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The Association Between Physical Activity Levels and Severity of Knee Osteoarthritis

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Abstract: ***Background: Knee osteoarthritis is a disabling joint disease, resulting in cartilage degeneration and joint damage. The relation between physical activity levels and the severity of the disease is controversial. Aim of the study: To assess the level of physical activity among patients with knee OA and its impact on disease severity. Patients and Methods: This is a cross - sectional study, which includes a total of 100 consecutive patients with knee osteoarthritis. Data was collected using a pre - structured questionnaire, which included patient's bio - demographic and clinical data on knee OA. The level of physical activity was assessed using the global physical activity questionnaire. The severity of knee OA was assessed using the Kellgren - Lawrence classification. Results: Patients age ranged from 44 to 78 years, with a mean of 56.8±8.7 years. Eighty two percent of patients were females. The mean duration of osteoarthritis was 4.8±2.5 years. Disease severity, was predominantly reported as grade 1 among 58%, grade II= 25%, grade III=10% and grade IV= 7% respectively. Eighty two percent of the participants were using medications for pain relief and 54.0% had co - morbidities. Age was statistically different between severity grades (P - value < 0.001). Also, diabetes was more prevalent in advanced stages of the disease (grade III and IV), (P - value < 0.001). a similar trend was found regarding the use of medications (P - value = 0.008) and disease duration (P - value < 0.001). Twenty one percent of participants had active jobs, while 79% are either unemployed or retired. Thirteen percent were regularly attending physiotherapy sessions and only 4% were doing home exercises. There was no significant difference between the severity grades regarding Job status, attending physiotherapy sessions and doing home exercises. Moderate activity and walking were significantly lower in advanced disease (P - value 0.008) and (<0.001) respectively, while vigorous activity levels were not statistically significant. Conversely, mean sedentary time was higher in grade III and IV compared to grade I and II (P - value < 0.001). A statistical association was found regarding way of Muslim praying (P - value = 0.01), climbing stairs (P - value < 0.001), and type of WC used (P - value = 0.002). Conclusions: Moderate level of physical activity was associated with less knee OA severity while Sedentary behavior was associated with increasing disease severity.***

Keywords: Knee Osteoarthritis, Physical activity, Disease severity, Quality of life

1. Introduction

Definition of Osteoarthritis

Osteoarthritis (OA) is the most common chronic degenerative joint disease. It is caused by cartilage degeneration leading to joint deformity, with subsequent impairments in health - related quality of life [1, 2]. Knee OA accounts for nearly four fifths of the worldwide burden of OA. [3, 4]

Epidemiology:

Osteoarthritis affects 350 million people worldwide (15% of the population), so it's the most common form of arthritis. [5,6].

Prevalence of knee OA increases with age, reaching 45.77% among people aged over 50 years, compared to 6.82% in those aged 18 - 30 years. [6]. It is also more prevalent in women than men [7].

Clinical features:

The most common complaints included joint pain, stiffness and swelling. [8]. Pain is the leading feature of knee OA, it is intermittent and associated with weight bearing, it becomes worse with movement and improves with rest [9]. Stiffness is also a common complaint, it usually occurs in the morning and lasts less than 30 minutes. [9].

Diagnosis

Osteoarthritis is diagnosed clinically by the characteristic signs and symptoms imaging is used to confirm the diagnosis and to assess disease severity. [10]

The most widely used imaging modality is conventional radiography, it can detect characteristic OA features which includes:

- narrowing of the joint space.
- marginal osteophytes.
- subchondral sclerosis and cysts.

Treatment

Osteoarthritis is not yet a curable disease, the treatment goal is to alleviate signs and symptoms and to slow disease progression.

The therapeutic spectrum ranges from general measures, physiotherapy, orthoses, pharmacotherapy and surgery. [11]

Association between physical activity level and knee OA severity.

Free mobility and musculoskeletal health are important to perform daily activities. Knee osteoarthritis, for instance, is associated with significant deterioration in health related quality of life. [12]

It is known that physical activity protects against functional limitation, for instance, exercise programs like aerobic walking and resistance exercise training showed a protective

effect against functional limitation among individuals with knee osteoarthritis. [13].

Less is known about the effects of physical activity with specific intensities on disease severity and quality of life in people with knee osteoarthritis.

A recent study has shown that replacing sedentary time with light intensity activity reduces the risk of performance based functional limitation 2 years later in knee OA patients. [14]

However, the effect of moderate - high intensity physical activity on patients with knee OA is less known, the current study was held to assess the level of physical activity in patients with knee OA, and its impact on disease severity and on patient's health related quality of life.

