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Original article

Physical activity level and association with behavioral factors in knee osteoarthritis☆

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ABSTRACT

Background: The effects of physical activity (PA) in disease prevention and therapy have well-known effects on lower-limb osteoarthritis (OA), decreasing pain and improving function.
Objective: We aimed to describe the level and factors affecting PA practices of people with knee OA.
Design: Prospective epidemiological study.
Setting: In all, 548 people with knee OA were interviewed by use of self-administered anonymous questionnaires.
Main outcome measurement: The main outcome was physical activity level evaluated by the International physical activity questionnaire (IPAQ) (short version). Secondary outcomes included sociodemographic and clinical data, comorbidities, and barriers to and facilitators of practicing regular PA evaluated by 24 specific elements.
Results: The mean (SD) age of the study population was 67.6 (7.9) years; 73.9% were women and 30.9% had obesity (mean [SD] body mass index [BMI] 28.2 [5.7] kg/m2). Multi-joint OA affected 92% of the population, and 71.6% had comorbidities. The mean (SD) visual analog scale score for pain intensity was 4.5/10 (2.5), which was 51.4% better than the patient acceptable symptom state (PASS). The mean (SD) Western Ontario and McMaster Universities Osteoarthritis Index function score was 36.6/100 (20.7), which was 57.5% better than the PASS. In total, 67% of patients used analgesics, half of them at least once a week. According to the IPAQ, 42.6% of patients reported high, 38.6% moderate, and 18.8% low PA level; the median IPAQ total activity score was 2628 metabolic equivalent of task (MET)-min/week and time spent sitting was 257.1 min/day. Only one third of participants received non-pharmacological treatment corresponding to the latest recommendations. Variables significantly related to inactive or minimally active PA levels were BMI ($P = 0.0294$), sex ($P = 0.0008$), and biomedical barriers, related to self-efficacy ($P = 0.0118$).
Conclusions: The OA study population was less active, more sedentary, and had more comorbidities and more barriers to PA practice than the overall population.

1. Introduction

Osteoarthritis (OA) is the most common joint disease today, affecting 17% of the population, 35% with OA of the knee [1]. Guidelines for managing lower-limb OA recommend non-pharmacological treatment, and no curative treatment is available, except prosthetic surgery [2]. These therapies combine exercise programs, self-management, and education, along with weight loss when necessary [3]. Exercise programs include specific exercises (strength training, aerobic activity, adjunctive range of motion, and stretching exercises) and increasing physical activity (PA) level [4].

The effects of PA and specific exercise in disease prevention and therapy have well-known effects on lower-limb OA, decreasing pain and improving function. Symptomatic lower-limb OA affects

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function, causing loss of autonomy [5], and reduces activity in older people [6].

The relevance of monitoring PA levels in different populations appears essential [7], but no studies have specifically investigated people with knee OA. According to several authors, people with OA have lower PA levels than the general population; 37% are actually inactive. Sedentary living is associated with age, education level, functional limitations, sports hall availability and anxiety and depression disorders [8]. It may also depend on sex and body mass index (BMI) [9]. Sitting for more than 6 hr/day increases mortality risk [10]. Furthermore, sitting for more than 6 hr/day was found associated with PA <1470 metabolic equivalent of task (MET)-min/week, thus increasing cardiovascular disease mortality risk [10]. Qualitative studies are under way to analyze factors affecting regular PA habits in people with knee OA [11].

This epidemiological study primarily sought to determine PA level by using the short-form international physical activity questionnaire (IPAQ) score [12] in people with knee OA. Secondary objectives were to explore the association between PA level and anthropometric, sociodemographic, and clinical variables as well as barriers to and facilitators of regular PA, along with fears and beliefs about knee OA [13].

2. Methods

Subjects: for this cross-sectional study, a total of 548 people with knee pain related to knee OA in at least one knee were recruited on a volunteer basis in 9 conventional spa therapy locations in the center of France (Bourbon Lancy, Bourbon l'Archambault, Chatel Guyon, Chaudes Aigues, Evaux les Bains, Le Mont Dore, Néris les Bains, Royat, Vichy). Patients were recruited during a 2-month period between September 24 and November 19, 2014. OA diagnosis was confirmed by the physician in charge of the patient during the spa therapy period. Patients with behavioral and comprehension disorders and thus not able to be assessed or with bilateral total knee replacement were excluded.

