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Clinical features and myofascial pain syndrome in older adults with knee osteoarthritis by sex and age distribution: A cross-sectional study☆

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ABSTRACT

Background: A source of myofascial pain and myofascial trigger points (MTrPs) in muscles of the knee area could play a crucial role in the management of pain in osteoarthritis patients. The aim of this study was to describe and compare demographic, clinical and myofascial pain syndrome characteristics in older adults with knee osteoarthritis by sex and age distribution.
Methods: A cross-sectional study was carried out. 114 patients with osteoarthritis were recruited in older-adult care centers. The diagnosis of active and/or latent MTrPs (AMTrPs/LMTrPs) was performed. Numerical Pain Rating Scale, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Barthel Index, Timed Up and Go Test (TUG), Mini-Mental State Examination, EuroQol Group 5-Dimension Self-Report Questionnaire, chronicity, number of falls, and medication use were collected. All data were compared by sex (male or female) and age (< 70, 70–80, or > 80 years) distributions.
Results: The most prevalent muscles with AMTrPs and LMTrPs were the quadriceps vastus medialis (75.43%) and lateralis (65.78%), respectively. The clinical characteristics showed significant differences ($P<0.05$) for chronicity, WOMAC functionality and total scores, TUG, falls rate and medication between males and females, as well as for chronicity, Barthel index and TUG between age distributions. There were not any significant differences ($P>0.05$) by sex or age distribution according to the number and presence of active and latent MTrPs.
Conclusions: The demographic and clinical features of older adults with knee osteoarthritis may be influenced by sex and age distribution. Nevertheless, the myofascial pain syndrome associated with knee osteoarthritis did not seem to be related to sex or age distribution.

☆ **Ethics committee number**: The study protocol was approved by the Ethics Committee of the Rey Juan Carlos University, with the identification number 13/2015.

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1. Introduction

Osteoarthritis (OA) is one of the main reasons for disability within the elderly population; it has a high prevalence in society in general [1,2]. The knee is the most frequently affected joint among those associated with OA, and often results in disability [3,4]. OA of the knee is a syndrome distinguished by the presence of pain, and often corresponds with radiological and laboratory findings [5]. However, the real pathogenesis is still poorly understood. Many studies have shown a disparity between the pain description and the results from x-ray imaging [6–8]. OA has an estimated prevalence of seven million population within the United States [9]. More than in any other joint, OA of the knee causes a large number of the clinical symptoms that lead to impairment [10–12]. The estimated prevalence of OA in Spain is 46% for women and 21% for men over the age of 45 years of age [13]; OA of the knee represents 10% of this [14]. In this same country, knee OA had an economic impact of 4700 million euros only in 2014, an amount comparable to 0.5% of the Gross Domestic Product in that same year. In conclusion, we can state that this. This syndrome has become a major health issue in every country [15]. Although the etiology of knee OA remains undefined, it is known that its incidence increases with age [16,17]. In addition, being overweight becomes a risk factor for the development and progression of this syndrome and it can even be related to joint replacement [18–20]. One of the latest critical reviews found that a source of myofascial pain in knee OA and the existence of myofascial trigger points (MTrPs) in muscles of the knee area could play a crucial role in pain and impairment in patients with OA [21]. In fact, considering that MTrPs are known to be tender spots within a taut band of voluntary muscles that can produce signs and symptoms related to the sensitive, motor or autonomic component, their prevalence may reach 100% in patients with OA knee, specifically in the internal gastrocnemius [92%] and vastus medialis muscles [67%] [22]. Although these muscles have active myofascial trigger points (AMTrPs) that produce spontaneous and recognized pain, latent myofascial trigger points (LMTrPs) may play a role in limiting range of motion, altering muscle contraction patterns, and generating local or referred pain when manual pressure is applied [23,24].

Even though recent studies have focused on the relationship between MTrPs, function and pain in patients with knee OA [22,25–28], there is still a need to define and clarify specifically the distribution pattern and prevalence of MTrPs in these particular patients. The main aim of this study was to describe and compare demographic, clinical and myofascial pain syndrome characteristics in older adults with knee osteoarthritis by sex and age distributions.

