

RELATIONSHIP BETWEEN PHYSICAL ACTIVITY LEVELS AND PAIN QUALITY IN PATIENTS WITH KNEE OSTEOARTHRITIS

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ABSTRACT

Background

The impact of pain quality on physical activity in people with knee osteoarthritis (KOA) has been investigated in previous studies. Exercise enhances function, reduces pain, and decreases disability. Reduced physical activity is associated with pain, one of the main symptoms of KOA. This study evaluates how pain quality affects physical activity and focuses at clinical and sociodemographic correlations.

Methods

KOA patients (aged 40–70) were enrolled in a cross-sectional study from Sri Ramachandra Hospital's physiotherapy outpatient department. The Douleur Neuropathique 4 (DN4) questionnaire was used to classify the subjects into neuropathic and nociceptive pain groups. Knee range of motion, hamstring and quadriceps strength, pain intensity, and demographic data were all collected. The Global Physical Activity Questionnaire (GPAQ) was used to measure physical activity.

Results

Among 111 participants, the neuropathic group (53) had higher pain severity (5.08 ± 1.06 vs. 4.72 ± 0.97 , $p < 0.05$), reduced knee range of motion (98.77 ± 7.45 vs. 103.97 ± 6.93 , $p < 0.05$), and lower physical activity levels (300.57 ± 198.83 vs. 504.14 ± 204.56 MET-min/week, $p < 0.05$). Physical activity correlated negatively with pain severity ($r = -0.35$, $p < 0.05$) and pain quality ($r = -0.41$, $p < 0.05$) but positively with knee range ($r = 0.29$, $p < 0.05$) and muscle strength ($r = 0.32$, $p < 0.05$).

Conclusion:

Compared to nociceptive pain, neuropathic pain in knee osteoarthritis is related to increased pain intensity, diminished physical function, and markedly decreased levels of physical activity. Enhancing physical activity levels and quality of life in this population requires targeted therapies that address both pain quality and functional limitations.

Key Words:

Knee Osteoarthritis, Physical activity level, Pain quality, DN4, GPAQ

INTRODUCTION

Knee osteoarthritis (OA) is a common degenerative joint condition that mostly affects older persons. It is caused by the knee joint gradually deteriorating and the articular cartilage gradually degeneration. Osteoarthritis (OA) is commonly divided into two types: primary OA, which results from joint degeneration without a known cause, and secondary OA, which is caused by irregular joint stress from past accidents or underlying disorders like rheumatoid arthritis [1,2,3]. Pain is the most prevalent and debilitating symptom of osteoarthritis, a degenerative condition that can cause severe impairment. Individual differences in pain intensity might range from minor discomfort to excruciating, immobilizing pain. [4]

According to the World Health Organization (WHO), 73% of individuals with knee OA are over 55, and 60% of those affected are female, indicating the significant burden of the condition. With 365 million instances worldwide, the knee is the most often impacted joint, followed by the hand and hip. As the tenth most common cause of nonfatal health burden and a major contributor to mobility limits, particularly in women, knee OA is highly a concern. [5]

Knee OA patients frequently have lower levels of physical activity than the general population, with 37% of them being totally inactive, despite the fact that physical activity is essential for controlling the condition. Individuals with knee OA typically have more comorbidities, are more sedentary, and have more obstacles when trying to exercise.[6] In knee OA, there is a complicated and reversible relationship between physical activity levels and pain quality. Regular exercise can enhance joint function and lessen pain, but pain frequently results in reduced physical activity, which supports the cycle of worsening symptoms. Developing successful management techniques that can enhance physical activity levels and pain outcomes in people with knee OA requires an understanding of this relationship.[7]

Although previous research has investigated the link between physical activity and pain in knee osteoarthritis patients, the specific impact of different types of pain—such as neuropathic and nociceptive pain—on physical activity levels has not been thoroughly examined. This study seeks to fill this gap by evaluating how these distinct pain qualities influence physical activity in Knee OA patients and by analysing the relationship between physical activity and various sociodemographic and clinical factors. By distinguishing between neuropathic and nociceptive pain and their respective effects on physical activity level on individual with Knee OA. This study aims to assess the impact of pain quality on physical activity levels in patients with knee osteoarthritis (KOA).

