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The Impact of Kinesiophobia on Pain, Physical Activity, and Quality of Life Among People with Knee Osteoarthritis: A Systematic Review

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Abstract

Objective: Knee osteoarthritis is a prevalent musculoskeletal disorder that leads to pain, reduced physical activity, and impaired quality of life, particularly among older adults. Kinesiophobia, or fear of movement, is an important psychological factor that may influence these outcomes. This systematic review aimed to investigate the impact of kinesiophobia on pain, physical activity, and quality of life in individuals with knee osteoarthritis. **Methods:** A systematic search of electronic databases including PubMed (Medline), Scopus, CINAHL, Web of Science, ResearchGate, and Google Scholar was conducted for studies published between January 2015 and January 2023. Studies were selected based on predefined inclusion and exclusion criteria. Risk of bias was assessed using the Robvis tool. **Results:** A total of 3880 articles were identified, of which 3130 duplicates were removed. After screening titles, abstracts, and full texts, 13 studies met the eligibility criteria. The findings indicated no consistent statistically significant correlation between pain intensity and Kinesiophobia. However, Kinesiophobia demonstrated a significant negative influence on physical function and activity levels. Reduced physical activity, along with the presence of kinesiophobia and depressive symptoms, was associated with poorer quality of life and increased disability. **Conclusion:** Kinesiophobia plays a significant role in limiting physical activity and functional performance, thereby contributing to disability and reduced quality of life in individuals with knee osteoarthritis. Addressing fear of movement and pain-related beliefs should be an integral component of rehabilitation strategies to improve patient outcomes.

Major Findings: Kinesiophobia was not consistently associated with pain intensity but was significantly associated with reduced physical activity and functional performance in individuals with knee osteoarthritis. Higher kinesiophobia, reduced activity, and depressive symptoms were associated with greater disability and poorer quality of life.

Keywords: Disability, Kinesiophobia, Knee Osteoarthritis, Pain, Physical Activity, Quality of Life

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1. Introduction

Due to the aging population and longer lifespans, individuals are experiencing extended life durations and heightened vulnerability to non-communicable ailments, notably conditions affecting the musculoskeletal system[1]. In 2017, Musculoskeletal (MSK) disorders held the fifth position in terms of Disability-Adjusted Life-Years (DALYs) among all illnesses, and they stood at the top for years lost due to disability on a global scale. These disorders are prevalent across age groups, ranging from adolescents to the elderly[2]. The prevalence of

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musculoskeletal disorders rises with advancing age and constitutes the fourth major contributors to the overall disease burden in the elderly, following cardiovascular diseases, malignant neoplasms, and chronic respiratory diseases[1].

Musculoskeletal disorders are incapacitating ailments that notably hinder health status, particularly among older individuals, as they are linked to discomfort, mobility limitations, heightened chances of falls and fractures, and compromised capacity or inability to execute daily tasks[3].

Five prevalent conditions, encompassing Rheumatoid Arthritis (RA), Osteoarthritis (OA), Low Back Pain (LBP), Neck Pain (NP), and gout, are distinguished, while the remaining are grouped under the classification of 'other musculoskeletal disorders[2]. According to the WHO Scientific Group on Rheumatic Diseases, approximately 10% of the global population aged 60 or above experience notable clinical issues directly linked to Osteoarthritis (OA)[4].

Osteoarthritis (OA) is a chronic degenerative disease of the articular cartilages of synovial joints[6]. OA can be defined as a condition characterized by focal areas of loss of articular cartilage within the synovial joints, associated with hypertrophy of the bone (osteophytes and subchondral bone sclerosis) and thickening of the capsule[4]. In the advanced stages of Osteoarthritis (OA), the articular cartilage undergoes pathological transformations such as becoming softer, developing ulcers, and experiencing localized disintegration. Additionally, there is a possibility of inflammation affecting the synovial tissue[5].

Because it tends to affect joints in the lower extremities like the hip and knee, Osteoarthritis (OA) is the primary reason for lower limb disability in the elderly. The projected likelihood of experiencing knee OA over a lifetime is around 40% for men and approximately 47% for women[6]. Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India[5]. Globally, the collective influence of osteoarthritis in the knee and hip was positioned as the eleventh major contributor to disability among 291 different diseases[7].

Joint pain and stiffness are the prevailing indications of Osteoarthritis (OA). While these symptoms might initially appear on one side of the body, the majority of individuals affected by OA will eventually encounter the condition bilaterally[7]. Pain and stiffness, particularly after exercise, are the major symptoms, resulting in considerable impact on ability to perform activities of daily living[8]. The estimates of symptomatic Osteoarthritis (OA) prevalence are reduced since its identification is determined by a combination of factors including symptoms like pain, discomfort, and stiffness, along with radiographic characteristics[6].

Research has indicated an absence of connection between radiographic results and the intensity of pain in individuals with knee Osteoarthritis (OA). However, a limited association has been noted between radiographic findings and levels of disability[9]. The development of joint osteoarthritis is influenced by factors such as advanced age, being female, being overweight or obese, experiencing knee injuries, engaging in repetitive joint use, having lower bone density, muscle weakness, and increased joint laxity[10].

