

## Physical activity among patients with knee osteoarthritis during the COVID-19 pandemic

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### Abstract

**Objectives:** This study aimed to assess the level of physical activity among patients with knee osteoarthritis (OA) during the COVID-19 pandemic.

**Methods:** A total of 55 patients, aged 40 to 69 years, diagnosed with knee osteoarthritis based on the criteria set by the American College of Rheumatology (ACR) or Kellgren and Lawrence classification, were included in this study. These patients were seen at the diagnostic center of the Souss Massa University Hospital for rheumatology consultation. Pain levels were measured using the Visual Analog Scale (VAS), while knee osteoarthritis severity was evaluated using the Western Ontario McMaster University of Osteoarthritis score (WOMAC). The International Physical Activity Questionnaire (IPAQ) short version was used to assess physical activity levels.

**Results:** The mean age of the patients was 54.6 +/- 7.2 years, with a majority of females (90.9%, n=50). The average body mass index (BMI) was 31.3 [24-39], indicating obesity in 92.3% (n=48) of the patients. The mean duration of osteoarthritis progression in the study population was 6.3 +/- 6.5 years. Radiographic analysis revealed stage II knee osteoarthritis in 38.2% (n=13) of the patients and stage III in 29.4% (n=10).

No significant difference in VAS scores was observed between pre-pandemic and pandemic periods. The average WOMAC score was 52.2 +/- 18. The mean IPAQ total activity score was 1357 metabolic equivalent of task (MET)-min/week, and patients spent an average of 342 minutes per day in sedentary activities. Regarding physical activity levels during the past 7 days, 58.2% of patients engaged in moderate activity, 36.4% had low activity, and only 5.5% reported intense activity.

**Conclusion:** Among the study participants, 52.7% of women and 5.5% of men were classified as having moderate physical activity levels. In univariate analysis, the WOMAC score was found to be the only factor significantly associated with the level of physical activity measured by the IPAQ categorical score (intense, moderate, low activity). A positive and statistically significant correlation (p<0.001) was observed, indicating that as the WOMAC score increased, physical activity levels decreased.

**Keywords:** Osteoarthritis; Knee; IPAQ; WOMAC; Physical activity; Covid-19; Pain

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## 1. Introduction

Osteoarthritis is a chronic joint disease that affects the entire joint and is a major cause of chronic pain worldwide. Factors such as increased life expectancy, sedentary lifestyle, and excess weight can have a significant impact on physical activity, particularly in weight-bearing joints. Regular physical activity plays a crucial role in optimizing joint biomechanics and is an important pillar in the treatment of osteoarthritis.

Physical activity refers to any body movement resulting from muscle contraction that leads to energy expenditure. It encompasses a wide range of activities, from sports exercises and jogging to everyday hobbies and tasks [1].

For individuals with musculoskeletal conditions, increasing physical activity can help reduce pain and improve quality of life [2]. Light to moderate regular physical activity is recommended globally as a primary treatment for common musculoskeletal conditions like osteoarthritis [3] [4]. Furthermore, it offers additional benefits such as cardiovascular development, reduced risk of diabetes and obesity [5].

Pain, functional limitations and fatigue are prevalent symptoms among osteoarthritis patients [6]. These symptoms often lead to reduced participation in daily activities and a more sedentary lifestyle, which can contribute to weight gain and worsen the impact of osteoarthritis, especially in weight-bearing joints [7]. During the COVID-19 pandemic, many patients discontinued their physical activity routines due to the imposed confinement measures [8]. This change in behavior further exacerbated the progression of knee degeneration. To preserve joint cartilage, bone mineral density and muscle mass, moderate physical activity is recommended [9] [10].

The aim of this study was to evaluate physical activity levels in individuals with osteoarthritis during the COVID-19 pandemic and to examine the relationship between physical activity and clinical and paraclinical parameters associated with osteoarthritis. To the best of our knowledge, no such study has been conducted in Morocco thus far.