Aim of the study:
To assess the level of physical activity in patients with knee OA, and its impact on disease severity and on patients quality of life.

Patients and methods

Study design:
This cross - sectional study was conducted at Rheumatology units of Al - Zahraa and Al - Karama Teaching Hospitals in the City of Al - Kut from November 2023 to June 2024.

Sample selection:
A total of 100 consecutive patients, diagnosed with knee osteoarthritis by fulfilling the clinical ACR criteria of OA ([15]. were included in the study.

Informed consent was obtained from each participant studied according to the declaration of Helsinki.

Ethical approval was obtained from the ethics committee in Medical Department, College of Medicine, University of Baghdad with approval number 140 on the 9th of October 2023. Patients having the following conditions were excluded from the study:

- Autoimmune inflammatory diseases like RA or SLE.
- History of knee trauma.
- Previous knee surgery.

2. Data Collection and Entry

Data entry was undertaken using a paper clinical research form via face to face interview and questionnaire.

The questionnaire used in the study was the global physical activity questionnaire [16].

Patients age, sex, employment status and co - morbidities were reported respectively.

Data on knee OA was also reported which included:
Duration of the disease, medications used and their types, attendance of physiotherapy sessions and doing home exercises.

Blood samples were taken for CBC and ESR, and all patients underwent weight bearing Antero - posterior view x - rays of both knee joints, which were viewed to assess the severity of knee osteoarthritis according to the Kellgren - Lawrence classification system [17].

Statistical analysis:
Continuous variables were expressed as means and standard deviations. Categorical variables were expressed as frequency and percentages. The Welch's t - test and One - way ANOVA were performed depending on whether the independent variables had 2 or 3 levels. The difference between categorical variables were investigated using either the χ^2 test with yates' correction or Fisher's exact test, depending on the context. Post - hoc test with Bonferroni correction was also performed to analyze inter - group differences.

P-value less than 0.05 was considered statistically significant. R software packages were used for data processing, visualization, and statistical analysis.

3. Results

Description of study baseline characteristics
One hundred consecutive patients with osteoarthritis were studied. The mean age of studied patients was 56.8 ± 8.7 years. The proportion of females were 82.0%. History of co - morbidities was reported in 54.0% of the cohort, of which hypertension was the dominant chronic disease (39.0%). Disease characteristics showed mean duration of osteoarthritis was 4.8 ± 2.5 years. Eighty two percent of the participants were using medications for disease management including NSAIDs (81%), and analgesics (paracetamol - 10%). Disease severity grading was reported as Grade 1 among 58 patients which was the most prevalent followed by the others grade II as 25 patients, grade III as 10 patients and grade IV as 7 patients, as shown in table (1)

Table 1: Description of Patient's demographic, co - morbidities and disease characteristics among 100 osteoarthritic patients studied

Characteristics	Patients number (100)
Age, years	56.8 ± 8.7
Sex	
Males	18 (18.0%)
Females	82 (82.0%)
Presence of co - morbidities	54 (54.0%)
Hypertension	39 (39.0%)
Diabetes	23 (23.0%)
Cardiac disease	1 (1.0%)
Osteoarthritis severity	
Grade I	58 (58.0%)
Grade II	25 (25.0%)
Grade III	10 (10.0%)
Grade IV	7 (7.0%)
Duration of the disease (year)	4.8 ± 2.5
Use of medications	82 (82.0%)
NSAIDs	81 (81.0%)
Paracetamol	10 (10.0%)
Others (antineuropathicmedications, supplements	11 (11.0%)
[1]Mean ± SD; n (%)	

*NSAIDs: Non-Steroidal Anti-inflammatory drugs.

The mean and standard deviation of complete blood count parameters were reported as follows: mean WBC count (× 10^9/L ±1.5), mean hemoglobin value was 13.0 ± 1.5 g/dL; platelets count mean was 279.4 ± 68.0 (× 10^9/L), and mean biochemical parameters in study cohort. ESR 26.4 ± 14.4 mm/hr. Twenty one percent of the participants had an active job while the majority (79%) were unemployed; 13% were regularly attending physiotherapy sessions and only 4% were doing home exercises. With regards to physical activity, most of the patients were walking regularly (77%) at a rate of 1.9 ± 2.1 hours per week; 26% had moderate activity at a rate of 5.8 ± 4.8 hours/ week and only 3% had vigorous activity. None of the participants reported using sport as a recreational activity. Quality of life among patients with knee osteoarthritis was reported as follows: 59% were doing Islamic prayer on a chair; 71% had knee pain during climbing stairs, and 56% were using eastern type of water closet (WC) as presented in table 2.

