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RESEARCH

# RELATIONSHIP BETWEEN KINESIOPHOBIA, QUADRICEPS MUSCLE STRENGTH AND QUALITY OF LIFE IN PATIENTS WITH KNEE OSTEOARTHRITIS


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## Abstract

***Introduction:*** The aim of this study was to investigate the relationship between kinesiophobia, quadriceps muscle strength and quality of life in patients with knee osteoarthritis.

***Materials and Method:*** We included 145 patients (age, 55.9±8 years) diagnosed with osteoarthritis of the knee in this study. Kinesiophobia, pain intensity, quadriceps muscle strength, disability and quality of life were evaluated using Tampa Scale for Kinesiophobia, visual analogue scale, hand-held dynamometer, Lysholm scale and short form-36, respectively.

***Results:*** There was a significant relationship between pain at rest (p= .028), pain during activity (p=.015), disability (p=.019), vitality (p=.03) and social function (p=.036) of short form-36 and quadriceps muscle strength in females. No significant relationship was found between the test variables and quadriceps muscle strength (p> .05) in males. There was a significant relationship between pain during activity (p=.021), quadriceps muscle strength (p=.017), vitality (p=.026) and social function (p=.007) parameters of quality of life and kinesiophobia in females. There was a significant association between quadriceps muscle strength and kinesiophobia (p=.001) in males.

***Conclusion:*** Quadriceps muscle weakness was associated with increased pain intensity and disability and reduced quality of life in females but not in males with osteoarthritis. Additionally, kinesiophobia was associated with higher pain intensity during activity, quadriceps muscle weakness and poorer quality of life in females. In males, level of kinesiophobia was associated with quadriceps muscle weakness.


***Key Words:*** Osteoarthritis; Quadriceps muscle; Muscle weakness; Disability; Quality of life

ARAŞTIRMA

# DİZ OSTEOARTRİTLİ HASTALARDA KİNEZYOFOBİ, KUADRİSEPS KAS KUVVETİ VE YAŞAM KALİTESİ ARASINDAKİ İLİŞKİ


## Öz

***Giriş:*** Bu çalışmanın amacı, diz osteoartritli hastalarda kinezyofobi, kuadriseps kas kuvveti ve yaşam kalitesi arasındaki ilişkiyi araştırmaktır.

***Gereç ve Yöntem:*** Çalışmaya 145 diz osteoartritli hasta (age, 55.9±8 years) dahil edilmiştir. Kinezyofobi, ağrı şiddeti, kuadriseps kas kuvveti, özürlülük ve yaşam kalitesi sırasıyla Tampa Kinezyofobi Ölçeği, Vizüel Analog Skala, el dinamometresi, Lysholm Skala ve Kısa Form-36 ile değerlendirilmiştir.

***Bulgular:*** Bayanlarda, istirahatte ağrı (p= .028), aktivite sırasında ağrı (p=.015), özürlülük (p=.019), Kısa Form-36'nın canlılık (p=.03), sosyal fonksiyon (p=.036) parametreleri ve kuadriseps kas kuvveti arasında anlamlı ilişki tespit edilmiştir. Erkeklerde, kuadriseps kas kuvveti ve diğer değişkenler arasında anlamlı bir ilişki bulunmamıştır (p> .05). Bayanlarda, aktivite sırasında ağrı (p=.021), kuadriseps kas kuvveti (p=.017), Kısa Form-36'nın canlılık (p=.026), sosyal fonksiyon (p=.007) parametreleri ve kinezyofobi arasında anlamlı ilişki bulunmuştur. Erkeklerde ise kuadriseps kas kuvveti ve kinezyofobi arasında anlamlı bir ilişki saptanmıştır (p=.001).