The study protocol was approved by the ethics committee of the university hospital of Clermont-Ferrand (medical ethics committee of South-East France Sud-Est 6; authorization no. 2015/CE38) and registered on ClinicalTrials.gov (NCT02681133). This study was conducted in compliance with both Good Clinical Practices and the Declaration of Helsinki. In accordance with French law, the ethics committee of South-East France (Sud-Est 6) and the study protocol, all participants provided their verbal consent to participate in the study after being informed about the study procedures. The verbal consent was reported in the medical file; it was sufficient for research in routine care. This study was conducted in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement.

3. Data collection

Data were collected by use of an anonymous self-administered questionnaire. An average of 15 min was needed to complete the questionnaire. People were eligible if they gave their oral consent to participate and had symptomatic knee OA according to the criteria of the American College of Rheumatology (ACR) [14], confirmed by physical examination.

Data were collected on sociodemographic variables (sex, age, educational level, and working situation), clinical variables (OA duration, painful joints, joint replacement, pain during the last day and most intense pain during the last month on a visual analog scale [VAS], and pain medication) and comorbidities (obesity, diabetes, hypertension, renal failure, gastrointestinal bleeding, anxiety/depression, physical impairment limiting activity, and cardiovascular disease) by declarative information based on Osteoarthritis Research Society International guidelines [15]. To avoid any misdeclaration, we considered the pharmacological treatment of participants.

To assess PA, the short-form IPAQ was used [16]. This form includes 7 items, divided into frequency, intensity, and duration of PA at low (walking), moderate, and vigorous levels, in addition to total PA per week. It also included an item about sitting time, expressed as minutes per day, measuring sedentary lifestyle. Data are expressed as continuous data, in MET-min/week, and as categorical scores (inactive, minimally active, and Health-Enhancing Physical Activity [HEPA] active). A category labeled HEPA active indicated levels exceeding the minimum public-health PA recommendation, believed to induce greater health benefits [12]. The IPAQ Research Committee proposes a measure equal to approximately "at least 1 hr per day or more, of at least moderate-intensity activity above the basal level of PA". This level amounts to 12,500 steps/day. The minimally active category was more than the minimum level of activity recommended for adults in current public health recommendations, as preventive measures and for a good general state of health. This level was equivalent to "half an hour of at least moderate-intensity PA on most days". The inactive category defined insufficiently active individuals who did not meet the criteria of the other categories. The scoring protocol is available at http://www.ipaq.ik.se. According to the scoring instructions, vigorous-intensity PA was assigned a value of 8.0 METs, moderate PA a value of 4.0 METs, and walking a value of 3.3 METs. PA was calculated as the time dedicated to each activity multiplied by the specific MET for that activity [12].

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was used to assess physical disability. We used only the function sub-scale score, normalized to a 0–100 score. Higher scores indicated more severe impairment [17].

The patient acceptable symptom state (PASS) is the minimum value for patient well-being. For knee OA patients, the PASS consists of a VAS pain score cut-off of $\leq$ 3.23 mm, with a WOMAC function score cut-off of $\leq$ 31 mm [18].

Fears and beliefs concerning knee OA were assessed by the 11-item Knee Osteoarthritis Fears and Beliefs Questionnaire (KOFBeQ) (ecomponent). One total (0–99) and 4 sub-scores were computed (daily living activities, physician, disease, and sports or leisure activity scores). Higher scores indicate substantial fears and beliefs [13].

The barriers to and facilitators of regular PA practice were assessed by 24 independent and specific items from a qualitative study [19] designed for the study in the absence of any reference scale. Responses to each item ranged from 0 (strongly disagree) to 4 (strongly agree).