Table 2: Description of Job status, physical activity, and quality of life among 100 osteoarthritic patients studied

Characteristics	Patients, N = 100[1]
Job status	
Active	21 (21.0%)
Retired	6 (6.0%)
Unemployed	73 (73.0%)
Attending physiotherapy sessions	13 (13.0%)
Doing Home exercise	4 (4.0%)
Physical activity	
Vigorous activity	3 (3.0%)
Time (hours/week)	11.3 ± 4.2
Moderate activity	26 (26.0%)
Time (hours/week)	5.8 ± 4.8
Walking	77 (77.0%)
Time (hours/week)	1.9 ± 2.1
Sedentary time	
Time (hours/day)	5.8 ± 1.5
Recreational activities	
Vigorous - intensity sports	0 (0.0%)
Moderate - intensity sports	0 (0.0%)
Quality of life	
Prayer	
On chair	59 (59.0%)
Normal (on floor)	41 (41.0%)
Climbing stairs	
With pain	71 (71.0%)
Without pain	19 (19.0%)
Cannot	10 (10.0%)
Type of WC used	
Eastern	56 (56.0%)
Western	44 (44.0%)
[1]Mean ± SD; n (%) W C = Water Closet	

Study parameters were compared between different grades of OA severity, it was found that age was statistically different between severity grades (P - value < 0.001). Also, diabetes was more prevalent in advanced stages of the disease (grade III proportion was70%, grade IV proportion was 43% (P - value < 0.001). a similar trend was noted in medications used (P - value= 0.008) and disease duration (P - value < 0.001) as shown in table 3. **Table (3):** Description of Patient's demographic, co - morbidities and disease characteristics in different grades of 100 osteoarthritic patients.

Characteristics	Grade I, N = 58[1]	Grade II, N = 25[1]	Grade III, N = 10[1]	Grade IV, N = 7[1]	P - value[2]
Age, years	54.7 ± 8.0	56.4 ± 8.0	63.3 ± 8.6	66.0 ± 7.5	<0.001
Sex					0.6
Males	10 (17.2%)	6 (24.0%)	2 (20.0%)	0 (0.0%)	
Females	48 (82.8%)	19 (76.0%)	8 (80.0%)	7 (100.0%)	
Presence of co - morbidities	28 (48.3%)	13 (52.0%)	8 (80.0%)	5 (71.4%)	0.2
Hypertension	20 (34.5%)	11 (44.0%)	4 (40.0%)	4 (57.1%)	0.6
Diabetes	11 (19.0%)	2 (8.0%)	7 (70.0%)	3 (42.9%)	<0.001
Duration of the disease (year)	3.4 ± 1.6	5.5 ± 1.6	7.7 ± 1.5	9.3 ± 2.0	<0.001
Use of medications	41 (70.7%)	24 (96.0%)	10 (100.0%)	7 (100.0%)	0.008
Haemoglobin (g/dL)	12.7 ± 1.5	13.5 ± 1.3	13.2 ± 1.8	12.9 ± 1.3	0.2
WBC count (× 10^9/L)	7.5 ± 2.0	6.9 ± 1.4	7.8 ± 1.7	7.1 ± 1.5	0.5
Platelets count (× 10^9/L)	281.0 ± 66.5	284.1 ± 61.6	252.4 ± 105.6	288.1 ± 28.6	0.6
ESR (mm/hr)	25.6 ± 13.9	26.7 ± 16.2	28.4 ± 16.2	29.7 ± 9.3	0.9
[1]Mean ± SD; Median (IQR); n (%) [2]Welch Two Sample t - test; Pearson's Chi - squared test; Fisher's exact text					

Disease duration was found statistically different between the 4 grades, except between grade III and IV (post - hoc test with Bonferroni adjustment) as presented in (figure 1).

