Original Article

Variation of Pain Intensity with Smoking in Knee Osteoarthritis in Males

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ABSTRACT

Background: Knee osteoarthritis is a significant cause of disability, affecting daily living activities predominantly in females but also impacting males. Various factors contribute to its development, including smoking, yet data on its effect on the male population is sparse.

Objective: To explore the relationship between smoking and pain intensity in males with moderate-stage knee osteoarthritis.

Methods: A cross-sectional study was conducted over six months, enrolling 71 male participants aged 30 to 75 years with grade 2 knee osteoarthritis, diagnosed according to the Kellgren and Lawrence scale. Participants were categorized into smokers and non-smokers. Data on smoking habits and pain severity, assessed using the numeric pain rating scale, were collected through questionnaires. The association between smoking and pain intensity was analyzed using the Pearson Chi-square test, with a significance level set at P<0.05.

Results: Out of 71 participants, 36 (50.7%) were smokers, and 35 (49.3%) were non-smokers. Severe pain was reported by 25 smokers, while 26 non-smokers experienced moderate pain. The analysis revealed a significant association between smoking and increased pain severity (P<0.05), with a direct correlation between the number of cigarettes smoked and pain intensity.

Conclusion: The study identified a significant association between smoking and higher pain intensity in male patients with knee osteoarthritis. These findings suggest that smoking cessation should be a key component of osteoarthritis management strategies to alleviate pain and improve quality of life in affected individuals.

Keywords: Knee Osteoarthritis, Smoking, Pain Intensity, Male Population, Cross-Sectional Study.

INTRODUCTION

Knee osteoarthritis, a prevalent condition characterized by the degeneration of articular cartilage primarily affecting the tibiofemoral and patellofemoral joints, has been extensively studied for its multifactorial etiology including family history, obesity, aging, and gender predispositions (1). This degenerative disease manifests through symptoms such as pain, swelling, stiffness, reduced range of motion, joint crepitus, and disability, alongside radiographic changes classified into four grades based on the Kellgren and Lawrence scale, which delineates the progression from joint space narrowing to severe sclerosis (2). The pathogenesis of knee osteoarthritis involves an imbalance in the enzymes responsible for cartilage degradation and regeneration, leading to the deterioration of joint health (3). Notably, the prevalence of knee osteoarthritis escalates in women post the age of fifty; however, in men, symptomatic knee osteoarthritis is more commonly observed than its radiographic counterpart, suggesting a discrepancy between clinical manifestations and radiological findings (4, 5, 6, 7).

Intriguingly, the impact of smoking on knee osteoarthritis in males has garnered attention due to the observed correlation between tobacco use and the exacerbation of osteoarthritic symptoms. A 30-month prospective study involving 159 male participants, both smokers and non-smokers, revealed a significant association between smoking and the acceleration of cartilage loss as well as intensified knee pain. This relationship is attributed to the adverse effects of tobacco smoke components on chondrocyte function, which impairs cartilage repair mechanisms, consequently leading to heightened musculoskeletal pain in male smokers (8). This finding is further complicated by the observation that individuals with advanced knee osteoarthritis (grades 3 and 4) may not necessarily experience knee pain, indicating that radiographic changes do not consistently correlate with the severity of pain

experienced by patients (9, 10). Conversely, some studies have posited a seemingly paradoxical lower risk of osteoarthritis development among smokers compared to non-smokers (11, 12), thus presenting a complex interplay between smoking and knee osteoarthritis pathophysiology.

Given the conflicting evidence and the significant public health implications, the current study aims to elucidate the variation of pain intensity in relation to smoking among males with moderate-stage grade 2 knee osteoarthritis. This investigation is predicated on the hypothesis that smoking significantly increases pain intensity in this demographic, against a null hypothesis positing no significant variance in pain intensity attributable to smoking habits. Through this research, we seek to contribute to the nuanced understanding of knee osteoarthritis's multifaceted nature, particularly in the context of modifiable risk factors such as tobacco use.

MATERIAL AND METHODS

The research was structured as a cross-sectional study, meticulously conducted over a six-month period from June to December 2022. This investigation primarily targeted male patients diagnosed with knee osteoarthritis, focusing its recruitment efforts on individuals between the ages of 30 and 75. The exclusion criteria were clearly defined, disqualifying males under the age of 30 and over the age of 75 to ensure a homogenous study population. The setting for this comprehensive study encompassed three distinguished medical institutions: Farooq Hospital, Westwood branch, Akhtar Saeed Trust Hospital, EME, Lahore, and District HQ Hospital, Faisalabad, thereby facilitating a broad and inclusive sample representation.