The degeneration of the knee joint, combined with pathological interactions and psychological elements, can significantly impact both pain and physical limitations. It is widely acknowledged that individuals dealing with chronic pain and disability tend to develop heightened apprehension towards movement or potentially harmful actions. This prominent cognitive aspect can consequently lead to anxiety and depression among those with knee osteoarthritis[11]. Among the many biopsychosocial factors which contribute to the experience and impact of pain, negative or maladaptive psychological factors (ex: fear) are among the most important.

Kinesiophobia (also known as fear of movement) is defined as an excessive, irrational and debilitating fear to carry out a physical movement, due to a feeling of vulnerability to a painful injury or reinjury[12,13]. Based on the fear avoidance model, when pain is perceived as threatening, pain catastrophizing occurs, which may develop pain related fear and anxiety, in turn leading to avoidance behaviour. Subsequently, avoidance behaviour as an adaptation to pain in the long term would develop disuse, disability, and depression[13].

Important factors in managing pain involve comprehending its origin, recognizing a patient's personal perceptions of pain, and being informed about effective methods for managing and confronting pain. A patient's attitudes towards pain can significantly influence their capacity to embrace strategies for pain management and address the challenges posed by their impairments. This fear creates an obstacle when physical activity is recommended for treatment, leading to important clinical consequences like decreased adherence to the prescribed regimen and the persistence of negative pain-related encounters[10].

Raising levels of physical activity holds significance in both the management of the condition and in tackling accompanying health issues like obesity, heart disease, and diabetes, which frequently coexist in individuals with knee osteoarthritis. While a qualitative study of individuals with knee osteoarthritis explored the hindrance posed by movement-related fear on physical activity, the connection with real physical activity hasn't been examined yet[14].

Constrained physical activity negatively impacts mental health and overall quality of life. Gaining advantages from exercise and physical activity has demonstrated the ability to cultivate optimistic attitudes and drive for sustaining an active lifestyle. Thus, understanding self-directed management becomes crucial to prevent the limitation of daily activities, as failing to do so could lead to a harmful cycle involving reduced activity, weakened muscles, weight gain, decreased social interaction, feelings of depression, heightened pain, and compromised functional abilities[15].

Certainly, an increased level of kinesiophobia is indicative of higher pain levels. Additionally, longitudinal investigations have indicated that elevated kinesiophobia levels at the outset are linked to unfavorable shifts in quality of life, as well as favorable changes in disability and pain[12].

Since there is a requirement to assess the literature that substantiates the impact of kinesiophobia on pain, knee function, and quality of life in individuals with knee osteoarthritis, this systematic review aims to achieve that objective.

2. Objective

This review aims to uncover the influence of kinesiophobia on pain, physical activity, and quality of life in individuals dealing with knee osteoarthritis.

3. Methodology

This systematic review was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO; Registration No. CRD420250566954) before commencement of the review.

3.1 Inclusion Criteria

- **Population:** Studies including adults (≥18 years) diagnosed with knee osteoarthritis.
- **Intervention/Exposure:** Studies evaluating the impact of kinesiophobia (fear of movement or reinjury) on pain, physical activity, and quality of life.
- **Outcome measures:** Studies reporting at least one of the following outcomes — pain intensity, physical activity levels, or quality of life.
- **Study design:** Randomized controlled trials, cohort, and cross-sectional studies.
- **Publication type:** Peer-reviewed journal articles, dissertations, conference papers, and relevant grey literature sources such as theses or institutional reports, if full text and sufficient methodological details were available.
- **Language:** Studies published in English.
- **Time frame:** Publications from 2015 to 2023.

3.2 Exclusion Criteria

- **Population:** Studies involving participants with other types of arthritis or joint diseases, unless data specific to knee osteoarthritis can be extracted separately.
- **Intervention/Exposure:** Studies that do not specifically assess kinesiophobia or that use non-validated measures.
- **Outcome Measures:** Studies that do not report relevant outcomes (pain, physical activity, or quality of life) or lack sufficient data for extraction.
- **Study Design:** Case reports, case series, narrative reviews, editorials, and expert opinions.
- **Publication Type:** Non–peer-reviewed articles, abstracts without full texts, or grey literature sources lacking methodological transparency or complete data.

3.3 Eligibility Criteria

Individuals diagnosed with knee osteoarthritis were incorporated as participants in the study.

- **Outcome**
  - Primary Outcome: To evaluate the degree of kinesiophobia in individuals with knee osteoarthritis.
  - Secondary Outcome:
- To measure the extent of pain, physical activity, and quality of life in patients with knee osteoarthritis.
- To examine how kinesiophobia impacts the levels of pain, physical activity, and quality of life in patients with knee osteoarthritis.
- **Study Setting**

The studies conducted within Health care setup, residential homes etc were included.

- **Language**

Research papers published in the English language were incorporated.