2. Methods

2.1. Study design

A cross-sectional study was carried out from March 2016 to June 2016, following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement and checklist [29]. Previously, the study was approved by the Clinical Research Ethics Committee of the Rey Juan Carlos University, Madrid, Spain. All subjects signed an informed consent form before their inclusion in the study. Furthermore, the Helsinki Declaration and ethical standards in human experimentation were followed.

2.2. Participants

This cross-sectional study was developed with a total of 114 participants were recruited from the following older-adults care centers: “Manuel Herranz” and “La Atalaya”, in Pozuelo de Alarcón (Madrid), and “Julián Muñoz”, “Miguel de Cervantes”, and “Rigoberta Menchú”, Leganés (Madrid), in March 2016.

The inclusion criteria were as follows: participants aged 62 years or older with knee pain and unilateral or bilateral dysfunction, and primary knee osteoarthritis fulfilling the American College of Rheumatology criteria for clinical and radiographic diagnostics [26].

Exclusion criteria were: any other condition that could cause myofascial or neuropathic pain in the lower limb, such as lumbar radiculopathy, saphenous nerve entrapment, or paresthetical meralgia; previous total replacement of the same knee; previous simultaneous total replacements of both knees; any other surgical procedure of the lower limbs in the previous 6 months; prior diagnoses or prescriptions in the medical record for myopathy or lumbo-sacral neuropathy; rheumatoid arthritis; initiation of opioid analgesia or corticosteroid or analgesic injection intervention for hip or knee pain within the previous 30 days; alcohol or drug consumption; uncontrolled hypertension or moderate to high risk for cardiac complications during exercise; conservative or invasive physical therapy (previous 6 months or during follow-up); or physical impairments unrelated to the hip or knee preventing safe participation in exercise and walking, such as vision problems that affect mobility, body weight > 155 kg, neurogenic disorder, primary or significantly limiting back pain, advanced osteoporosis, or inability to walk 10 m without an assistive device, inability to comprehend and complete study assessments or comply with study instructions, stated inability to attend or complete the proposed course of intervention and follow-up schedule, fibromyalgia syndrome, or other altered affective/cognitive modulation processes of pain perception. A mean pain intensity > 7 points in the Numeric Rating Scale (NRS) was also an exclusion criterion.

The inclusion and exclusion criteria were based on previous studies [20,22,25,26]. After signing informed consent forms, the participants were physical examined.

2.3. MTrP diagnosis

The diagnosis of active and/or latent MTrPs followed the essential and confirmatory criteria described by Travell and Simons [30]. Essential criteria included palpable tense bands, extreme local pain from pressure a nodule of the taut band, the patients' recognition of their pain upon pressing the sensitive nodule to identify an AMTrP, and painful limited range of movement at full stretch. AMTrPs produce spontaneous and recognizable pain under stimulation, whereas LMTrPs generate localized pain or unrecognizable referred pain on stimulation [31,32]. Recently, a Delphi panel produced an expert-based standardized definition of an AMTrP [33] that can include different sensory sensations as spreading to a distant area, deep pain, dull ache, tingling or burning pain. Also, they affirmed that the main clinical differences between AMTrP and LMTrPs are the reproduction of any of the symptoms experienced by a patient and recognition of pain. The current study applied all of these diagnostic criteria for the participants' physical examinations.

2.4. Outcome measurement

Both the second physiotherapist (MVOS) and the occupational therapist (VBC) carried out pain, function, and test assessments. The Pain intensity (Numerical Pain Rating Scale, NRS), Function (Western Ontario and McMaster Universities Osteoarthritis Index, WOMAC), the Barthel Index (BI), the Timed Up and Go Test (TUG), Mini-Mental State Examination (MMSE), and the EuroQol Group 5-Dimension Self-Report Questionnaire (EQ-5D) results were collected. Sociodemographic data such as age, sex, and body mass index were collected. Also, the onset of knee pain (chronicity of 1, 2, 3, or ≥ 4 years), number of falls and use of medication were extracted. The primary outcomes were pain intensity and function in knee OA.