Prior to the commencement of data collection, ethical clearance was rigorously obtained from the ethics review committee of Akhtar Saeed College of Rehabilitation Sciences, Lahore, underpinning the study's adherence to ethical standards and patient confidentiality protocols. The sample size was strategically calculated employing the sample size formula (13), a methodological approach designed to estimate the prevalence of knee osteoarthritis within the targeted male demographic accurately. The recruitment of participants was executed through a non-probability convenience sampling technique, thereby streamlining the process of participant selection. Eligible participants were those diagnosed with grade 2 knee osteoarthritis, as determined by the Kellgren and Lawrence scale (14, 15), a criterion meticulously confirmed by referrals from orthopedic surgeons and physical therapists affiliated with the participating hospitals. Data collection was facilitated through the distribution of a comprehensive questionnaire, which was administered following the procurement of informed consent from each participant. This questionnaire was meticulously designed to capture a wide array of data, with a particular emphasis on smoking habits and pain levels, the latter of which was quantitatively measured using the numeric pain rating scale (16-18).

The gathered data encompassed a diverse cohort of male patients, including both smokers and non-smokers (19), thereby ensuring a comprehensive analysis of the study's central hypothesis. Subsequent data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 25, a choice that reflects the study's commitment to employing advanced statistical tools for data interpretation. The analytical approach was characterized by the presentation of quantitative variables such as age and pain levels through means, standard deviations, ranges, and histograms. In contrast, categorical variables were succinctly summarized in tabulated forms, showcasing frequencies, percentages, and bar charts for visual representation. The utilization of parametric tests was strategically aligned with the study's objectives, facilitating a robust analytical framework.

The association between smoking habits and pain intensity in knee osteoarthritis patients was rigorously evaluated using the Pearson chi-square test, applied through a 2x2 contingency table analysis. The significance of the findings was determined based on a P-value threshold of 0.05 or less, a standard criterion that underscores the statistical rigor of the study.

RESULTS

The study conducted on a cohort of 71 male participants aged between 30 to 75 years, with a mean age of 50.79 ± 11.20 years, explored the demographics, diagnosis, smoking habits, and pain intensity associated with knee osteoarthritis (OA) (Table 1). The majority of the participants were married (95.8%), reflecting a significant representation of this demographic in the sample. In terms of osteoarthritis diagnosis, the distribution was fairly even with 39.4% having right knee OA, 40.8% left knee OA, and 19.7% diagnosed with bilateral knee OA, indicating a slightly higher prevalence of left knee OA in this cohort.

The smoking status among participants revealed a diverse distribution, with non-smokers constituting 49.3% of the study population, followed by light smokers at 36.6%, and medium smokers at 14.1%. This distribution highlights the significant presence of smoking habits within the study group, providing a substantial basis for analyzing the correlation between smoking and pain intensity in knee OA patients.

Further analysis through cross-tabulation of smoking status with pain intensity (Table 2) indicated a stark contrast in pain categorization among smokers and non-smokers. Smokers demonstrated a higher incidence of severe pain, with 25 out of 36 smokers categorizing their pain as severe, whereas only 7 out of 35 non-smokers reported severe pain, resulting in a statistically

significant P-value of <0.01. This demonstrates a clear association between smoking status and increased pain intensity among the participants.

Table 1 Demographic Characteristics of Participants

Variable	Category	Frequency	Percent (%)
Age Group	30 to 75 years		
	Mean Age	50.79±11.20	
Marital Status	Married	68	95.8
	Unmarried	3	4.2
Diagnosis	Right Knee OA	28	39.4
	Left Knee OA	29	40.8
	Bilateral Knee OA	14	19.7
Smoking Status	Non-smokers	35	49.3
	Light smokers	26	36.6
	Medium smokers	10	14.1

Table 2 Cross-tabulation of Smoking Status with Pain Intensity

Smoking Status	Mild	Moderate	Severe	Total	P-value
Smokers	0	11	25	36	<0.01
Non-smokers	2	26	7	35	
Total	2	37	32	71	

Table 3 Cross-tabulation of Pain Intensity with Level of Smoking in Knee Osteoarthritic Patients

Smoking Level	Mild	Moderate	Severe	Total	P-value
Non-smokers	2	26	7	35	<0.01
Light smokers	0	9	17	26	
Medium smokers	0	2	8	10	
Total	2	37	32	71	

Moreover, when pain intensity was cross tabulated with the level of smoking (Table 3), the findings further underscored the relationship between smoking intensity and pain levels. Among light smokers, 17 reported severe pain, contrasting with medium smokers where 8 out of 10 experienced severe pain. Non-smokers, on the other hand, predominantly reported moderate pain (26 out of 35), with a minor fraction experiencing severe pain. This delineation of pain severity across different smoking levels, supported by a P-value of <0.01, significantly illustrates the exacerbating effect of smoking on pain intensity in knee OA patients.