4. Statistical analysis

Statistical analysis involved using SAS v9.4. Statistical significance was defined as $P < 0.05$ (two-sided). Continuous variables are presented as mean (SD) or median (interquartile range [IQR]), as recommended for analysis of IPAQ data (www.ipaq.ki.se/scoring.pdf), and categorical data are presented as number (%). First, participants were described in terms of sociodemographic and clinical characteristics. Participants with and without comorbidities were compared by Mann-Whitney non-parametric test for quantitative variables or chi-square or Fisher exact test for categorical variables. The PA level was described by IPAQ categorical and continuous scores (in MET-min/week). Univariate associations between the categorical IPAQ score (inactive, minimally active, HEPA active) and variables were tested by Kruskal-

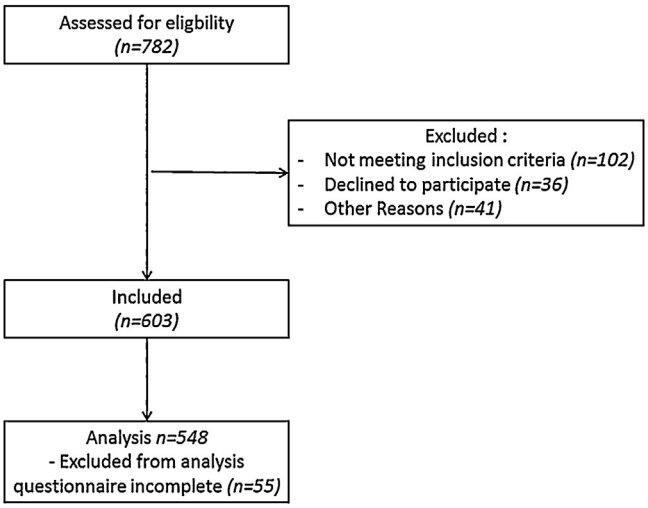

Fig. 1. Flow of participants in the study.

Wallis non-parametric test or chi-square or Fisher's exact test. Univariate associations between IPAQ continuous MET scores and variables were tested by Spearman correlation coefficients or Mann-Whitney/Kruskal-Wallis non-parametric test (because IPAQ continuous MET scores were not normally distributed). Multinomial logistic regression was performed with a forward-variable selection model to test independent associations of factors with PA level. The first dependent variable was the categorical IPAQ score (the model respected the proportional-odds assumption) to characterize people with a low PA level, then the total activity IPAQ score, dichotomized as <3000 and ≥ 3000 MET-min/week. The short-form IPAQ score enabled evaluation of PA level, with the graphic determination of the 3,000 MET-min/week threshold enabling correlations to be determined between continuous (MET-min/week) and categorical scores. Among participants with categorical inactive or minimally active IPAQ scores (Fig. 1), for 96.8%, total continuous IPAQ scores were <3000 MET-min/week. Among participants with HEPA active categorical IPAQ scores, for 96.4%, total continuous IPAQ scores were ≥ 3000 MET-min/week.

5. Results

5.1. Participants

The characteristics of the 548 participants are in Table 1.

5.1.1. Pain and medication

The mean (SD) pain score on the VAS during the last 24 hr was 4.5/10 (2.5), and the mean (SD) intense pain during the last month was 6.5/10 (2.4). For 51.4% and 79.0% of participants, pain score on the VAS over the last 24 hr and during the last month, respectively, was greater than the PASS. Pain was correlated with type of pain medication: 67.1% were taking painkillers, 42.9% on a daily basis, 29.1% several times per week, and 27.9% less than once a week. In total, 30.8% of participants were undergoing physiotherapy, 14.1% weight management, and 21.9% complementary medicine; 5.8% wore knee braces and 29.2% orthopedic insoles. A total of 36.7% of participants took no other treatments, 35.6% took one, 18.8% two, and 7.3% three.

5.1.2. Function and fears and beliefs

The mean (SD) physical function score on the WOMAC function subscale was 36.6/100 (20.7). For 57.5% of patients, the WOMAC function subscale score was greater than the PASS score for OA. The mean (SD) fear and belief score on the KOFBeQ was 42.8/99 (23.0).

5.1.3. OA phenotypes

Stratification into sub-phenotypes followed the OARSI guidelines [15], with the following 4 sub-phenotypes shown to have

Table 1
Patient characteristics.