Pain intensity was measured with the NRS of 11 points (interval from 0–10), where 0 corresponds to no pain, and 10 to the worst pain imaginable. A graphical representation of 11 spaces was used to indicate the patient's own evaluation of his or her pain. The patients were asked to assess the subjective pain intensity of the painful knee and lower limb by pointing with one of their fingers to mark the level of pain on the scale. The NRS is a valid and reliable tool for use in older adults [34,35], and its correlation with the Visual Analogue Scale (VAS) shows a high convergent validity (0.79–0.95) [36].

Function was measured with WOMAC. The WOMAC score is the most widely used instrument to evaluate symptomatology and function in knee OA [37,38]. The secondary outcomes were the BI, TUG, MMSE, and EQ-5D. The BI is the best of the activities of daily living measurement scales. The modified scoring of the BI by Shah [39] achieved greater sensitivity and improved reliability for functional status evaluation of the residents than the original version [40], without causing additional difficulty or affecting the implementation time. It comprises 10 items with a total score ranging from 0–100 points. A higher score means better capacity to perform daily living activities.

In the TUG, participants were asked to stand up from a standard chair, walk to a line on the floor 3 m away, return to the chair, and sit down again. Subjects were timed from the point when their buttocks left the chair to when their buttocks touched the chair when returning to the seated position. The instructions were to walk at a normal pace. Participants had one practice trial, and the second trial was timed. If a walking aid was usually used inside the home, then the walking aid was used during the test. Faster test completion indicated better functional and mobility status. The score was the time taken in seconds to complete the test. These objective measures were selected on the basis of their ability to reflect functional mobility impairments. The cut-off point of ≥13.5 was established as the study population was homogeneous in terms of disease type, all patients experienced problems with lower extremity functioning, and individuals with cognitive problems were excluded [41]. Consecutive time ranges indicated a gradual increase in fall risk. A TUG test score > 30 seconds suggested the need for a walking aid. The TUG is a reliable test with adequate minimum detectable change for clinical use in individuals with doubtful to moderate (grades 1–3) knee OA [42,43]. Intra-rater reliability and inter-rater reliability of the TUG test were 0.97 (95% CI, 0.95–0.98) and 0.96 (95% CI, 0.94–0.97), respectively.

The MMSE is a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment and to screen for dementia [44,45]. The MMSE is a screening tool that includes 11 questions in six sections, each representing a different cognitive domain or function (orientation, registration, attention and calculation, recall, language, and copying), with the maximum score of 30. A score of ≤23 points has been considered as evidence of cognitive impairment, with scores between 18–23 points indicating mild impairment and scores of ≤17 indicating severe impairment. The current study selected an MMSE score cut-off of ≤ 23 as clinical experience has shown that people with very low MMSE scores have difficulties following instructions. Individuals with cognitive problems were excluded.

The EQ-5D provides a simple descriptive profile and single index value for health status by rating five items. Scores from 5–15 are used ro provide health economic evaluation and comparison with other OA knee populations; lower scores indicate better quality of life [46].

2.5. Falls rate and consumption medication

All participants supplied information about their falls over the last 12 months and any medication taken. Time to first fall, and number of clinically significant falls were registered and reported by older-adult care center nurses, out-patient participants, and during telephone follow-up. This prospective method has been found to be reliable, minimizing recall bias, in fall prevention studies [47]. Use of medication was measured as any dispensed during the month and the average number of prescriptions dispensed per month of use [48].

2.6. Procedures

This study was carried out by two physical therapists (EASR and MVOS; > 4 years clinical experience) with experience in Myofascial pain Syndrome (MPS) and an occupational therapist (VBC) with > 10 years of clinical experience. Physical therapist 2 (MVOS) carried out the assessments to collect sociodemographic and primary outcome measurements. Physical therapist 1 (EASR) performed the physical exam for the presence of active or latent MTrPs in the muscles of the involved lower limb(s), using the criteria described by Travell and Simons [30].