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## 2. Material and methods

### 2.1. Study Population

This study involved a descriptive and analytical cross-sectional survey conducted on a population of 55 patients aged between 40 and 69 years, diagnosed with knee osteoarthritis (OA). The selection of participants was based on the criteria set by the American College of Rheumatology (ACR) [11] or Kellgren and Lawrence classification [12] (table 1). The patients were recruited from rheumatology consultations at the diagnostic center of the Souss Massa University Hospital. Inclusion criteria required participants to have at least one standard anteroposterior and/or Schuss radiological image of the knee. Informed consent was obtained from all study participants.

### 2.2. Methods

Data collection encompassed sociodemographic, clinical, and paraclinical parameters of the patients, which were obtained using a questionnaire and by reviewing the patients' medical records. Parameters such as the duration of osteoarthritis progression, radiological staging, personal medical history, pain levels before and after confinement and comorbidities were recorded.

**Anthropometric Measurements:** Weight and height were measured, and the body mass index (BMI) was calculated using the formula: body weight (kg) divided by the square of height (m<sup>2</sup>).

**Radiological Staging of Osteoarthritis:** Anteroposterior and side-view radiographs of the knees were taken while the patients were bearing weight. These radiographs were evaluated by a trained reader who was blinded to the patients' information. In cases where Schuss views were limited, the standard anteroposterior and profile views were used as the reference for analysis. For the 10 patients who did not have X-ray radiographs, the clinical criteria established by the ACR were employed for analysis as a default approach.

**Table 1** The Kellgren and Lawrence (KL) classification [12]

Five grades	
Grade 0	Absence of radiographic signs of osteoarthritis.
Grade 1	Doubtful.
Grade 2	Certain osteoarthritis but of minimal severity.
Grade 3	Moderate osteoarthritis.
Grade 4	Severe osteoarthritis.

**Pain Assessment:** To evaluate overall pain, a visual analog scale (VAS) ranging from 0 to 10 mm was used for both knees. The assessment was conducted twice, before and after the confinement period.

**Osteoarthritis Assessment:** The functional status of the patients was assessed using the Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) [13]. The WOMAC total score, which encompasses pain, stiffness and functional limitations, was calculated. Additionally, individual scores for WOMAC pain, WOMAC stiffness, and WOMAC functional limitations were determined.

**Measurement of Physical Activity:** For the measurement of physical activity levels, the short Arabic version of the International Physical Activity Questionnaire (IPAQ) was employed [14]. The questionnaire focused on the duration of physical activity engagement during the last seven days of the COVID-19 pandemic. Specifically, the time spent on sitting, walking, moderate-intensity activities and vigorous-intensity activities was recorded.

Following the IPAQ protocol, categorical levels of physical activity were determined based on the total number of days engaged in physical activity and metabolic equivalents of task minutes (METs) per week. Moderate physical activity was classified as engaging in at least five days of any combination of walking, moderate-intensity, or vigorous-intensity activities with a minimum of 600 MET-minutes per week. High physical activity was defined as participating in at least seven days of any combination of walking, moderate-intensity or vigorous-intensity activities, achieving a minimum of 3000 MET-minutes per week. Sedentary physical activity was categorized as having less than 150 MET-minutes per week.

### 2.3. Statistical Analysis

The statistical analysis was conducted using Jamovi (Version 2.3), a statistical software designed for Windows. Descriptive statistics were used to present the data, expressed as mean  $\pm$  standard deviation (SD) or as counts and percentages.

To compare the data, Student's t-test for unpaired data or Fisher's nonparametric exact test was applied depending on the nature of the variables. A p-value of less than 0.05 was considered statistically significant.

ANOVA correlation analyses were performed to examine the relationship between the level of physical activity and independent variables such as age, body mass index (BMI), visual analog scale (VAS), the Western Ontario McMaster University of Osteoarthritis score (WOMAC) and radiological stages

## 3. Results

### 3.1. Study Population

Initially, 80 patients were selected for participation in the study. However, 14 patients were subsequently excluded due to being over the age of 69, and an additional 11 patients could not be reached for data collection.