- **Information Sources**
- The electronic databases PubMed, Scopus, Web of Science, CINAHL, and Google Scholar were searched from January 2015 to December 2023. The final search of all databases was conducted on 15 December 2023. Database-specific search strategies were adapted according to the indexing and search functionalities of each database. Medical Subject Headings (MeSH) were used where applicable, and keyword-based searches were employed for databases not supporting MeSH terms.
- Studies conducted between 2015-2023 were included.

3.4 Search Strategy

("Osteoarthritis, Knee"[Mesh]
OR knee osteoarthritis[tiab]
OR degenerative arthritis[tiab]
OR degenerative joint disease[tiab])
AND
("Kinesiophobia"[Mesh]
OR kinesiophobia[tiab]
OR "fear of movement"[tiab]
OR "fear of pain"[tiab])
AND
("Pain"[Mesh]
OR pain[tiab]
OR "Physical Activity"[Mesh]
OR physical activity[tiab]
OR "Motor Activity"[Mesh]
OR movement[tiab]
OR exercise[tiab]
OR "Quality of Life"[Mesh]
OR quality of life[tiab]
OR "health-related quality of life"[tiab]
OR wellbeing[tiab])

3.5 Study Selection

- Two staged selection process was done independently by two reviewers.
- In the first stage, titles and abstracts of identified studies were checked for applicability and any conflict of interest was resolved by the discussion with the 3rd researcher.
- In the second stage the eligible studies were independently reviewed by two reviewers separately

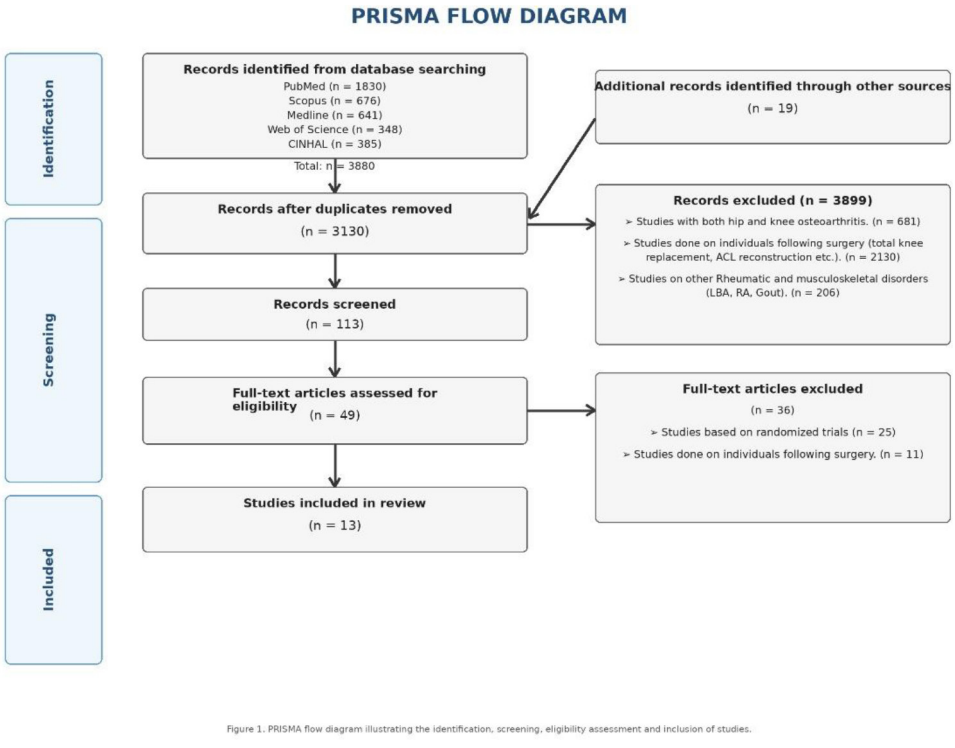


Figure 1. PRISMA flow diagram illustrating the identification, screening, eligibility assessment, and inclusion of studies in the systematic review.

and the final selection was made by viewing the full-text articles as per the eligibility criteria.
- All these steps were performed for four wee.

3.6 Risk of Bias Assessment

Randomized controlled trials were assessed using the Cochrane Risk of Bias 2 (RoB 2) tool, while cross-sectional and cohort studies were evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists. Two reviewers independently conducted the assessments, and any disagreements were resolved through discussion or consultation with a third reviewer.

4. Data Analysis

The results of the risk of bias assessment and data extraction are summarised in a table. In the process of data extraction, if we missed any data in the included studies, we communicated with the author.

4.1 Risk of Bias in Included Studies

Thirteen studies were included in the risk of bias assessment, comprising one randomized controlled trial, ten cross-sectional studies, and two cohort studies. The randomized controlled trial demonstrated an overall low risk of bias. Most cross-sectional and cohort studies were judged to have a moderate risk of bias, primarily due to their observational design, limited control of confounding variables, and reliance on self-reported outcome measures. Overall, the methodological quality of the included studies was considered acceptable for narrative synthesis.

5. Results

From the exploration of databases, a total of 3880 publications were obtained. Among these, 3130 duplicates were identified and removed due to their irrelevance as determined by their titles and abstracts. Ultimately, 13 articles were deemed suitable following a comprehensive evaluation of their full texts.