2.7. Detection of active or latent MTrPs

The tensor fasciae latae, hip adductors, hamstrings, quadriceps, gastrocnemius, and popliteus muscles were examined in each participant, following a protocol regarding patient and limb positions exactly reproduced from Mayoral et al.'s [26] study, as these muscles are frequently involved in myofascial knee pain. Patients were considered according to this syndrome if they had at least one active (pain-generating) MTrP [30].

2.8. Sample size calculation

The sample size was calculated with the software from the Unit of Clinic and Bio-statistical Analysis, University Hospital complex of A Coruña, Coruña University (available at http://www.fisterra.com/mbe/investiga/9muestras/9muestras2.asp). Considering the knee osteoarthritis prevalence of 10.2% according to the EPISER study by the Spanish Society of Rheumatology [14] and the total population of 46,549,045 individuals in Spain in July 2017, according to the Statistical National Institute (http://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981), the sample size calculation for an α level of 0.05 (confidence interval, α-1 = 95%), a proportion of 5% and a precision of $\pm$ 4%, provided at least 114 patients with knee osteoarthritis.

2.9. Statistical analysis

All data were evaluated for normality of distribution by means of the Kolmogorov–Smirnov test, and considered to show a normal distribution if $P<0.01$. Demographic data and clinical characteristics were described for the total sample as well as by sex (male or female) and age (176: < 70, 70–80, and > 80 years) distributions [49]. Considering the quantitative data, mean and standard deviation (SD) for parametric data, median and interquartile range (IR) for non-parametric data were utilized. Frequencies were used for categorical variables.

With respect to the comparison of quantitative data by sex distribution, Student *t*-tests for independent samples were used to establish if differences were statistically significant for parametric data, and Mann–Whitney *U* tests were used to obtain if differences were statistically significant for non-parametric data. Considering the comparison of quantitative data by age distribution, one way analysis of variance (ANOVA) and Bonferroni's post-hoc analyses were used to establish if differences were statistically significant for parametric data. Kruskal–Wallis tests and Wilcoxon's post-hoc analyses were used to see if differences were statistically significant for non-parametric data. With regard to the dichotomous categorical variables, the Fisher's exact test was used to assess sex differences and the Chi-square (χ^2) test was used to evaluate age distribution differences. For all analyses, statistical significance was set at *P*-value <0.05 and a 95% confidence interval (CI). In addition, all analyses were performed with the SPSS 22.0 (Chicago, IL, USA) commercially available software.

3. Results

A total sample of 114 participants between 65 and 86 years of age with a median $\pm$ IR of 72 $\pm$ 36.8 years completed the research. The majority of the sample suffered from type 1 obesity and chronic knee osteoarthritis. The medians $\pm$ IR of AMTrPs and LMTrPs were 3.00 $\pm$ 2.25 and 4.00 $\pm$ 5.00, respectively, in older adults with knee osteoarthritis. The most prevalent muscle which presented AMTrPs was the quadriceps vastus medialis (75.43%), while the most prevalent muscle which presented LMTrPs was the quadriceps vastus lateralis (65.78%).

3.1. Demographic and clinical characteristics by sex distribution

Regarding Table 1, the demographic characteristics between males (n = 43) and females (n = 71) showed statistically significant differences ($P<0.01$) for weight, height and body mass index (BMI), except for the age ($P=0.484$). Higher values of weight and height were shown in favor of the males, while a greater BMI was shown in favor of the females. The clinical characteristics showed statistically significant differences ($P<0.05$) for chronicity, WOMAC functionality and total scores, Timed Up & Go test, falls rate and medication, showing higher values in favor of the females with respect to males, except for falls rate (with a higher rate of falls in favor of the males). The rest of the comparisons did not show any statistically significant difference ($P>0.05$).

Table 1
Comparison of demographic and clinical characteristics of the total sample and by sex distribution.