***Sonuç:*** Kuadriseps kas zayıflığı, osteoartritli bayanlarda ağrı şiddeti ve özürlülüğü arttıran, yaşam kalitesini azaltan bir faktördür, fakat erkeklerde böyle bir sonuç bulunmamıştır. Aynı zamanda, bayanlarda kinezyofobi, aktivite sırasında ağrı şiddeti, kuadriseps kas zayıflığı ve daha düşük yaşam kalitesi ile ilişkili bulunmuştur. Erkeklerde ise kinezyofobi düzeyi kuadriseps kas zayıflığı ile ilişkili bulunmuştur.


***Anahtar Sözcükler:*** Osteoartrit; Kuadriseps Kası Kas Zayıflığı; Yeti yitimi; Yaşam kalitesi


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## INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease that affects the cartilage and many of its surrounding tissues (1). It is one of the major causes of lower extremity disability among older adults (2) and most often occurs in the knee, hip, hand, spine and foot. In the Framingham Study, the prevalence of radiographic knee OA was 19.2% among individuals aged above 45 years (1). Knee OA is characterized by pain and limitations in the ability to perform activities of daily living, such as stair climbing, walking and housework (3). Steultjens et al. (4) reported that knee muscle strength was associated with disability and avoidance of activity in patients with knee OA. The quadriceps muscle assists in shock absorption in the knee joint during gait, and knee extensor muscle weakness leads to abnormal joint loading in patients with knee OA (5).

In recent decades, the fear-avoidance model has been put forward to explain the association between chronic pain and disability. This new theory describes the role of emotional, cognitive and behavioural factors in the management of chronic pain and disability. According to the fear-avoidance model, psychological factors such as pain catastrophizing and kinesiophobia can be the risk factors for persistent pain and disability (6). Kinesiophobia is defined as 'an excessive, irrational and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury' (7, 8). Several studies have reported the negative effects of kinesiophobia on disability and activities of daily living in individuals with OA. Somers et al. (9) reported that the severity of OA was associated with psychological disability and walking performance. Scopaz et al. (10) documented that anxiety and fear-avoidance beliefs correlated with self-reported physical function in patients with knee OA. Low-level physical activity can lead to muscle weakness when the patients avoid physical activity due to pain. Impairment of quadriceps femoris muscle performance can reduce the stabilization ability of the knee joint and contribute to injuries of the intraarticular structures. This may increase disability and decrease quality of life in patients with knee OA. Therefore, the aim of this study was to investigate the relationship between kinesiophobia, muscle strength and quality of life in patients with knee OA.

## MATERIALS AND METHOD

### Participants

We included 145 patients (age, 55.9±8 years; body mass index (BMI), 30.8±5 kg/m$^2$) diagnosed with OA of the knee in this study. Inclusion criteria were age between 40 and 75 years and unilateral or bilateral knee OA diagnosed according to the clinical criteria of the American College of Rheumatology (11). Exclusion criteria were the presence of rheumatoid arthritis or other systemic inflammatory arthropathies, knee and hip surgery within the last 12 months or a history of knee and hip arthroplastic surgery, history of stroke and neuromuscular diseases and intraarticular corticosteroid injections into either knee within the previous 3 months. All the participants underwent radiographic examination of both knees using an anteroposterior and lateral view with weight-bearing positioning. Radiographs were scored for OA by the same experienced radiologist (I.Z.). The Kellgren–Lawrence score (range, 1–4) was used to assess radiographic severity, with higher scores indicating greater radiographic severity of knee OA (12). This study was approved by the Ethics Committee of the Ankara Numune Training and Research Hospital, and the participants gave informed, written consent. They were evaluated via the following measures:

#### Pain Intensity

Pain intensity in the knees was measured using the visual analogue scale (VAS). Patients were asked to place a mark along a 100 mm line to best describe the severity of pain experienced by them at rest and during activity in the past week.

#### Quadriceps Muscle Strength

Quadriceps muscle strength was evaluated by the 'Make test' method using a hand-held dynamometer (JTECH Medical Industries, Salt Lake City, UT, USA). The participants were instructed to sit on an examination table with their test hip and knee in 90° and 60° flexion, respectively, stabilizing themselves by holding onto the sides of the table. The participant were asked to perform 5-s isometric maximum voluntary contraction against the dynamometer held in the examiner's hand (13). Scores were recorded in kilograms.