The mean age of the remaining patients was  $54.6 \pm 7.2$  years. The majority of patients (92.3%; 48 individuals) were classified as overweight based on their body mass index (BMI) exceeding 30. The average duration of osteoarthritis progression among the patients was  $6.3 \pm 6.5$  years (**Table 2**).

Regarding the demographics of the study population, 90.9% were female, 80% were married, and 92.7% resided in urban areas. Only 16.4% of the participants reported using walking aids, and none of the patients had undergone total knee replacement surgery (**Table 3**).

**Table 2** Overview of the typical features of the study population, presented as mean values with their corresponding standard deviations (SD)

	Mean	Standard deviation
Age (y/o)	54.6	7.2
BMI (kg/m <sup>2</sup> )	31.3	4.7
Duration of osteoarthritis evolution (years)	6.3	6.5
VAS before confinement	8	1.7
VAS after confinement	7.9	1.7
WOMAC total (0-96)	52.2	18
WOMAC pain (0-20)	9.8	3.3
WOMAC impotency (0-68)	38	14.6
WOMAC stiffness (0-8)	4.4	1.6
IPAQ-SF (MET-minutes/week)	1357	1189
Time spent sitting (hours)	5.7	2.6

BMI: body mass index, VAS: visual analog scale, WOMAC: Western Ontario McMaster Universities Osteoarthritis Index, IPAQ -SF: International physical activity questionnaire-short form

**Table 3** Summary of the overall characteristics of the study population, presented as counts and percentages

	Headcount	Percentage
<b>Gender</b>		
Female	50	90.9%
Male	5	9.1%
<b>Marital status</b>		
Single	1	1.8%
Married	44	80%
Divorced	1	1.8%
Widowed	9	16.4%
<b>Living in</b>		
Urban	51	92.7%
Rural	4	7.3%
<b>Use of walking aids</b>		
Yes	9	16.4%
No	46	83.6%
<b>Radiographic Stage</b>		
Grade II	13	38.2%

Grade III	10	29.4%
Grade IV	3	8.8%
<b>IPAQ-SF activity level</b>		
Low	20	36.4%
Moderate	32	58.2%
Intense	3	5.5%

IPAQ -SF: International physical activity questionnaire-short form

### 3.2. Pain and Medication

The mean pain score (SD) on the Visual Analog Scale (VAS) prior to the confinement period was 8/10 (1.7), and the average pain score (SD) during the confinement period was 7.9/10 (1.7). Pain levels were found to be associated with the type of analgesic used: 50.9% (28) of participants took analgesics, with 42.9% taking them daily, 29.1% taking them several times a week, and 27.3% (15) taking them less than once a week.

Corticosteroid infiltration was administered to 27.8% (15) of participants, while hyaluronic acid viscosupplementation was administered to 14.8% (8) of participants.

### 3.3. Function and Disability

The mean (SD) physical function score, as measured by the total WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index), and its sub-scores for pain, stiffness and physical impairment, were 52.2/96 (18), 9.8/20 (3.3), 38/68 (14.6), and 4.4/8 (1.6), respectively. Overall, our study population exhibited moderate functional limitations with a total WOMAC score of 52.2.

### 3.4. Physical Activity Assessment

The assessment of physical activity, using the IPAQ Short questionnaire, revealed a total of 1357 Metabolic Equivalent of Task (MET)-min/week. On average, participants spent 5.7 hours per day sitting. The analysis of physical activity levels during the COVID-19 pandemic showed that 58.2% of the study population engaged in moderate physical activity, 36.4% were classified as having low activity levels, and only 5.5% had high-intensity activity levels.

### 3.5. Radiological Stages of Osteoarthritis

Among patients diagnosed with osteoarthritis based on X-ray radiographs, the analysis revealed that 38.2% (13) were classified as having radiological stage II, 29.4% (10) had stage III, and only 8.8% (3) had stage IV. Correlation analysis showed that age was approaching significance ( $p = 0.052$ ) in relation to radiological stages: as the stages progressed, the average age tended to increase. Similar trends were observed for BMI: the average BMI was 28.5 at stage I and 32.4 at stage IV, but this difference did not reach statistical significance ( $p = 0.204$ ). Regarding physical activity and radiological stages, the difference approached significance ( $p = 0.081$ ).