Within the provided data, research was conducted in various locations including Maharashtra (Mumbai), Saudi Arabia, Finland, Turkey, Brazil, the USA (Chicago), and Japan. The majority of the studies encompassed cross-sectional designs (n=10), while there were two prospective cohort studies and one randomized trial study.

The studies included individuals within the age range of 35 to 80 years who self-reported experiencing pain lasting over a span of 3 months. In general, participants were not considered if they had encountered musculoskeletal ailments other than knee osteoarthritis in either or both limbs within the past 6 months, had undergone previous surgery on their lower extremities or lower back, had neurological conditions, or were on a consistent regimen

Table 1. Risk of bias assessment

Study Number	Random Sequence Generation	Allocation Concealment	Blinding of Participants And Personnel	Blinding of Outcome Assessment	Incomplete Outcome Data	Selective Reporting	Other Source of Bias	Over All
1	No information	No information	No information	No information	High	Low	High	Unclear
2	No information	Low	No information	Low	Low	Low	Low	Low
3	No information	No information	No information	No information	High	Low	High	High
4	No information	No information	Low	No information	Low	Low	Low	Low
5	No information	No information	No information	No information	Low	Low	Low	Low
6	No information	No information	No information	No information	Low	Low	Low	Low
7	No information	No information	Low	No information	Low	Low	High	Low
8	No information	No information	Low	No information	Low	Low	Low	Unclear
9	No information	No information	Low	No information	Low	Low	Low	Low
10	No information	Low	Low	No information	Low	Low	Low	Low
11	No information	No information	Low	No information	Low	Low	High	Low
12	No information	No information	Low	No information	Low	Low	Low	Low
13	No information	No information	Low	No information	Low	High	Low	Low

Table 2. Evidence synthesis table

Author Name	Type of Study	Year of Study	Number of Participants	Outcome Measures	Results
Mastour Saeed Alshahrani *et al.*[11]	Cross sectional study	2022	50 participants	TSK-17, VAS, sit-to-stand test:-functional performance, digital inclinometer:- knee Joint Position Sense (JPS)	The research findings suggest a direct correlation between kinesiophobia and knee-related factors. This implies that heightened kinesiophobia is linked to greater knee pain and diminished JPS and functional capabilities.
Manolya Acar *et al.*[16]	Cross sectional study	2022	60 participants	TSK-17, VAS, Nottingham Health Profile (NHP):- quality of life, WOMAC, Hospital Anxiety and Depression Scale (HADS):- anxiety and depression, Berg Balance Scale, TUG, IPAQ:- physical activity	The research findings indicate that kinesiophobia is linked to factors such as quality of life, disability, and depression. However, there is no statistically significant correlation observed between kinesiophobia and parameters such as pain intensity, muscle strength, ROM, physical activity level.
Ozan GÜR *et al.,*[17]	Cross sectional, correlational type of study	2021	18 participants	Modified Mini-Mental Test:-cognitive status, TSK-17, Pain Catastrophizing Scale (PCS), NPRS, ROM Testing, Sit to Stand Test, TUG, Stair Climb Test:-Lower extremity strength test	Kinesiophobia was identified to have a significant correlation with pain intensity during physical activity, the angle of active knee flexion, the time taken for the 5 Times Sit-to-Stand test, and TUG test ($p<0.05$). In contrast, there was no statistically significant correlation observed between pain catastrophizing and the results of functional tests ($p>0.05$).
Miloni Banker *et al.,*[18]	Cross-sectional, correlational type of study	2020	40 participants	Multidirectional Reach test:- Postural stability, 9-Step stair climb test, PCS:-Pain catastrophizing, TSK-17, PSEQ:- self-efficacy	A notable finding is the strong negative correlation between forward reach and both pain catastrophizing and kinesiophobia, while a significant positive correlation is observed with pain self-efficacy. Additionally, there is a significant positive correlation between functional performance, as measured by stair climb test time, and both pain catastrophizing and kinesiophobia.
Eeva-Eerika Helminen *et al.,*[19]	A longitudinal cohort study of five years	2020	108 participants	WOMAC, RAND-36 subscales:-physical and mental component; BAI; TSK-17; PCS; PSEQ; LS: life satisfaction; SOC: sense of coherence; GAC: global assessment of change.	Elevated pain catastrophizing was found to be a significant predictor of increased WOMAC pain scores, while kinesiophobia was associated with diminished functioning in both the mental and physical component summaries of the RAND-36 assessment.

Table 2. Continued...