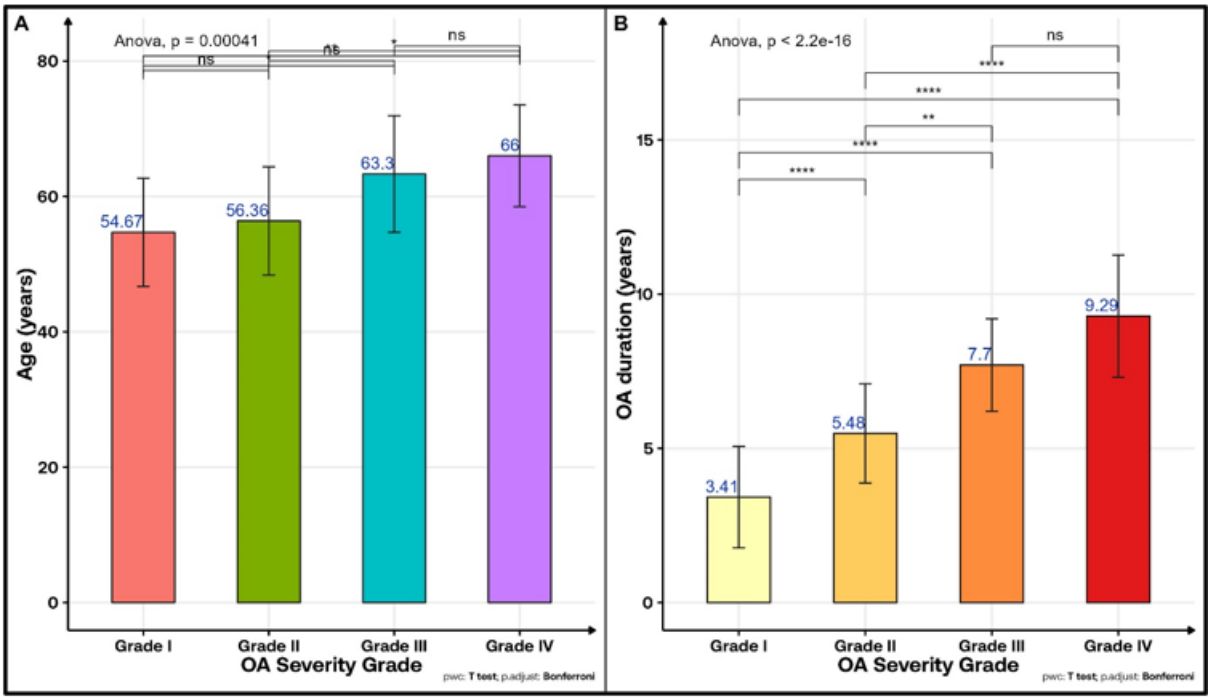

Figure 1: Post - hoc test analyzing inter - group differences between A: the mean age; B: the mean duration of OA; in different grades of OA patients.

When we compare group of patients with various disease severity, no differences were reported in job status, attendency of physiotherapy sessions and/or performed home exercises. On the other hand, moderate activity, and walking were significantly lower in advanced stages of disease (P - value < 0.001), conversely mean sedentary time was higher among grade III and IV disease severity compared to grade I and II (P - value < 0.001). Similarly, a statistical association was found regarding the way of Muslim prayer (P - value = 0.01), climbing stairs (P - value < 0.001), and type of WC used (P - value = 0.002), as shown in table 4.

Table 4: Description of Job status, physical activity, and quality of life in different grades of disease severity among 100 osteoarthritic patients studied

Characteristics	Grade I, N = 58[1]	Grade II, N = 25[1]	Grade III, N = 10[1]	Grade IV, N = 7[1]	P - value[2]
Job status					0.2
Active	15 (25.9%)	6 (24.0%)	0 (0.0%)	0 (0.0%)	
Retired	2 (3.4%)	2 (8.0%)	1 (10.0%)	1 (14.3%)	
Unemployed	41 (70.7%)	17 (68.0%)	9 (90.0%)	6 (85.7%)	
Physiotherapy sessions	4 (6.9%)	5 (20.0%)	3 (30.0%)	1 (14.3%)	0.080
Doing Home exercise	3 (5.2%)	1 (4.0%)	0 (0.0%)	0 (0.0%)	>0.9
Physical activity					
Vigorous activity	2 (3.4%)	1 (4.0%)	0 (0.0%)	0 (0.0%)	>0.9
Moderate activity	22 (37.9%)	4 (16.0%)	0 (0.0%)	0 (0.0%)	**0.008**
Walking	51 (87.9%)	20 (80.0%)	6 (60.0%)	0 (0.0%)	**<0.001**
Sedentary time (hours/day)	5.4 ± 1.3	5.6 ± 1.2	6.6 ± 1.3	8.0 ± 1.9	**<0.001**
Quality of life					
Prayer					**0.010**
On chair	31 (53.4%)	12 (48.0%)	9 (90.0%)	7 (100.0%)	
On floor	27 (46.6%)	13 (52.0%)	1 (10.0%)	0 (0.0%)	
Climbing stairs					**<0.001**
With pain	40 (69.0%)	23 (92.0%)	5 (50.0%)	3 (42.9%)	
Without pain	17 (29.3%)	2 (8.0%)	0 (0.0%)	0 (0.0%)	
Cannot	1 (1.7%)	0 (0.0%)	5 (50.0%)	4 (57.1%)	
Type of water closet (wc) used					**0.002**
Eastern	38 (65.5%)	15 (60.0%)	3 (30.0%)	0 (0.0%)	
Western	20 (34.5%)	10 (40.0%)	7 (70.0%)	7 (100.0%)	