MATERIALS AND METHODS

The observational study was conducted after obtaining approval from Institutional Ethical Committee – **CSP/15/SEP/43/49**. The subjects were recruited from the Physiotherapy – New OPD at Sri Ramachandra Hospital, Chennai, based on the inclusion criteria. The recruitment process began in March 2024 and was completed by July 2024. Subjects who met the following inclusion and exclusion criteria were included in the study.

Participants eligible for the study were adults aged 40 to 75 years of either gender with radiographically confirmed unilateral symptomatic knee osteoarthritis. Only individuals classified as grade 1 or 2 on the Kellgren-Lawrence scale were included. Additionally, participants were required to possess adequate cognitive function and communication skills to comprehend the study procedures and provide informed consent. Individuals were excluded if they presented with acute or chronic cardiac, pulmonary, or systemic disorders that could compromise safe participation in exercise testing. Other exclusion criteria included a history of recent musculoskeletal injury to the lower extremities, active joint infection, recent orthopedic surgery involving the lower limbs, and those who were awaiting total joint replacement surgery.

The study assessed physical activity levels using the Global Physical Activity Questionnaire (GPAQ). Pain quality was evaluated with the DN4 questionnaire, while pain intensity was measured using the Visual Analogue Scale (VAS).

PROCEDURE

The study included 111 subjects who were above 40 years of age. Osteoarthritic subjects who were symptomatic and had radiographically verified unilateral knee osteoarthritis (KOA) were included in the study. Initially, subjects completed baseline interviews and provided demographic data. The subjects were categorized into neuropathic and nociceptive groups using the DN4 questionnaire. A one-time measurement was taken for pain intensity, quadriceps and hamstring strength, and knee joint range of motion. Physical activity level was measured using the GPAQ.

RESULTS

A total of 111 subjects who satisfied the inclusion criteria were included in the study. A detailed history, physical examination, clinical data and outcome measures were collected at baseline. The result is presented as mean $\pm$ standard deviation as appropriate in the following tables.

Table 1: BASELINE DEMOGRAPHIC TABLE OF 111 SUBJECTS

Demographic data	Nociceptive group Mean $\pm$ SD	Neuropathic group Mean $\pm$ SD
AGE	56.53 $\pm$ 7.12	55.26 $\pm$ 8.40
Gender (Male, Female)	20,38	15,38
Body Mass Index	26.72 $\pm$ 3.14	28.11 $\pm$ 3.70
Pain Severity	4.72 $\pm$ 0.97	5.08 $\pm$ 1.06
Symptom duration (in months)	2.17 $\pm$ 1.27	9 $\pm$ 4.65

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Table 1 shows mean age, BMI, symptom duration and pain severity of all 2 groups.

Table 2: COMPARISON OF VARIABLES BETWEEN NOCEPTIVE AND NEUROPATHIC GROUP

	Nociceptive Mean $\pm$ SD	Neuropathic Mean $\pm$ SD	t-value	p-value
Pain severity	4.72 $\pm$ 0.97	5.08 $\pm$ 1.06	1.79	0.03*
Knee range of motion	103.97 $\pm$ 6.93	98.77 $\pm$ 7.45	3.76	0.00*
Body Mass Index	26.72 $\pm$ 3.14	28.11 $\pm$ 3.70	2.13	0.01*
Knee Flexor Muscle power	3.71 $\pm$ 0.45	3.51 $\pm$ 0.49	2.16	0.01*
Knee Extensor muscle power	3.69 $\pm$ 0.46	3.51 $\pm$ 0.49	1.96	0.02*
Physical Activity level	504.14 $\pm$ 204.56	300.57 $\pm$ 198.83	5.26	0.00*

P<0.05* t- test

Table 2 represents the comparison of variables between nociceptive and neuropathic group. A total of 111 subjects were classified based on their pain quality i.e., Nociceptive and Neuropathic. Among 111 subjects, 58 were Nociceptive and 53 were Neuropathic.