Characteristics	Total group N = 114	Male N = 43	Female N = 71	*P*-value
Chronicity (months)	56.50 ± 28.50	54.00 ± 31.00	60.00 ± 31.00	**0.039**[b]
Age (years)	72.00 ± 8.00	71.00 ± 6.00	72.00 ± 9.00	0.484[b]
Weight (kg)	75.75 ± 11.54	79.98 ± 8.62	73.19 ± 12.73	**0.001**[a]
Height (m)	1.58 ± 0.09	1.66 ± 0.07	1.54 ± 0.06	<**0.001**[a]
BMI (kg/m^2)	30.05 ± 4.57	28.71 ± 3.26	30.87 ± 5.06	**0.007**[a]
WOMAC pain	8.00 ± 3.00	8.00 ± 5.00	8.00 ± 3.00	0.576[b]
WOMAC_stiffness	3.00 ± 2.25	2.00 ± 1.00	3.00 ± 3.00	0.162[b]
WOMAC functionality	23.27 ± 9.68	20.67 ± 8.12	24.84 ± 10.25	**0.025**[a]
WOMAC total	33.62 ± 11.40	30.41 ± 9.45	35.56 ± 12.08	**0.013**[a]
NPRS	6.00 ± 2.00	6.00 ± 2.00	6.00 ± 1.00	0.310[b]
EUROQoL-5D	7.00 ± 3.00	7.00 ± 2.00	7.00 ± 3.00	0.478[b]
Barthel Index	98.00 ± 6.00	98.00 ± 4.00	98.00 ± 8.00	0.849[b]
Timed Up & Go test	9.00 ± 4.00	9.00 ± 4.00	10.00 ± 5.00	**0.004**[b]
Mini-mental test	29.00 ± 2.00	29.00 ± 2.00	29.00 ± 2.00	0.709[b]
Falls rate	1.00 ± 2.00	1.00 ± 2.00	1.00 ± 2.00	**0.036**[b]
Medication	3.00 ± 2.00	3.00 ± 2.00	3.00 ± 3.00	**0.034**[b]

Abbreviations: BMI, body mass index; EUROQoL-5D: Euro-Quality-of-Life Five Dimensions; IR, interquartile range; MHL, mechanical hyperkeratosis lesions; NPRS, numerical pain rating scale; SD, standard deviation; WOMAC, The Western Ontario and McMaster Universities Osteoarthritis Index. In all the analyses, $P<0.05$ (with a 95% confidence interval) was considered statistically significant in bold.
[a] Mean ± SD and Student's *t*-test for independent samples were used.
[b] Median ± IR and Mann–Whitney *U* test were utilized.

3.2. Myofascial pain syndrome by sex distribution

The results of the comparison of the myofascial pain syndrome between male and female are shown in Table 2. There were no statistically significant differences ($P>0.05$) by sex distribution according to the number and presence of AMTrPs and LMTrPs.

3.3. Demographic and clinical characteristics by age distribution

Considering Table 3, the demographic characteristics among older adults with < 70 years (n = 39), 70–80 years (n = 55) and > 80 years (n = 20) did not show any statistically significant differences ($P>0.05$). The clinical characteristics showed statistically significant differences ($P<0.05$) for chronicity, Barthel Index and Times Up and Go test. Statistically significant differences ($P<0.05$)

Table 2
Comparison of myofascial pain syndrome of the total sample and by sex distribution.

Myofascial pain syndrome	Total group N = 114	Male N = 43	Female N = 71	*P*-value
AMTrPs, n	3.00 ± 2.25	3.00 ± 3.00	4.00 ± 2.00	0.606[a]
LMTrPs, n	4.00 ± 5.00	4.00 ± 3.00	5.00 ± 5.00	0.235[a]
TFL AMTrPs, yes/no	12/102	3/40	9/62	0.530[b]
TFL LMTrPs, yes/no	57/57	22/21	35/36	1.00[b]
ADD AMTrPs, yes/no	19/95	10/33	9/62	0.195[b]
ADD LMTrPs, yes/no	40/74	15/28	25/46	1.00[b]
HT AMTrPs, yes/no	34/80	12/31	22/49	0.834[b]
HT LMTrPs, yes/no	29/85	11/32	18/53	1.00[b]
BF AMTrPs, yes/no	21/93	5/38	16/55	0.213[b]
BF LMTrPs, yes/no	33/81	15/28	18/53	0.294[b]
RA AMTrPs, yes/no	44/70	14/29	30/41	0.328[b]
RA LMTrPs, yes/no	5/109	2/41	3/68	1.00[b]
VL AMTrPs, yes/no	53/61	19/24	34/37	0.847[b]
VL LMTrPs, yes/no	75/39	26/17	49/22	0.417[a]
VM AMTrPs, yes/no	86/28	33/10	53/18	1.00[b]
VM LMTrPs, yes/no	13/101	2/41	11/60	0.126[b]
GTN AMTrPs, yes/no	29/83	14/27	15/56	0.190[b]
GTN LMTrPs, yes/no	38/76	12/31	26/45	0.414[a]
PL AMTrPs, yes/no	14/100	5/38	9/62	1.00[b]
PL LMTrPs, yes/no	17/95	8/35	11/60	0.796[b]