Characteristic	Category	All participants ($n=548$)
Sex	Men	143 (26.1)
	Women	404 (73.9)
Age (years), mean (SD)		67.6 (7.9)
Body mass index (kg/m^2), mean (SD)		28.2 (5.7)
Body mass index (kg/m^2)	≤ 30	375 (69.1)
	>30	168 (30.9)
Marital status	Single	160 (29.3)
	Couple	386 (70.7)
Education	Less than high school	317 (59.3)
	High school or higher	218 (40.7)
Residence	Urban	249 (50.3)
	Rural	246 (49.7)
Occupation	Active	62 (11.3)
	Retired	458 (83.6)
	Disabled	38 (6.9)
Osteoarthritis duration (years)		12.9 (10.9)
Walking device	Yes	73 (14.0)
	No	447 (86.0)
Pain (VAS, 0/10), mean (SD)	Intensity over the last 24 hr	4.5 (2.5)
	Higher intensity over the last month	6.5 (2.4)
Treatment for pain due to osteoarthritis	Yes	349 (67.1)
	No	171 (32.9)
If treatment, frequency	Every day	146 (42.9)
	Several times per week	99 (29.1)
	Less than one time per week	95 27.9)
WOMAC (0/100), mean (SD)	Function score	36.6 (20.7)
KOFBeQ (0/99), mean (SD)	Total score	42.8 (23.0)

Data are expressed as mean (SD) or n (%). VAS: visual analog scale; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; KOFBeQ: knee osteoarthritis fears and beliefs questionnaire.

Table 2
Characteristics of participants with and without comorbidity.

Characteristic	No comorbidities ($n = 150$)	At least one comorbidity ($n = 398$)	*P*-value
Body mass index (kg/m²), mean (SD)	24.9 (2.9)	29.4 (5.9)	< 0.0001
Pain (VAS 0/10)			
Intensity over the last 24 hr, mean (SD)	4.1 (2.3)	4.7 (2.6)	0.0198
Higher intensity over the last month, mean (SD)	5.9 (2.3)	6.7 (2.5)	0.0004
Treatment for pain due to osteoarthritis			
Yes	76 (54.3)	273 (71.8)	0.0002
No	64 (45.7)	107 (28.2)	
If treatment, frequency			
Every day	20 (27.4)	126 (47.2)	0.0058
Several times per week	24 (32.9)	75 (28.1)	
Less than once per week	29 (39.7)	66 (24.7)	
KOFBeQ score, mean (SD)			
Daily living activity score	7.2 (7.3)	10.0 (8.2)	0.0007
Physician score	16.2 (10.7)	18.6 (10.8)	0.0250
Disease score	6.1 (5.9)	7.5 (6.0)	0.0184
Sports and leisure activity score	7.5 (6.0)	9.1 (6.3)	0.0091
KOFBeQ total score (0/99), mean (SD)	37.0 (21.9)	44.9 (23.1)	0.0010
WOMAC function score (0/100), mean (SD)	32.4 (18.6)	38.3 (21.3)	0.0089
Walking device, yes	6 (4.2)	67 (17.8)	< 0.0001

Data are expressed as *n* (%) unless indicated.

prevalence for multi-joint OA: knee-only OA with or without co-morbidities (5.5% vs. 2.2%) and multiple-joint OA with or without co-morbidities (67.2% vs. 25.2%). Among the 92.3% of participants with multiple-joint OA, 19.2% had bilateral-knee OA. Symptomatic knee OA was accompanied by OA of the lumbar spine in 67.2%, cervical spine in 58.2%, shoulders in 49.3%, hands in 48.5%, and hips in 33.6%. Only 19% of participants underwent joint replacement (hip/knee). Family history of OA was reported by 66.7% of participants, and 23.9% reported not knowing this information. History of knee injury or surgery was reported by 44.1% of participants.

5.1.4. Comorbidities

In total, 72.6% of participants had at least one pertinent comorbid health concern (Table 2). Patients with and without comorbidities did not differ in sociodemographic data. BMI was higher, pain was more severe and frequency of medication, predominantly higher painkiller intake, was higher for participants with than without co-morbidities. Total score and all KOFBeQ subscales for fears and beliefs were higher with than without comorbidities and the mean physical functioning score on the WOMAC function was higher. Participants with comorbidities more frequently needed walking aids.