### 3.6. Factors Associated with Physical Activity Level Measured by IPAQ

Among the study participants, 52.7% of women and 5.5% of men were categorized as having moderate activity levels. In the univariate analysis, the only factor found to be associated with the level of physical activity measured by the categorical score of the IPAQ (intense, moderate, low activity) was the WOMAC score. A positive and statistically significant correlation ( $p < 0.001$ ) was observed: as the WOMAC score increased, physical activity decreased.

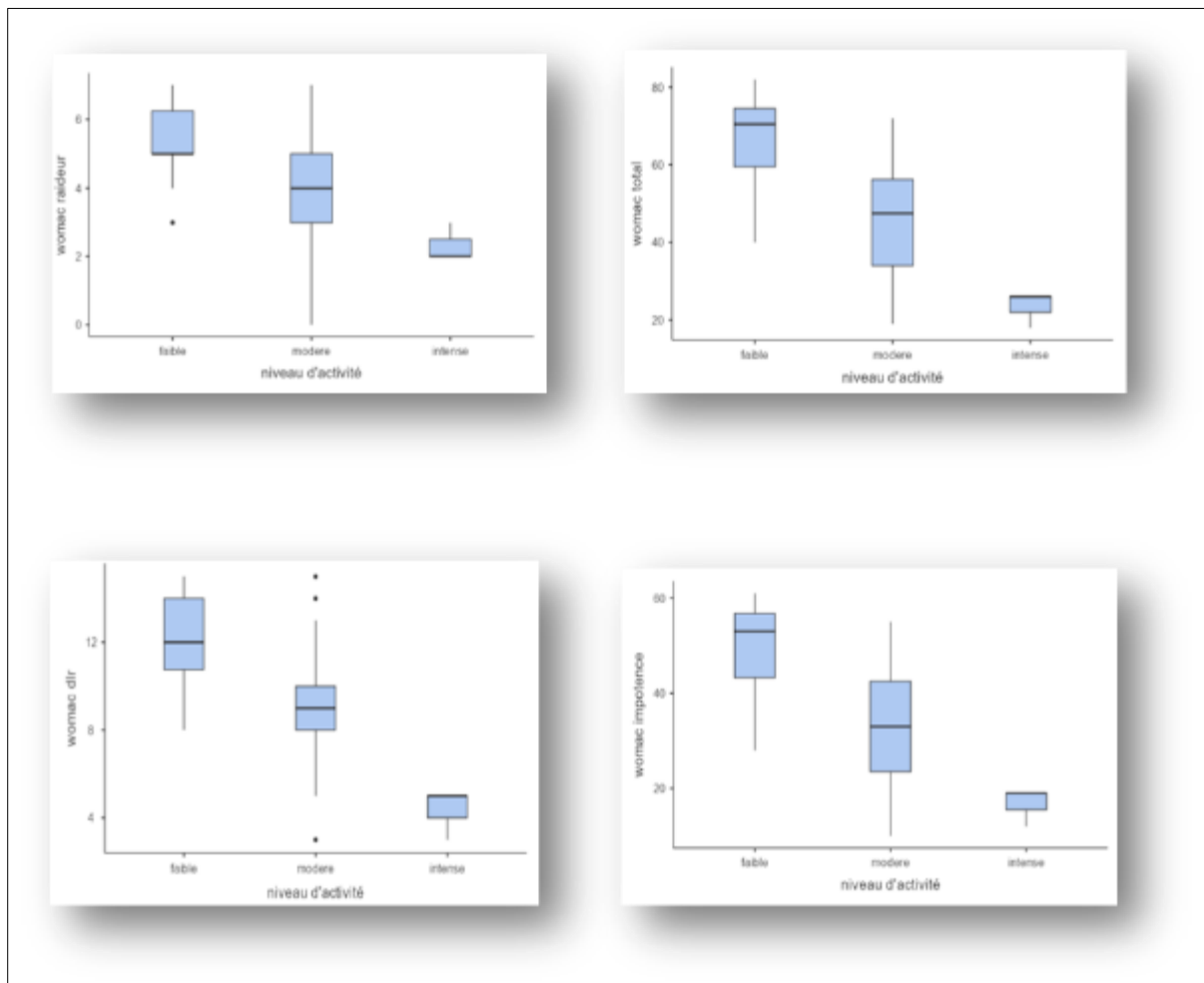
For WOMAC total and pain, there is a statistically significant difference between the low activity group and those with moderate and intense activity, as well as between those with moderate and intense activity. For WOMAC stiffness and impotence, this significant difference is observed between the low activity group compared with the moderate and intense activity groups (**Table4 +figure 1**).

