were married and 26% were widow/divorced. [26] About income in the experimental group, 30 (60%) adults had income above Rs. 6001. in the control group, 17 (34%) adults had above Rs. 6001. In a present study in the experimental group, t 41 (82%) and in the control group, 49 (98%) adults who live in rural areas, **A** study by **Walaa Hassan Abd Alfalah 1, Heba Mohamed et.al (2022)** majority elderly (study, control) were living in the urban area (90.7%, 92.0) respectively.[28] In a present study related to dietary patterns in the experimental group, 41(82%) and in the control group, 47(94%) adults are taking a non-vegetarian diet.

Assessment of osteoarthritis among adults:

In the present study, all 50 adults (100%) in the experimental group had osteoarthritis. This finding aligns with the study by **Joseph A., George M.V. et al.** (2014), which included 100 women, equally divided between experimental and control groups. In the control group exhibited severe pain in 38 women (76%) during the pretest, which decreased slightly to 33 women (66%) with severe pain in the post-test. In the experimental group, 37 (74%) had severe knee joint pain in the pretest among women, but this number improved to 50 (100%) experiencing moderate knee joint pain by the post-test. [15] Similar study by **Magda M. Mohsen, Nabila E**. Sabola et.al (2021). **[29]** There was an improvement in elderly patients in the study group and then the control group after intervention which reflected in improvement their practice toward symptom management.

Classification of adults in the experimental group and control group suffering from osteoarthritis on pre-test level of KOOS scale

In experimental group exhibited the following results for the KOOS scale scores related to osteoarthritis. Initially, all 50 adults (100%) had a moderate level of KOOS scores before the intervention. After administering the participatory quadriceps strengthening exercise program, 36 adults (72%) had a mild KOOS score, while 14 adults (28%) still had a moderate score. compare the pre-test and post-test KOOS scores, revealing significant improvements. In a similar study by **Joseph A., George M.V. et al.** (2014) in the experimental group, 37 women (74%) had severe knee joint pain at the pretest, while 13 women (26%) had moderate pain. Post-intervention, all 50 women (100%) had moderate knee joint pain. [30] In the control group of the present study, the pre-test KOOS scale scores indicated that 24 adults (48%) had mild scores and 26 adults (52%) had moderate scores. After the intervention, 46 adults (92%) had moderate scores and 4 adults (8%) had severe scores. Similarly, study by **Joseph A, George M.V. et al.** (2014)**, [30]** the control group showed 38 women (76%) with severe pain at the pretest, decreasing to 33 women (66%) with severe pain at the post-test. The mean KOOS scale pre-test score for the experimental group was 81.22, while the post-test mean score dropped to 46.48, indicating a significant reduction ($p<0.05$).

This represents a decrease of 24.81% in the knee injury and osteoarthritis outcome score. Conversely, the control group had a mean pre-test KOOS score of 55.00 and a mean post-test score of 84.04, which was significantly higher ($p<0.05$). This results in an increase of 24.99% in the KOOS score for the control group. Study by **Joseph A., George M.V. et al**. (2014)**,** the experimental group showed a significant reduction in pain scores from 66.14 (pre-test) to 41.00 (post-test), with a significant difference of 28.503 ($p\leq0.001$). whereas in the control group pain scores remained relatively stable, from 65.04 (pre-test) to 64.70 (post-test), with a non-significant difference of 0.526 ($p\leq0.05$). [27]

Quadriceps strengthening exercises have a significant positive effect on reducing symptoms of osteoarthritis and improving function. Hence $\mathbf{H_1}$ is accepted.

5. LIMITATION

The study was limited in Karad Taluka in two villages only.

6. CONCLUSIONS

Quadriceps exercises were effective in decreasing pain and improving the quality of life for adults after exercise. therapeutic exercise should be used to relieve pain, and stiffness improve physical activity for adults and have a healthy lifestyle to improve the quality of life.

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Ethical approval: The study was approved by the Institutional Ethical Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad.

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Conflicts of interest - NIL

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