5.2. Physical activity level

5.2.1. PA level measured by IPAQ categorical and continuous scores

For IPAQ categorical score, 42.6% of participants were classified as HEPA active, 38.6% minimally active, and 18.8% inactive (Table 3). For IPAQ continuous score, the median PA level score was 2628 (IQR 1386–4758) MET-min/week, and the time spent sitting was 257.1 (IQR 180–360) min/day.

5.3. Factors associated with PA level measured by categorical IPAQ score

In total, 54.3% of men versus 38.2% of women were classified as HEPA active. On univariate analysis factors associated with PA level measured by IPAQ categorical score (HEPA active, minimally active, inactive) were sex, the only sociodemographic characteristic ($P = 0.0012$), and BMI, the only clinical factor ($P = 0.0044$) (Supplementary material 1). PA level was lower for obese participants (BMI > 30 kg/m²) than others; 33.3% obese participants were HEPA active versus 46.6% of non-obese participants.

PA level was not significantly correlated with mean pain score over the last 24 hr or last month ($P = 0.8674$ and $P = 0.7804$, respectively), regardless of comorbidities ($P = 0.8294$), physical functioning ($P = 0.6140$), or fears and beliefs.

PA level was lower for patients reporting barriers to PA practice that were intrinsic (lack of motivation) and linked to self-efficacy (very uncertain, tired) but was higher for patients with facilitators (psychological benefits).

On multivariable analysis, categorical IPAQ score remained associated with sex ($P = 0.0008$), BMI ($P = 0.0294$), and self-efficacy ($P = 0.0118$).

5.4. Factors associated with PA level measured by continuous IPAQ scores

The following factors were associated with PA level measured by vigorous-intensity activities, moderate-intensity activities, total physical activity in MET-min/week, walking, and sitting time.

Patients living in urban areas practiced significantly less vigorous-intensity activities than others (mean [SD] 2592.3 [2223.1] vs. 3420.3 [2601.7] MET-min/week) ($P = 0.0475$). Furthermore, living environment (near or far from sports facilities) was linked to vigorous-intensity activities ($P = 0.0370$). No factors were linked with moderate-intensity activities.

Total IPAQ scores for PA were higher for men than women (mean [SD] 4081.2 [3,314.0] vs. 3246.4 [2782.6] MET-min/week) ($P = 0.0074$) and were lower for obese than non-obese participants (mean [SD] 2842.0 [2417.3] vs. 3727.1 [3068.5] MET-min/week) ($P = 0.0015$). Total IPAQ scores for PA were higher for people in a couple relationship than single people (mean [SD] 3605.3 [2944.8] vs. 3156.3 [2966.1] MET-min/week) ($P = 0.0418$) and were higher with less barriers to PA practice, intrinsic attitudes (motivation) ($P = 0.0479$) or self-efficacy (very uncertain) ($P = 0.0448$), and less fatigue ($P = 0.0225$). To be in good spirits when performing PA was a facilitator of high total PA scores ($P = 0.0306$).

Table 3
Physical activity level measured by International Physical Activity Questionnaire (short form).

Characteristic	Category	All participants (n = 548)
Physical activity level	Low	99 (18.8)
	Moderate	203 (38.6)
	High	224 (42.6)
IPAQ score (MET-min/week), mean (SD)	Vigorous activity	2931.7 (2445.1) [2160 (1020–4080)]
	Moderate activity	1694.9 (1404.5) [1200 (600–2400)]
	Walking	1413.3 (1205.5) [990 (594–1782)]
	Total activity	3470.9 (2951.1) [2628 (1386–4758)]
Time spent sitting (min/week), mean (SD)		283.6 (143.2) [257.1 (180–360)]
Time spent sitting (min/week)	<180	89 (17.5)
	180–359	280 (55.0)
	≥360	140 (27.5)

Data are expressed as n (%) unless indicated.