Author Name	Type of Study	Year of Study	Number of Participants	Outcome Measures	Results
Burcu Aydemir *et al.,*[20]	Cross sectional study	2020	37 participants	isokinetic dynamometer:- muscle strength, TSK-17, KOOS,University of California Los Angeles (UCLA) activity rating scale.	Knee flexion strength showed an indirect connection with physical activity levels, primarily due to its relationship with kinesiophobia rather than pain. Among individuals with Knee OA, those with greater knee extension strength tended to have lower TSK scores. Furthermore, a lower TSK score was associated with higher UCLA scores, while considering the influences of pain and strength.
Melek Aykut Selcuk *et al.,*[9]	Cross sectional study	2020	96 participants	VAS, TSK-17 and BFOM, Beck Depression Inventory (BDI), WOMAC, IPAQ short form, and quality of life by SF-12.	Diminished quality of life and heightened disability were influenced by low physical activity levels, depression, and kinesiophobia. Notably, pain intensity did not exhibit any correlation with the TSK-17 score among these patients. The elevated level of kinesiophobia observed could potentially be attributed to the high levels of pain and depression, as well as the reduced physical activity levels within this patient group.
Daisuke Uritani *et al.,*[14]	a randomized controlled trial	2020	167 participants	Accelerometer based device for no of steps. Depression Anxiety Stress Scale, Arthritis Self-Efficacy Scale,BFOM, and PCS	The study findings suggest that the extent of physical activity, as measured by the average daily step count, might be linked to individuals' fear of movement, pain catastrophizing, and potentially their self-efficacy for managing symptoms in those with knee OA.
Hasan KILINÇ *et al.,*[21]	Cross sectional, correlational type of study	2019	200 participants	Oxford Knee Score (OKS). Six-Minute Walk Test (6-MWT). International Physical Activity Questionnaire-Short Form (IPAQ-SF), TSK-17, BDI.	The study underscores the importance of evaluating and implementing innovative rehabilitation approaches in individuals with knee OA due to the combination of low functional status, elevated depression, and increased kinesiophobia, all of which have an impact on physical activity levels within this population.
Isabel A. C. Baert *et al.,*[22]	Cross-sectional, correlational type of study	2017	109 participants	PCS, TSK-17, and Pain Coping Inventory, isometric and isokinetic knee muscle strength measurements, VAS, WOMAC, and functional tests.	Increased kinesiophobia and reduced utilization of an active coping approach were linked to lower levels of isometric knee extension strength. Notably, psychosocial factors explained less than 3.8% of the variation observed in both knee pain and physical performance in this study.

Table 2. Continued...

Author Name	Type of Study	Year of Study	Number of Participants	Outcome Measures	Results
Nuray Alaca *et al.*,[23]	descriptive cross-sectional study	2019	78 participants	VAS, WOMAC, Lequesne Index (LI), TSK-17	In the present research, kinesiophobia was prevalent, and the study identified positive associations between TSK scores and WOMAC scores. Additionally, there was an inverse correlation observed between PBQ-Pscores and individuals' functional/ clinical status. Furthermore, psychological pain beliefs scores tended to decrease as the disease's severity increased, and they exhibited a mild correlation with both functional and clinical status.
Dave P Thompson *et al.*,[24]	Cross sectional study	2016	58 participants	KOOS-ADL, modified Chronic Pain Self-efficacy Scale (CPSS), TSK-17, Modified Version of the survey of Activities and Fear of Falling in the elderly (MSAFFE) questionnaire, Consequences of falling scale (COFS).	Higher levels of pain and stiffness have a more pronounced impact on the disability levels of individuals with an elevated BMI due to increased mechanical stress on the knee joint. Focusing on factors related to falls or cognitive aspects is unlikely to be an effective approach for enhancing disability outcomes related to osteoarthritis of the knee.
Eeva-Eerika Helminen *et al.*,[25]	a one-year prospectivecohort study	2015	111 participants	WOMAC, RAND-36 subscales, Life Satisfaction scale, TSK-17, BDI, PCS, Beck Anxiety Inventory, Sense of Coherence scale.	Unfavorable emotional states and pain-related expectations emerged as significant predictors in knee osteoarthritis. Individuals with a lower inclination for pain catastrophizing experienced less pain according to WOMAC scores. Moreover, lower scores on the TSK were associated with improved general (RAND-36 function, mental, and physical summaries) and condition-specific (WOMAC) functional symptoms.

of corticosteroids or had contraindications to undergoing Magnetic Resonance Imaging (MRI).

5.1 Role of Kinesiophobia on Pain

Research findings indicate that psychological elements, including anxiety and depression, are prevalent among individuals with osteoarthritis, and these factors significantly contribute to the persistence of pain[9].

Considering that individuals with knee osteoarthritis encounter variations in pain, which tend to be enduring rather than escalating with time, it is reasonable to speculate that the heightened apprehension of engaging in activities due to the anticipation of painful episodes might have a more notable impact on the observed reduced levels of physical activity in this group[20].

Researchers assessed pain severity at rest or during activity using tools like the Visual Analogue Scale (VAS), Numerical Pain Rating Scale (NPRS), and WOMAC pain scores. Findings reveal that none of the examined psychosocial factors are individually linked to knee pain or physical performance[21].

Ten studies conducted cross-sectional analyses to examine the connection between kinesiophobia and pain intensity. Among them, a portion of the studies demonstrated that there was no statistically significant correlation between pain intensity and kinesiophobia.