### Kinesiophobia

Participants' kinesiophobia levels were measured using the Tampa Scale for Kinesiophobia (TSK). TSK is a self-report measure that assesses the fear of (re)injury due to movement in musculoskeletal diseases (7,8). It comprises 17 items that are scored on a 4-point scale from 'strongly agree' to 'strongly disagree'.

### Lysholm Scale

The Lysholm knee scoring scale was originally developed to determine the functional status of patients with ligament injuries of the knee and has been widely used to evaluate disability in other knee pathologies. This scale comprises eight domains (limp, support, locking sensation, instability, pain, climbing stairs, swelling and squatting) with closed-answer alternatives. The final sum (i.e., score) is rated from 0 (severe impairment) to 100 points (no limitation) (14).

### Quality of Life

The short form-36 (SF-36) is a widely-used measure of quality of life and comprises 36 items evaluating physical functioning, physical role functioning, emotional role functioning, social role functioning, general health, mental health, bodily pain and vitality (15).

**Table 1.** Characteristics of the study population

| Variables | Males (n=31) Mean±sd | Females (n=114) Mean±sd | p value |
|---|---|---|---|
| Age (years) | 55.87±8.93 | 55.92±7.79 | .977 |
| Body mass index (kg/m$^2$) | 28.52±3.69 | 31.47±5.24 | .004** |
| Kellgren-Lawrence score (Right knee) | 1.64±0.70 | 1.95±0.97 | .051 |
| Kellgren-Lawrence score (Left knee) | 1.67±0.74 | 1.94±0.97 | .102 |
| Pain at rest (VAS) | 2±1.93 | 2.5±2.61 | .235 |
| Pain during activity (VAS) | 7.22±1.92 | 8.06±1.60 | .032* |
| Disability (Lysholm) | 60.09±16.21 | 47.06±18.68 | .000** |
| Quadriceps muscle strength (Right limb) (kg) | 15.80±3.15 | 14.78±3.00 | .113 |
| Quadriceps muscle strength (Left limb) (kg) | 15.39±2.73 | 14.39±2.75 | .079 |
| Kinesiophobia (TSK) | 26.29±8.23 | 26.61±7.83 | .845 |
| SF-36 Physical Function | 54.19±22.21 | 34.54±20.66 | .000** |
| SF-36 Role Physical | 29.03±38.78 | 13.02±29.46 | .014* |
| SF-36 Bodily pain | 44.70±19.19 | 33.00±19.86 | .004** |
| SF-36 General health | 60.96±18.55 | 44.96±17.73 | .000** |
| SF-36 Vitality | 47.41±20.07 | 36.45±21.97 | .011* |
| SF-36 Social function | 58.46±21.25 | 46.68±24.99 | .011* |
| SF-36 Role emotional | 49.56±47.76 | 24.50±39.15 | .003* |
| SF-36 Mental health | 66.19±19.01 | 57.32±18.68 | .025* |

Abbreviations: VAS Visual Analogue Scale, TSK Tampa Scale for Kinesiophobia
** P< 0.05.*

*** P< 0.01.*

### Statistical Analyses

Data were analysed using SPSS (Version 16.0, SPSS Inc., Chicago, IL). Descriptive statistics (mean±SD) were calculated for all variables. Normality of outcome variables was analysed using the Kolmogorov–Smirnov test. Relationships between study parameters were assessed using Pearson's correlation coefficient and Spearman rank correlation coefficient for parametric and non-parametric data, respectively. Statistical significance was established at p<.05.