Walking scores were lower for obese than non-obese participants (mean [SD] 1222.6 [1,195.0] vs. 1489.1 [1205.4] MET-min/week) (P = 0.0039).

Sitting time was less for women than men (mean [SD] 274.5 [140.6] vs. 308.2 [148.1] min/day) (P = 0.0137) and was longer for obese than non-obese participants (mean [SD] 308.2 [157.2] vs. 274.5 [135.5] min/day) (P = 0.0554). Patients with cardiovascular disease spent significantly more time sitting than others (mean [SD] 324.5 [159.4] vs. 275.6 [138.7] min/day) (P = 0.0069). Sitting time was longer for participants with than without walking aids (mean [SD] 333.6 [184] vs. 279.1 [134.2] min/day) (P = 0.0574). Beliefs that PA enables one to meet other people (P = 0.0454), and that the living environment (proximity to sports facility) enables regular PA practice (P = 0.0125) was a facilitator for reducing sitting time. Patients with intrinsic (motivation) barriers (P = 0.0136) and deteriorating OA (P = 0.0417) spent more time sitting.

5.5. Factors associated with PA level measured by total continuous IPAQ score: <3000 versus ≥3000 MET-min/week

Patient characteristics were compared between 2 groups: total PA continuous IPAQ score < 3000 MET-min/week and ≥ 3000 MET-min/week (Supplementary material 2). On univariate analysis, total continuous IPAQ score < 3000 MET-min/week was associated with female sex (P = 0.0032), increased BMI (P = 0.0005), and agreeing with "Today, I am very uncertain of being able to practice PA" (P = 0.0535) and "I am too tired to practice PA" (P = 0.0317). Total continuous IPAQ score ≥ 3000 MET-min/week was associated with participants agreeing with "to be in good spirit when I do PA" (P = 0.0317). On multivariable analysis, the factors remaining independently associated with total continuous IPAQ score <3000 MET-min/week were sex (P = 0.0038), BMI (P = 0.0003), living in an urban area (P = 0.0396), and agreeing with "I am too old to do sport!" (P = 0.0384).

6. Discussion

We aimed to describe the level and factors affecting PA practices of people with knee OA. Multi-joint OA affected 92% of the population, and 71.6% had comorbidities. The mean (SD) VAS score for pain intensity was 4.5/10 (2.5) and the mean (SD) WOMAC function score was 36.6/100 (20.7). The median IPAQ total activity score was 2,628 MET-min/week and time spent sitting was 257.1 min/day. Variables significantly associated with inactive or minimally active PA levels were BMI, sex, and biomedical barriers, related to self-efficacy.

Women represented the majority of this patient population. Two-thirds of patients had comorbidities, nearly one third were obese, and more than two thirds had a BMI >25 kg/m^2. The participants' OA dated back to 15 years, affecting several joints for most. Over half of the study population regularly took analgesics to relieve their OA pain. Pain and function scores were higher than the PASS for 50% of participants. The baseline characteristics of participants with knee OA studied by the PASS [18] were in accordance with age, BMI, sex, VAS, and WOMAC values of our study population.

Less than half of our participants practiced a sufficient PA level to provide enhanced health benefits [16] or ≥ 3000 MET-min/week; the median MET-min/week score was 2628; however, they spent < 6 hr/day sitting [10]. PA level significantly affected or was affected by anthropometric data (sex, BMI, and obesity), disease management (walking aids), extrinsic factors (living area, family, and social situation), and intrinsic factors (motivation, well-being, self-efficacy, fatigue, ageing, and fearing to make OA injury worse).

The results of the short-form categorical IPAQ suggest that less than half of the participants had an HEPA active PA level. Even if we cannot directly compare studies because of different study designs, 82% of the 1180 adult patients studied in "the original activity 12-country validation study of the IPAQ", selected from the general population, had an HEPA active PA level. However, our total median continuous IPAQ score was similar: 2514 and 2,628 MET-min/week [our study]) [12]. In contrast, the European PA surveillance system (EUPASS) reported a total median continuous IPAQ score of 3,826 MET-min/week [20], with 51.8% classified as HEPA active (French population n = 550). These studies were conducted in the general population. More specifically, Jurakic et al. demonstrated that 55- to 64-year-old individuals achieved the highest median IPAQ score (4320 MET-min/week, long-form IPAQ), with people older than 64 years old having the second highest score (4026 MET-min/week) [20]. These results suggest that our population was less active than the general population. However, very few studies have assessed the PA level of the OA population by using the IPAQ survey.