The TSK scores exhibited a mild positive correlation with age, BMI, WOMAC, LI, and PBQ-O (physiological pain) scores (each with $p<0.05$). Conversely, a mild negative correlation was observed with PBQ-P (psychological pain) scores ($p<0.05$)[23].

Earlier studies have noted that gradually increasing physical activity can lead to increased pain intensity among individuals with knee pain. Additionally, knee Osteoarthritis (OA) patients displaying high levels of pain catastrophizing tend to experience more intense pain related to their activity. These findings align with the observation that physical activity exacerbates pain in knee OA patients and that persistent knee pain can result in reduced quality of life and disability. A study focusing on kinesiophobia revealed that moderate levels of kinesiophobia were linked to increased pain intensity and increased disability among individuals with knee pain.[23] Based on our observations from the derived model, catastrophizing, self-efficacy, and kinesiophobia collectively account for 71% of the variability in the scores of pains and physical function subcategories. Kinesiophobia directly and significantly influences the scores of pains and physical function subcategories with a magnitude of 0.45[25].

Findings revealed that individuals with Osteoarthritis (OA) exhibited elevated levels of kinesiophobia and organic pain beliefs. However, those with lower psychological pain beliefs experienced a more compromised functional status[23].

Certain studies have shown a connection between increased pain and reduced physical activity in individuals dealing with knee osteoarthritis, although contrasting findings have also been reported[14].

5.2 Physical Activity

Maintaining the capacity to carry out everyday tasks is crucial for effectively addressing pain and disability caused by the disease in individuals with osteoarthritis. However, patients experiencing kinesiophobia might be hesitant to participate in physical activities[23].

The qualitative investigation has shown that the fear of pain acts as a psychological obstacle, inhibiting individuals with knee osteoarthritis from participating in physical activities.

Fear of movement and pain catastrophizing were linked to activity levels even after accounting for pain intensity. This implies that an individual's perspective on pain, rather than the actual severity of pain, is connected to their engagement in physical activity[14]. The majority of earlier research on osteoarthritis primarily relied on questionnaires to evaluate physical activity, instead of employing more precise techniques like accelerometry. Additionally, these studies often did not account for potential confounding demographic variables such as education level and employment status that could impact the observed associations[14]. The results of the study suggest that knee pain is a notable indicator of isokinetic knee extension strength during high-speed movements (240 degrees/second), accounting for 7.3% of the diversity in muscle strength[22].

In a conducted cross-sectional study, physical activity levels were categorized as low in 68.4%, moderate in 27.7%, and high in 3.9% of patients exhibiting high-level kinesiophobia. Similarly, physical activity was categorized as low in 46.2%, moderate in 23.1%, and high in 30.7% of the group displaying low-level kinesiophobia. A statistically significant distinction between the two groups was observed ($P=0.004$)[9].

The investigation revealed that diminished physical activity, along with depression and kinesiophobia, played a role in diminishing quality of life and escalating disability[9].

5.3 Quality of Life

The study identified that lack of physical activity among knee osteoarthritis patients led to a decline in quality of life and an upsurge in disability. The researchers also noted that patients with KL grade 2 and higher (according to the Kellgren-Lawrence Osteoarthritis Classification System) were more prone to develop significant kinesiophobia. Furthermore, the impact of the radiological grade on both disability and quality of life was notable.

Research carried out on individuals with chronic pain has indicated that women tend to experience elevated pain intensity and depression, increased disability, reduced physical activity levels, and lower quality of life. Moreover, they established that kinesiophobia was linked to depression and quality of life for both genders, and it was also connected to disability in women and higher age in men[9].

In a cross-sectional investigation, the regression analysis unveiled that a substantial portion of the diversity in the Tampa Scale of Kinesiophobia (17.9%) could be attributed to quality of life alone. Furthermore, an extra 16.5% of the alterations in the Tampa Scale of Kinesiophobia were accounted for by changes in

disability. These results emphasize the importance of closely tracking quality of life and disability status within rehabilitation programs aimed at enhancing movement confidence among individuals with osteoarthritis[16]. The study findings underscored the significance of evaluating and introducing inventive rehabilitation approaches within the knee osteoarthritis population due to the impact of low functional status, elevated depression, and kinesiophobia on physical activity levels[21].

6. Discussion

Osteoarthritis (OA) stands as the prevailing type of arthritis, characterized by joint inflammation and substantial structural alterations that result in pain and impaired functional ability[8]. Osteoarthritis can be found unpredictably among the elderly population, with a higher prevalence in females aged 45 and above. In contrast, males tend to experience OA more frequently before the age of 45[5]. The occurrence of knee osteoarthritis is widespread and increases as individuals grow older. In comparison, hip Osteoarthritis (OA) is not as commonly seen[8].

Psychological distress, both in general and specifically related to pain, can have an adverse impact on the quality of life, disability levels, and effectiveness of treatments in people dealing with OA. The pain associated with OA is probably influenced by multiple factors, including alterations in pain processing within the central nervous system, along with psychological and cognitive elements[26].