## RESULTS

Characteristics of the study population are presented in Table 1. There were significant differences in BMI, pain during activity, disability and all parameters of SF-36 between males and females (p< .05; Table 1). Correlational analyses revealed that there were significant relationships between pain at rest (p=.028), pain during activity (p=.015), disability (p=.019), vitality (p=.03) and social function (p=.036) of SF-36 and right quadriceps muscle strength in females. However, no significant relationship was found between radiographic severity of disease and quadriceps muscle strength in females (p> .05). In males, no relationship was found between radiographic severity of disease, pain intensity, disability, SF-36 parameters and quadriceps muscle strength (p> .05; Table 2). In addition, there were significant relationships between pain during activity (p=.021), quadriceps muscle strength (p=.017), vitality (p=.026) and social function (p=.007) parameters of SF-36 and kinesiophobia in females with OA. There was significant association between quadriceps muscle strength and kinesiophobia (p=.001) in males. No significant relationship was found between radiographic severity of disease and kinesiophobia in either gender (p> .05; Table 3).

**Table 2.** Correlation between quadriceps muscle strength and other variables

| Variables | Quadriceps muscle strength (Right limb) | | Quadriceps muscle strength (Left limb) | |
|---|---|---|---|---|
| | Males (n=31) | Females (n=114) | Males (n=31) | Females (n=114) |
| Kellgren-Lawrence score (Right knee) | .368 | .091 | | |
| Kellgren-Lawrence score (Left knee) | | | .174 | .156 |
| Pain at rest (VAS) | .553 | .028* | .713 | .028* |
| Pain during activity (VAS) | .095 | .015* | .074 | .003** |
| Disability (Lysholm) | .538 | .019* | .479 | .001** |
| SF-36 Physical Function | .116 | .068 | .053 | .164 |
| SF-36 Role Physical | .520 | .563 | .251 | .894 |
| SF-36 Bodily pain | .680 | .055 | .981 | .103 |
| SF-36 General health | .361 | .346 | .563 | .221 |
| SF-36 Vitality | .819 | .030* | .672 | .024* |
| SF-36 Social function | .204 | .036* | .586 | .066 |
| SF-36 Role emotional | .531 | .306 | .616 | .963 |
| SF-36 Mental health | .367 | .668 | .145 | .949 |

Abbreviations: VAS Visual Analogue Scale, TSK Tampa Scale for Kinesiophobia

* P< 0.05.

** P< 0.01.

**Table 3.** Correlation between kinesiophobia and other variables

| Variables | Kinesiophobia (TSK) | |
|---|---|---|
| | Males (n=31) | Females (n=114) |
| Kellgren-Lawrence score (Right knee) | .859 | .749 |
| Kellgren-Lawrence score (Left knee) | .662 | .945 |
| Body mass index (kg/m$^2$) | .282 | .448 |
| Pain at rest (VAS) | .191 | .862 |
| Pain during activity (VAS) | .414 | .021* |
| Quadriceps muscle strength (Right limb) | .001** | .017* |
| Quadriceps muscle strength (Left limb) | .013* | .034* |
| Disability (Lysholm) | .862 | .091 |
| SF-36 Physical Function | .390 | .095 |
| SF-36 Role Physical | .733 | .226 |
| SF-36 Bodily pain | .984 | .118 |
| SF-36 General health | .360 | .163 |
| SF-36 Vitality | .211 | .026* |
| SF-36 Social function | .128 | .007** |
| SF-36 Role emotional | .513 | .516 |
| SF-36 Mental health | .568 | .241 |

Abbreviations: VAS Visual Analogue Scale, TSK Tampa Scale for Kinesiophobia

* P< 0.05.