A 2003 review assessed the PA level of OA patients by classifying them into 3 groups: inactive (30.6%), insufficiently active (44.9%), and in accordance with recommendations (24.55%) (similar to minimally active IPAQ). These authors demonstrated that the OA population was less active than the general population [7]. Roseman et al. confirmed this finding with their category-based IPAQ scores: 52.75% inactive, 38.5% minimally active, and 8.6% HEPA active, for a mean total continuous IPAQ score of 2,830.7 MET-min/week [21]. These results were considerably lower than in our study (mean 3,470.9 MET-min/week) and in the general adult population. Roseman et al.'s patients with knee or hip OA were recruited from 75 general practitioners (baseline Praxart project) who received the questionnaires.

The IPAQ score for time spent sitting revealed that OA patients were relatively sedentary, with this value differing by sex. Jacobi et al. analyzed a French-population cohort, recording a median of 143 min/day for men (vs. 300 min/day per day in our study) and 120 min/day for women (vs. 240 min/day in our study) [22]. Roseman et al. [21] reported results different from ours for time spent sitting, recording 306 min/day for men and 351 min/day for women.

Knee OA patients are an under-represented OA population, as in our study. Only 7.8% (7.7% in our population) of multi-joint symptomatic individuals had knee OA only [23]. For this reason,

we chose multi-joint OA, with or without comorbidities. As for McAlindon et al. [15], the best-available evidence for efficacy and safety in knee OA was evaluated for all considered treatments, rather than for their real clinical signs.

BMI, pain, medication, fears and beliefs (KOFBeQ), function (WOMAC), and barriers to PA practice were all important for patients with at least one comorbidity [24,25]. If obesity is considered a comorbidity, PA levels were significantly correlated with comorbidity presence. The NUGENOB study revealed that 17% of obese individuals had an HEPA active IPAQ score as compared with 33% of obese OA participants in our study [26]. These findings were well below those obtained for normal-weight and overweight individuals in both analyses.

Some limitations were observed in this study. In fact, even if the EUPASS declared the IPAQ to be a reference tool in measuring a population's PA level [20], this measure remains subjective and declarative. In a comparison study of the IPAQ survey with the Behavioral Risk Factor Surveillance System, the findings showed that the IPAQ score overestimates the assessment of PA level [27], with Naal et al. [28] reporting the same in their study. In addition, the IPAQ score can vary depending on the season. Scores collected in winter are lower than those of summer, when outside practice is easier [19]. A systematic review reported a mean overvaluation of approximately 86% for data surveys versus accelerometer measurement [16]. However, for sitting time, the authors noted the contrary, with data survey underestimating sedentary time (3.5 times less) than accelerometer measurement [22]. We can conclude that patients are eager to show themselves to be more active than they really are. Thus, accelerometer measurement is more relevant than data survey but requires substantial financial resources.

Our study contributes to better defining PA phenotypes for people with knee OA regarding sociodemographic, medical and fears and beliefs data. These data could help to provide tailored educational strategies taking in count the PA profile of individuals, which could be individual or group sessions, aerobic or strengthening programs [29].

7. Conclusions

This study provides new data in addition to existing literature on OA while highlighting new elements regarding PA in OA. The OA study population was less active, more sedentary, and had more comorbidities and more barriers to PA practice than the overall population. This study could help better adapt healthcare measures, while accounting for individuals' overall status, including symptoms of OA pathology and comorbidities, providing tailored educational strategies with respect to PA.

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Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

Supplementary data (technical appendix, statistical code, and dataset) associated with this article can be found, in the online version, at https://doi.org/10.1016/j.rehab.2018.09.005 and from Candy Guiguet-Auclair: cauclair@chu-clermontferrand.fr.

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