Among them kinesiophobia is one of the crucial factors that cause pain and worsening of function after Total Knee Arthroplasty (TKA). Hence, it is essential to assess kinesiophobia and establish its correlation with pain and functioning in osteoarthritis cases[17].

The analysis of data gathered from the studies included in this systematic review provided evidence to confirm the theory that kinesiophobia is linked to the severity of pain and significantly influences physical activity and the overall quality of life in individuals suffering from knee osteoarthritis.

As per the findings of the cross-sectional study, there is a positive correlation between kinesiophobia and factors such as knee pain intensity, knee Joint Position Sense (JPS), and functional performance. Additionally, the results of the regression analysis indicated that kinesiophobia is a noteworthy predictor of the level of pain intensity[11]. However, contrary to this, different research studies demonstrated no significant statistical link between kinesiophobia and variables like pain intensity, physical activity level, and mobility. In the study, the lack of a direct connection between kinesiophobia and pain intensity, as evaluated through the use of a Visual Analog Scale (VAS), does not necessarily imply that pain is not a factor contributing to kinesiophobia[16].

The "Intensity of pain" and the "presence of pain" are two different concepts. In the research, a direct correlation was observed between kinesiophobia and the aspect of pain presence that was examined as a component of the quality-of-life assessment. This implies that the existence of pain could potentially trigger kinesiophobia, yet it remains challenging to definitively determine the impact of pain severity on the development of kinesiophobia."

However, both research studies indicated that individuals who exhibited elevated levels of kinesiophobia experienced heightened pain intensity. Patients with heightened kinesiophobia also demonstrated increased pain intensity during periods of rest, nighttime, and physical activity[9].

The TSK-17 score was connected to the severity of pain experienced during activities and while at rest in individuals diagnosed with knee osteoarthritis[23]. The research demonstrated that while there wasn't a straightforward link between pain intensity and the TSK-17 score, patients with elevated levels of kinesiophobia exhibited notably greater activity-related pain intensity[9,22].

Long-term kinesiophobia can lead to muscle fatigue and disuse atrophy, create a vicious loop, and impair functional performance[11]. These results align with the fear-avoidance model, suggesting that certain patients may develop a fear of movement or adopt unhelpful ways of coping in response to their pain. Over time, this avoidance of physical activity and subsequent lack of movement can lead to physical changes such as muscle weakness[18]. Weakness in the muscles could potentially amplify the feeling of instability in the knee joint, impacting one's confidence in the knee's stability. This heightened sense of instability might trigger an intensified fear reaction to specific movements, subsequently leading to reduced physical activity[20].

Researchers have employed distinct functional assessments to evaluate the physical activity of the population, including evaluations like the sit-to-stand test, the 9-step stair climb test, and the 6-minute walk test. In some cases, advanced tools like the isokinetic dynamometer were utilized to measure lower extremity

muscle strength, while accelerometers were employed to monitor the count of steps taken by individuals. Moreover, numerous researchers solely relied on self-reported questionnaires such as WOMAC and IPAQ for their evaluations.

The majority of prior research on Osteoarthritis (OA) examined physical activity through surveys instead of employing more concrete techniques like accelerometry. Additionally, these studies often did not adequately consider additional demographic variables that could potentially impact the connection, such as educational attainment and employment situation[14].

It was determined that the active knee flexion angle decreased as the kinesiophobia levels increased. Furthermore, the strength of knee flexion and extension had an indirect impact on the level of physical activity by affecting kinesiophobia[20]. Pain catastrophizing, kinesiophobia, and the utilization of active coping mechanisms individually serve as predictors for isometric knee extension and flexion strength[22].

This outcome suggests that kinesiophobia might restrict active knee mobility and have an adverse impact on the functional condition of individuals dealing with knee osteoarthritis[17]. Earlier research has similarly indicated that alterations in knee muscle strength that develop over time are linked to restrictions in activities, even when considering knee pain in osteoarthritis cases. Studies support the notion that underlying muscle deficiencies combined with kinesiophobia play a more substantial role in impeding physical activity compared to solely relying on self-reported pain levels[20]. Self-reported knee instability (sensation of buckling, shifting, or giving way of the knee) has been found to be associated with functional limitations as well as knee pain and muscle strength[20].

The notable correlation between movement-related fear and the extent of physical activity suggests that the fear of movement could serve as a significant indicator for forecasting the level of physical activity, as indicated by the results of the regression analysis[21]. In the preoperative phase, patients with high kinesiophobia exhibited more impaired preoperative functional abilities[14].

If the fear-avoidance behavior developed in response to pain persists, it could result in psychological issues like anxiety, depression, and heightened vigilance, which, in turn, may lead to constraints in everyday life and work-related tasks, as well as muscle weakening and weight gain due to reduced physical activity. Ultimately, these factors could contribute to a deterioration in both disability levels and overall quality of life[9].

Many quality-of-life assessments inquire about patients' fundamental capabilities, and the presence of disability is a primary factor contributing to the decline in quality of life. Nonetheless, it's important to acknowledge that not every individual experiencing disability also experiences kinesiophobia[16].