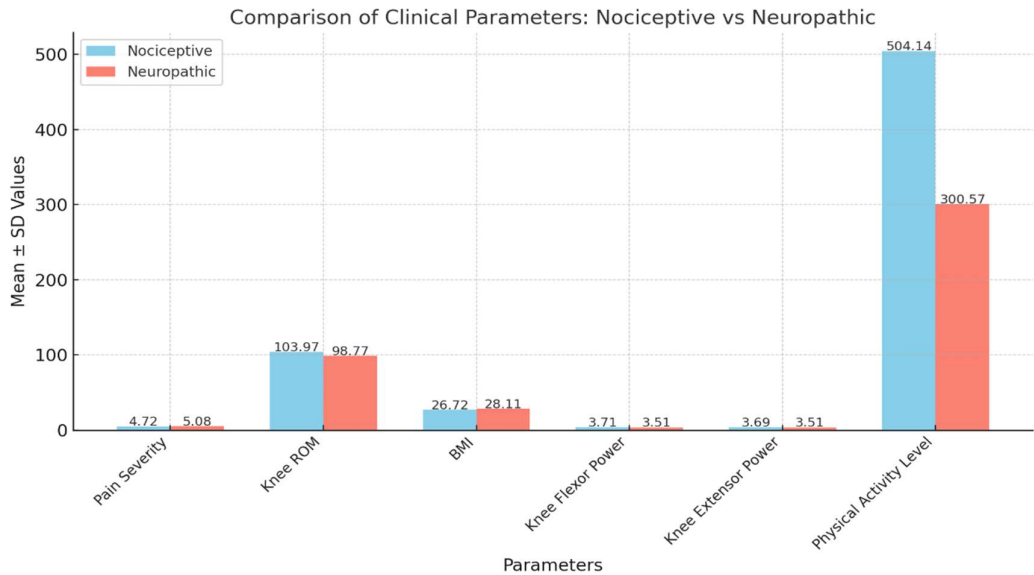
Table 3: ASSOCIATION OF PHYSICAL ACTIVITY LEVEL AND PAIN QUALITY

	PHYSICAL ACTIVITY LEVEL	
	Correlation coefficient	
	R value	P value
Pain severity	-0.35	0.00*
Pain quality	-0.41	0.00*
Knee Range of motion	0.29	0.00*
Knee Flexor Muscle power	0.29	0.00*
Knee Extensor Muscle power	0.32	0.00*

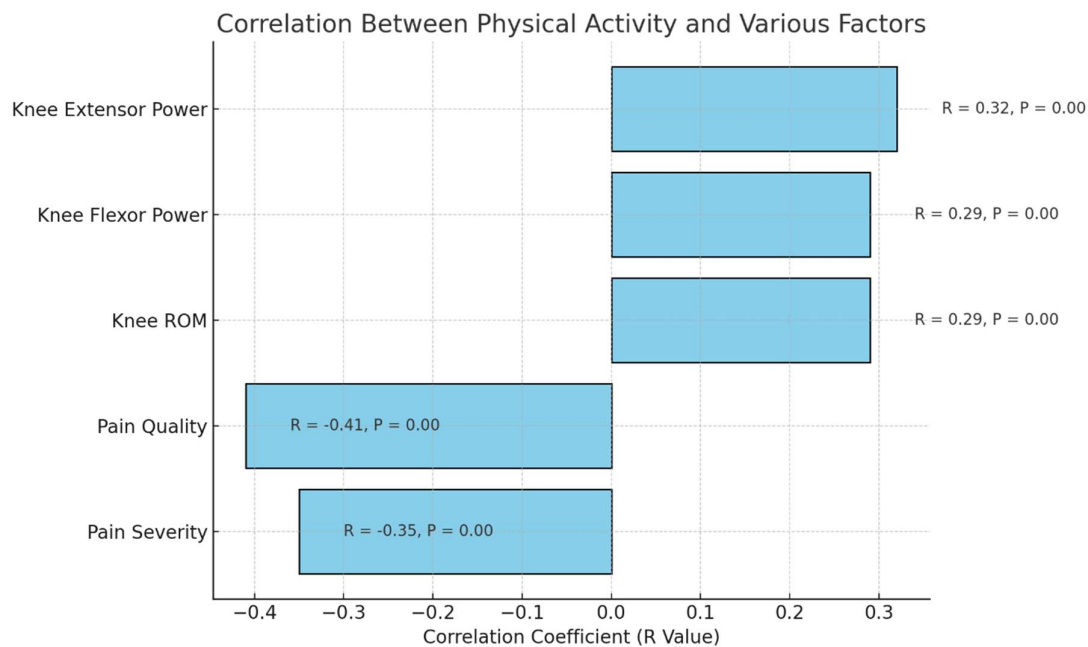
P<0.05* (Pearsons correlation)

Table 3 represents the correlation of physical activity level with various variables. Out of 111 subjects, 33 subjects had moderate level of physical activity which ranges between 600 MET-Minute per week to 1499 MET-Minute per week; 78 subjects had low level of physical activity which ranges below 600 MET-Minute per week and there were no subjects with high level of physical activity.