[1]Mean ± SD; n (%)
[2]One - way ANOVA; Fisher's exact test

*WC: Water Closet

4. Discussion

Knee osteoarthritis is commonly reported in clinical practice, it is one of the five most common causes of disability among adults in the United States. [18] About 12% of Americans over the age of 60 years have symptomatic knee osteoarthritis. [18]

It is important for physicians to address patients' worries about the proper pharmacologic and nonpharmacologic management of the disease. One of the most announced and controversial nonpharmacologic management approaches is exercise. [18]

People with knee OA usually ask about the effect of exercises on their arthritis, knee OA is believed to be a "wear and tear" phenomenon, so any increase in physical activity, by definition, will accelerate the degenerative process. However, a recent prospective observational study of more than 4, 900 patients (that aimed to examine the impact of physical activity on cartilage thickness loss in knee OA patients over 4 years), showed that physical activity was not associated with increased cartilage thickness loss. [19] It also found that in women, moderate physical activity slowed down cartilage loss when compared to low activity levels. [19]

Many studies demonstrated the risk factors and complications of knee osteoarthritis, but how physical activity affects the osteoarthritis severity needs to be clarified.

This study showed that most patients having knee OA were females (82%), female predominance was also reported in another study. [7]

About one fifth of patients had disease duration of 2 years or less.

Sixty - one percent of patients were (44 - 59) years old, and 39% were ≥ 60 years.

Eighty - two percent of patients used medications for pain relief including NSAIDs, Paracetamol and Antineuropathic medications, while less than one - fifth of them were attending physiotherapy sessions or doing home exercises. With regards to disease severity, higher severity was reported amongst older female patients, those with longer disease duration and those who used medications.

This study also showed that increased disease severity (grade III and IV) was significantly associated with low physical activity levels and more prolonged sedentary time.

These findings are consistent with findings from previous studies which showed a beneficial effect of physical activity on knee OA severity. [20] and pain. [21] However, no effect was observed on local synovial inflammation by MRI. [21] A recent study showed that lower muscle mass and reduced engagement in moderate - low intensity physical activity was associated with more knee pain and compromised self - reported function. [22] Also aerobic exercises and physical therapy programs were shown to improve physical function in post - menopausal women with knee OA. [23]

On the other hand, a one - year longitudinal study suggests that daily light or moderate - vigorous physical activity showed no improvement in knee symptoms over a year for individuals with knee OA, and it was even associated with worsening of symptoms in individuals with advanced disease (Kellgren - lawrence grade IV). [24] This finding highlights that disease stages should be taken into account before recommending any increase in physical activity for patients with knee OA.

Other parameters were used to assess joint health which included the way of Muslim prayer, Climbing stairs and type of Water Closet used were reported for the first time in this study, there were no previous similar studies for comparison.

There was significant differences between grades of disease severity, where it was shown that patients who were active and had mild disease had less disability and better quality of life (regarding the previously mentioned parameters) versus inactive patients with more advanced disease status. These findings support what was reported by a previous author, [25] which showed that low level of physical activity, kinesiophobia and depression contributed to reduced quality of life and increased disability among knee OA patients. Also, it was found that maintaining high physical activity levels improved the functional capacity in geriatric patients with knee OA. [26]

However, a recently published study evaluating the efficacy of strength and aerobic exercise programs compared to standard care on knee - related quality of life after one year found no significant differences between the exercise programs and standard care. [27] Another study showed a positive association between regular physical activity and long - term improvement in quality of life and physical function in patients with hip and knee OA. [28]

Study limitations:
The major limitation of the study is that the study is an analytic cross - section. The study is therefore unable to assess the long term effect of patients' activity levels on their joint's condition. Also, limited patient numbers (100) prevent any major conclusions from being drawn.

5. Conclusion

1) Moderate level of physical activity was associated with less knee OA severity.
2) Sedentary behavior was associated with increasing disease severity.
3) Physical activity has a beneficial effect on patients' quality of life.

Conflict of interest: The authors declare no conflict of interest.

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