Based on the findings from a five-year follow-up investigation, tendencies to avoid activities, heightened pain levels, increased comorbidity, advanced age, prolonged disease duration, and diminished muscle strength and joint motion range at the initial assessment were indicative of greater likelihood for future activity limitations in patients with knee osteoarthritis[19]. Our discovery revealed a connection between BFOM score, disability, and quality of life. Moreover, as the BFOM score increased, it had a negative impact on both the mental and physical functional abilities of the patients[9].

Literature reviews have shown that obesity elevates the likelihood of knee Osteoarthritis (OA) due to mechanical strain. Conversely, weight loss exhibits structural influences on articular cartilage, consequently postponing the onset of knee OA. A high BMI is linked with diminished physical capability, while consistent physical activity enhances functional well-being and diminishes discomfort[9,27].

Possibly, in patients with a higher BMI, the impact of pain and stiffness on disability levels could be more pronounced due to increased mechanical stress on the knee. As a result, this might lead to cognitive and falls-related factors exerting a relatively lesser influence on disability levels when compared to other population groups[24]. Given the rising prevalence of obesity and its association with the development of Osteoarthritis (OA), it's probable that a larger number of individuals will experience knee OA in the coming years[6].

There was no observable link between kinesiophobia and the extent of the disease, as assessed by Kellgren-Lawrence scores, among obese patients with Osteoarthritis (OA). The research also highlighted that fear associated with pain acted as a reinforcement for psychological obstacles and led to a reduction in walking pace. Within the study, kinesiophobia was prevalent, and positive connections were identified between TSK scores and WOMAC scores[23].

Moreover, longitudinal investigations have revealed that elevated levels of kinesiophobia at the initial

assessment forecast unfavorable shifts in quality of life, along with favorable changes in disability and pain[12]. On the other hand, a notable connection was identified between heightened pain and joint stiffness, and elevated levels of disability. It is plausible that a bidirectional relationship exists between these factors, where participants initially reduce their activity levels due to pain and stiffness. Subsequently, this reduction in activity could lead to physical deconditioning, ultimately resulting in increased pain and stiffness[24].

In the context of managing knee Osteoarthritis (OA) through the biopsychosocial approach, it is essential to address both the physical and psychosocial limitations while tailoring treatment plans to the unique needs of each patient[22].

Reports suggest that the gradual increase in physical activity can exacerbate pain intensity in individuals experiencing knee pain, particularly in cases of knee Osteoarthritis (OA) where there is a high level of pain catastrophizing. This implies that physical activity can amplify pain in knee OA patients and highlights how chronic knee pain can lead to disability and a diminished quality of life[9].

Hence, creating strengthening interventions that incorporate a gradual introduction of movements or activities that individuals with lower limb Osteoarthritis (OA) might be apprehensive about could potentially yield improved physical outcomes over the long term. Distinguishing between assessments of pain-related fear and pain intensity separately could aid in comprehending why a patient might opt to avoid specific activities[20].

For individuals with knee Osteoarthritis (OA), a treatment approach that combines pain-coping skills training with exercise therapy resulted in enhanced patient outcomes[22].

7. Conclusion

This systematic review has uncovered a connection between a higher degree of kinesiophobia and increased levels of pain intensity, greater disability, reduced physical activity, and a lower quality of life in individuals with knee Osteoarthritis (OA), as indicated by cross-sectional study analyses. The fear of movement negatively impacts physical activity and functional well-being, contributing to disability, which significantly undermines the overall quality of life in OA knee patients. These findings underscore the importance of clinicians assessing kinesiophobia in OA knee patients, as it can affect their adherence to exercise therapy, a crucial aspect of the recovery process. It should also be considered when planning and implementing rehabilitation programs for individuals with knee OA. Therefore, individual differences in pain beliefs and attitudes should be taken into account during assessment and treatment planning.

Given the limited number of longitudinal studies included in this review and the relatively low level of evidence obtained from the analysis, causality was not definitively established. Consequently, further longitudinal studies are warranted to delve deeper into these relationships.

8. Future Recommendation

The review recommends further meta-analyses to be done in order to improve the study's validity.

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8.2 Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

8.3 Acknowledgement

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8.4 Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. The authors confirm that they have no financial, personal, or other relationships with individuals or organizations within the past two years that could inappropriately influence, or be perceived to influence, the work reported in this manuscript.

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Author Contribution

Conceptualization, Anusha V Shenai and Stephiya Davis; methodology, Anusha V Shenai and Nireeksha N Shenoy; software, Preethi; validation, Stephiya Davis and Nireeksha N Shenoy; formal analysis, Anusha V Shenai and Preethi; investigation, Stephiya Davis and Preethi; resources, Anusha V Shenai and Stephiya Davis; data curation, Nireeksha N Shenoy and Preethi; writing—original draft preparation, Anusha V Shenai and Preethi; writing—review and editing, Stephiya Davis and Nireeksha N Shenoy; visualization, Preethi and Nireeksha N Shenoy; supervision, Anusha V Shenai and Stephiya Davis. All authors have read and agreed to the published version of the manuscript.

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