Graph1: COMPARISON OF VARIABLES BETWEEN NOCEPTIVE AND NEUROPATHIC GROUP



Graph2: ASSOCIATION OF PHYSICAL ACTIVITY LEVEL AND PAIN QUALITY



DISCUSSION

One of the most prevalent joint conditions affecting the elderly is osteoarthritis. Pain, loss of function, and impairment are the results of the ensuing osteophyte growth, cartilage degradation, and alterations to the joint capsule and synovial membrane [8]. Consequently, arthritic patients have lower levels of physical activity and health-related quality of life.[9]

This study investigated the association between physical activity levels and pain quality in patients with knee osteoarthritis (KOA). The findings provide valuable insights into how different pain types—nociceptive and neuropathic—affect physical activity and functional outcomes in this population.

The findings showed that the nociceptive and neuropathic groups were different significantly in terms of knee range of motion, muscle strength, degree of physical activity, and pain intensity. Compared to patients with nociceptive pain, individuals with neuropathic pain showed lower levels of physical activity, decreased muscle power, decreased knee range of motion, and more severe pain. These results demonstrate the major impact of neuropathic pain on physical activity and functional capacity, supporting its significance as a key factor in determining disability in KOA. Physical activity levels and pain severity had a negative correlation ($r = -0.35$,

$p < 0.05$), suggesting that lower levels of physical activity are linked to higher levels of pain. This is supported by earlier studies that indicate pain prevents individuals from participating in physical exercise, which contributes to the cycle of functional deterioration.[10]

Because neuropathic pain involves central sensitization mechanisms that worsen pain perception and lower tolerance to physical activity, it can be very severe. Neuropathic pain is characterized by burning sensations, electric shocks, and tingling.[11]

It's interesting to note that there was a higher link between pain quality and physical activity levels ($r = -0.41$, $p < 0.05$) than there was between pain severity and physical activity. This implies that physical activity behavior may be more significantly influenced by the qualitative aspects of pain than by its intensity. Neuropathic pain patients may have unpredictable, disturbing symptoms that make it difficult for them to participate in prolonged physical exercise, which further encourages sedentary behavior.[12]

Additionally, the study showed that functional measurements such as knee range of motion ($r = 0.29$, $p < 0.05$), knee flexor muscle power ($r = 0.29$, $p < 0.05$), and knee extensor muscle power ($r = 0.32$, $p < 0.05$) were positively correlated with physical activity levels. These results demonstrate the potential advantages of continuing physical activity to maintain muscular strength and joint function in KOA patients. Frequent exercise can reduce the negative consequences of osteoarthritis by improving muscular support around the knee joint, increasing synovial fluid circulation, and reducing stiffness.[13]

The findings also have implications for clinical practice. Clinicians should consider the qualitative aspects of pain when designing rehabilitation strategies for KOA patients. Neuropathic pain, in particular, may require specialized interventions, such as neuromodulatory therapies or pain education, to address central sensitization and improve activity levels.[14] Additionally, incorporating graded exercise therapy and cognitive-behavioural approaches may help patients overcome fear-avoidance behaviours and gradually increase physical activity.[15]

LIMITATION

We acknowledge certain limitations in our research.

- The main limitation is the cross-sectional design's reduced sample size, which increases the risk of selection bias.
- The Global Physical Activity Questionnaire (GPAQ) and other self-reported measures may introduce recall bias, and the cross-sectional design limits concluding about association.

CONCLUSION

This study concludes by underlining the association between physical activity and pain quality in KOA patients. Neuropathic pain tends to have a significant impact on activity levels and functional results, making specific interventions necessary to address its particular difficulties. A key component of managing KOA maintains encouraging physical activity, but specific approaches are required to get through challenges and enhance results. Clinicians can improve this gaining population's quality of life and physical function by treating both nociceptive and neuropathic pain components.

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