Physical activity level was approaching significance in relation to the average pain score during the confinement period ( $p = 0.057$ ), regardless of gender ( $p = 0.360$ ), BMI ( $p = 0.715$ ) or other characteristics.

**Table 4** Comparison between means IPAQ activity levels and WOMAC score

Activity level				
	Low	Moderate	Intense	P value
WOMAC total	67.25 +/- 12.2*	45.56 +/- 15,2	23.3 +/- 4,6	< 0,001
WOMAC pain	12,1 +/- 2,2*	8,97 +/- 3,09	4,33 +/- 1,1	< 0,001
WOMAC impotency	49,8 +/- 10,1**	32,66 +/- 12,1	16,7 +/- 4,04	< 0,001
WOMAC stiffness	5,35 +/- 1,35***	3,94 +/- 1,5	2,33 +/- 0,57	< 0,001

\* low VS moderate (<.001) and low VS intense (<.001) activity, moderate VS intense activity (0.019); \*\* low VS moderate (<.001) and low VS intense (<.001) activity; \*\*\* low VS moderate (0.003) and low VS intense (0.004)



**Figure 1 (Box plots)** Comparison between different sub-groups IPAQ levels activity and total score WOMAC and sub-score

#### 4. Discussion

Our study represents the first examination of physical activity levels among osteoarthritis (OA) patients in Morocco, particularly during the COVID-19 pandemic. However, a notable finding in our study was that the majority of participants displayed low to moderate levels of physical activity, which falls below the recommended guidelines for this population.

Interestingly, we did not find significant influences of gender, age, or BMI on physical activity levels. However, we did observe a weak association between physical activity and pain levels as well as the radiological stage of osteoarthritis. Additionally, physical activity showed a strong correlation with functional impairment as assessed by the WOMAC score.

It is noteworthy that our study population was relatively young, with an average age of 54.6 years, compared to previous literature that reported average ages of 69 years (8.3) [15] and 67.6 years (7.9) [16]. Despite the advantage of a younger age in maintaining higher physical activity levels, our population still exhibited moderate activity. This suggests that even among a younger population, factors such as pain and functional impairment can hinder physical activity engagement. As the population ages, it is expected that physical activity levels may become even more moderate and less vigorous [17].

The other demographic characteristics observed in our study align with existing literature, particularly regarding gender, where we found a majority of women (90.9%). This finding is consistent with the study by C. Gay et al. [18], where women represented the majority of participants.

Overall, our findings emphasize the need to address barriers to physical activity engagement among OA patients, especially considering the persistently low to moderate activity levels observed even among a younger population. Strategies to mitigate pain, improve functional abilities, and promote physical activity should be implemented to enhance the overall well-being and quality of life for individuals with OA.

In terms of obesity, the average BMI in our study was 31.3 +/- 4.7, which closely aligns with findings in the literature, such as the study by Heck et al. conducted on a North American population [19], where the average BMI was 30.2. Similar results were also observed in the studies by C. Gay et al. [15] [18].

More than half of the participants in our study regularly took analgesics to alleviate OA-related pain, with the mean VAS pain score increasing to 8/10 before confinement and 7.9/10 after confinement. This could be attributed to the predominance of women in our study population, as women tend to perceive pain levels higher than men, irrespective of the extent of joint damage [20].

S. Lavaud et al [21] discusses in their article an increase in pain during the initial confinement period of the COVID-19 pandemic. Another study suggests that patients may avoid physical activity due to fear of exacerbating pain and fatigue, particularly when they do not receive guidance on adapting physical activity to their condition [22].