These results collectively underscore a crucial insight into the interaction between smoking habits and knee osteoarthritis, revealing a significant correlation between smoking intensity and the severity of pain experienced by the patients. The analysis, grounded in the demographic characteristics and smoking status of the participants, elucidates the detrimental impact of smoking on the pain management and overall quality of life in individuals suffering from knee osteoarthritis.

DISCUSSION

In the realm of medical research on knee osteoarthritis, the focus has traditionally been cast on factors such as Body Mass Index (BMI), age, occupation, lifestyle, hemoglobin levels, and ergonomic considerations (3). The present study, however, pivots towards an in-depth examination of the interplay between smoking habits and pain intensity among male knee osteoarthritis patients aged between 30 to 75 years, with a mean age of 50.79 years. This cohort predominantly consisted of patients with left knee osteoarthritis (40.8%), closely followed by those with right knee osteoarthritis (39.4%), and a smaller fraction with bilateral knee osteoarthritis (19.7%). This demographic focus provides a nuanced understanding of the disease within a specific subset of the population, contrasting with the study by M. Navaid Iqbal, which surveyed a broader demographic including a significant majority of female participants (74%) compared to males (26%).

Historical perspectives, such as those offered by Wilder et al., have suggested a potential protective effect of smoking against osteoarthritis in unadjusted analyses, positing that current smokers were substantially less likely to develop knee osteoarthritis compared to non-smokers (20). This counterintuitive finding, suggesting an inverse relationship between smoking and osteoarthritis across various joints, becomes less clear after adjusting for confounding factors such as age, gender, BMI, heredity, occupation, and physical activity levels, ultimately showing no significant association. Conversely, the findings of the current study starkly highlight a significant correlation between smoking and increased pain intensity in knee osteoarthritis patients, with the severity of pain escalating in tandem with the quantity of cigarettes smoked.

Echoing the conclusions drawn by Al-Bashaireh et al. in their systematic review, our study underscores the detrimental impact of smoking on musculoskeletal health, evidenced by higher pain scores and greater cartilage loss among smokers, a trend that intensifies with increased smoking frequency (21). This correlation is consistent with broader literature indicating the negative effects of tobacco smoke on Bone Mineral Density (BMD) and the exacerbation of osteoarthritic symptoms by smoking.

The analysis also aligns with findings from Abate et al., who documented the adverse effects of smoking on the musculoskeletal system, including reduced Bone Mineral Content (BMC), osteoporosis, and fractures with delayed healing processes, as well as an increased annual loss of cartilage volume attributed to the toxic effects of nicotine on bones (22). Our study further corroborates these outcomes by reporting a clear negative impact of smoking on pain levels in male knee osteoarthritis patients, with pain severity increasing in direct correlation with smoking frequency.

The study's focus on a male cohort aged 30 to 75 years, specifically examining the correlation between smoking habits and pain intensity in knee osteoarthritis, offers a targeted insight into the condition's dynamics. However, this focus also constitutes a limitation, as it does not encompass the broader spectrum of osteoarthritis patients, particularly females, who represent a significant portion of the osteoarthritis demographic. The reliance on self-reported smoking habits and pain levels may also introduce a degree of bias, potentially affecting the study's accuracy.

Recommendations for future research include a broader demographic study encompassing both genders and a wider age range, alongside longitudinal studies to track the progression of osteoarthritis symptoms in relation to smoking habits over time. Additionally, there's a critical need for interventions aimed at smoking cessation among osteoarthritis patients to mitigate the exacerbation of pain symptoms and improve overall quality of life.

In summary, while the study adds to the growing body of evidence highlighting the negative impacts of smoking on health, particularly in exacerbating pain among knee osteoarthritis patients, it also underscores the importance of targeted interventions and further research to fully understand and address the complexities of this relationship.

CONCLUSION

This study concludes that smoking is significantly associated with increased pain intensity in male patients with moderate-stage knee osteoarthritis, where pain severity correlates directly with the frequency of smoking. These findings underscore the importance of incorporating smoking cessation programs into the management plans for patients with knee osteoarthritis, highlighting the broader implications of smoking on musculoskeletal health. By demonstrating the negative impact of smoking on pain levels in osteoarthritis, the study adds to the growing body of evidence supporting the need for public health interventions aimed at reducing smoking rates, particularly among individuals with chronic conditions such as osteoarthritis, to improve patient outcomes and quality of life.

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