** P< 0.01.

## DISCUSSION

The results of the present study showed that quadriceps weakness was associated with increased pain intensity and disability and reduced quality of life in females but not in males with OA. However, there was no significant difference in quadriceps muscle strength between females and males with OA. The patients assessed in this study were predominantly females (78%). Similar to our results, Steultjens et al. (4) observed a relationship between physical disability and muscle strength in patients (90% female) with knee OA. They reported that muscle strength of knee flexion and extension was a predisposing factor in the relationship between avoidance of activity and physical disability. Quadriceps muscle is the primary dynamic stabilizer of the knee joint. Quadriceps muscle weakness leads to instability of the knee, which may contribute to knee pain (16). Muraki et al. (16) found that the threshold of muscle strength for knee pain in females was similar to or higher than that in males. Hootman et al. (17) suggested that pain-related disuse atrophy could cause compression of joint surfaces during weight-bearing activity, leading to cartilage damage. Quadriceps muscle dysfunction may

contribute to abnormal knee kinematics during gait as well as impaired proprioception (16,18). Furthermore, quadriceps weakness may lead to reduced shock absorption ability at the knee joint, specifically at heel strike during normal gait, and may increase the progression of joint damage (19). Berger et al. (20) observed cartilage thickness for the vastus medialis and lateralis muscles using magnetic resonance imaging. They reported that distal vastus medialis volume was the primary predictor of the morphological features of cartilage in patients with symptomatic and radiographic knee OA.

The present study also found that kinesiophobia is associated with higher pain intensity during activity, quadriceps muscle weakness and poorer quality of life in females. In males, kinesiophobia only was significantly associated with quadriceps muscle weakness. Although the female OA patients in this study had higher pain intensity during activity than males, kinesiophobia scores did not significantly differ between females and males with OA. A possible explanation is that the females in this sample had a significantly higher BMI than the males. This could, therefore, lead to increased contact stress on the knee joint in females. In addition, females with OA have been found to experience more pain than males due to neural and psychosocial factors and are more likely to report reductions in daily living activities and quality of life (21). Finally, female patients lose the protective effect of oestrogen after menopause, leading to increased disease severity (22).

Kinesiophobia level reported in the previous studies on this subject was generally higher than that in our participants, and participants in these studies were predominantly female, similar to our study population. Domenech et al. (23) documented that kinesiophobia was moderately and significantly correlated with pain intensity and disability in patients with anterior knee pain. Hart et al. (24) reported that participants with OA had lower knee confidence and higher kinesiophobia than those without knee OA after anterior cruciate ligament reconstruction. In patients with OA, poorer knee confidence was associated with higher kinesiophobia and worse patient-reported and performance-based functional impairments. Somers et al. (9) reported that disease severity was correlated with psychological disability and walking speed in obese OA patients. However, severity of disease (as assessed using the Kellgren–Lawrence score) was not associated with kinesiophobia, similar to our findings. They showed that pain-related fear increased psychological disability and decreased walking speed. Scopaz et al. (10) suggested that both anxiety and fear-avoidance beliefs were related to self-reported physical function in patients with knee OA. They reported that higher anxiety and higher fear avoidance beliefs limited activities of daily living in patients with knee OA. Heuts et al. (25) suggested that the level of pain and pain-related fear were negatively associated with daily functioning in patients with OA. In individuals with OA, maintaining adequate daily activity is critical in managing disease-associated pain and disability, but patients with kinesiophobia may be hesitant to engage in physical activity.

A limitation of the present study is the lack of a control group without OA. However, our patients' average age was 55.9±8 years (range, 40–75 years), and in clinical practice, it is difficult to find patients within this age group without knee OA, especially radiographically.

In conclusion, the findings of this study indicated that quadriceps weakness was associated with increased pain intensity and disability and reduced quality of life in females with OA, but not in males. Furthermore, kinesiophobia was associated with higher pain intensity during activity, quadriceps muscle weakness and poorer quality of life in females. In males, kinesiophobia only was associated with quadriceps muscle weakness.

Individuals with OA may avoid physical activity due to pain during activity. The clinicians should question OA patients regarding symptoms of kinesiophobia that lead to psychological disability and develop strategies to overcome pain-related fear

of movement. Low-level physical activity may lead to decreased quadriceps muscle strength. Quadriceps muscle weakness can reduce stabilization of the knee joint and contribute to knee injuries. Quadriceps muscle strength can be improved through resistance training designed according to age, physical capacity and severity of disease among individuals with OA.

**Conflict of interest** None.

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