Our findings indicate that the study population exhibited moderate limitations, with a total WOMAC score of 52.2, which aligns with the results of F. Merle-Vincent et al. [23] who reported a total WOMAC score of 51.3. However, our study found a higher WOMAC score of 36.6 compared to the scores of 23.7 reported by C. Gay et al. in 2017 [15] and 36.6 reported in 2018 [18].

There is limited existing literature exploring the relationship between the WOMAC score and physical activity. However, our study revealed a statistically significant difference between the WOMAC score and its sub-scores (pain, stiffness, and physical impairment) and physical activity. A study conducted in Turkey examined the relationship between physical activity, pain and functional status assessed by the OKS total score, and found them to be important predictors of activity level [24].

Regarding physical activity, the study population exhibited an average level of physical activity measured by the IPAQ Short questionnaire, with a value of 1357 +/- 1189 Metabolic Equivalent of Task (MET)-min/week. This is similar to the findings of the Turkish study with an average of 1946.9 +/- 894.7 MET-min/week, in contrast to data reported in the literature. Rosemann et al. reported a mean of 2830.7 +/- 1896.5 MET-min/week, while C. Gay et al. [15] reported a mean of 2397 +/- 1675 MET-min/week in 2017 and a mean of 3470.9 +/- 2951.1 MET-min/week in 2018. In contrast, the European Physical Activity Surveillance System (EUPASS) reported a median total continuous IPAQ Score of 3826 MET-min/week [25]. In terms of sitting time, our study found an average of 5.7 hours +/- 2.6 per day, compared to 4.7 hours/day [18] and 8.6 hours +/- 2.3 hours/day [15] reported in other studies.

These findings suggest that our study population exhibited lower physical activity levels compared to the general population. However, it is important to note that there are limited studies assessing the physical activity levels of individuals with OA using the IPAQ survey. Our categorical classification of physical activity revealed that 36.4% of participants were minimally active, 58.2% had moderate activity, and only 5.5% were highly active. Similar results were reported in a study conducted by Rosemann et al. [26] and the Turkish study [24], both of which found moderate physical activity levels among patients with knee OA.

It is crucial for patients to develop a regular physical activity habit, and this is where healthcare professionals play a significant role. Through therapeutic education, physical therapy, and functional rehabilitation interventions, efforts can be made to increase the level of physical activity in the OA population and subsequently reduce disability associated with osteoarthritis. Physical activity also has the potential to improve muscle strength, reflex inhibition, proprioception, knee range of motion and help decrease the risk of excessive weight gain in OA patients [27].

While the periods of confinement and physical distancing measures were crucial in reducing the transmission of the virus, extended restrictions may have limited physical activity opportunities. People spent more time at home, resulting in reduced engagement in routine physical activities [28].

International research studies by Ammar et al. [29], Meyer et al. [30], Violant-Holz et al. [31], Di Sebastiano et al. [32], and Woodruff, Coyne, & St-Pierre [33] have indicated that adults, in general, experienced a decrease in physical activity levels and an increase in sedentary behavior during the COVID-19 pandemic.

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## 5. Conclusion

The significance of physical activity in both healthy individuals and those with chronic diseases has been increasingly recognized. While numerous studies have explored physical activity in various chronic conditions such as diabetes, hypertension, and coronary heart disease [34], there has been limited awareness and research on physical activity in rheumatic diseases, including knee OA. It is crucial for healthcare professionals, including rheumatologists, physiotherapists, and rheumatology nurses, to provide guidance and prioritize therapeutic education to promote increased physical activity and encourage a healthy lifestyle among patients.

This study aimed to assess physical activity levels in our OA population and examine the association between physical activity and clinical and paraclinical parameters related to osteoarthritis. Our findings indicate a strong correlation between low to moderate physical activity and pain, as well as functional impairment measured by the WOMAC score. These results highlight the importance of physical activity in OA patients and have the potential to contribute to the development of future clinical guidelines in this field.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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