Abbreviations: ADD, adductor; AMTrPs, active myofascial trigger points; BF, biceps femoris; GTN, gastrocnemius; LMTrPs, latent myofascial trigger points; HT, hamstrings (semitendinosus and semimembranosus); IR, interquartile range; PL, popliteus; RA, quadriceps rectus anterior; TFL, tensor fasciae latae; VL, quadriceps vastus lateralis; VM, quadriceps vastus medialis. In all the analyses, $P<0.05$ (with a 95% confidence interval) was considered statistically significant.
[a] Median ± IR and Mann–Whitney *U* test were utilized.
[b] Frequencies and Fisher's exact test were used.

Table 3
Comparison of demographic and clinical characteristics by age distribution.

Characteristics	<70 years N = 39	70–80 years N = 55	>80 years N = 20	*P*-value
Chronicity (months)	50.00 ± 26.00	59.00 ± 21.00	90.50 ± 57.75	<**0.001**[b]
Sex (male/female)	15/24	22/23	6/14	0.727[c]
Weight (kg)	75.37 ± 10.20	77.64 ± 11.08	75.30 ± 14.28	0.105[a]
Height (m)	1.59 ± 0.08	1.59 ± 0.09	1.56 ± 0.08	0.603[a]
BMI (kg/m^2)	29.63 ± 4.63	30.80 ± 4.44	28.82 ± 4.65	0.199[a]
WOMAC pain	8.00 ± 4.00	7.00 ± 4.00	8.00 ± 2.00	0.537[b]
WOMAC_stiffness	2.00 ± 3.00	3.00 ± 2.00	3.00 ± 2.00	0.542[b]
WOMAC functionality	22.51 ± 9.16	23.21 ± 10.24	24.90 ± 9.34	0.672[a]
WOMAC total	33.12 ± 11.33	33.34 ± 11.68	35.35 ± 11.16	0.757[a]
NPRS	6.00 ± 1.00	6.00 ± 2.00	6.00 ± 1.00	0.547[b]
EUROQoL-5D	7.00 ± 3.00	7.00 ± 2.00	8.00 ± 2.75	0.395[b]
Barthel Index	98.00 ± 4.00	98.00 ± 6.00	94.50 ± 10.00	**0.002**[b]
Timed Up and Go test	9.00 ± 3.00	9.00 ± 3.00	12.00 ± 2.75	**0.003**[b]
Mini-mental test	29.00 ± 2.00	29.00 ± 1.00	29.00 ± 1.75	0.197[b]
Falls rate	1.00 ± 2.00	1.00 ± 2.00	1.00 ± 2.00	0.610[b]
Medication	3.00 ± 2.00	3.00 ± 3.00	2.00 ± 2.75	0.300[b]

Abbreviations: ANOVA, analysis of variance; BMI, body mass index; EUROQoL-5D: Euro-Quality-of-Life Five Dimensions; IR, interquartile range; MHL, mechanical hyperkeratosis lesions; NPRS, numerical pain rating scale; SD, standard deviation; WOMAC, The Western Ontario and McMaster Universities Osteoarthritis Index. In all the analyses, $P<0.05$ (with a 95% confidence interval) was considered statistically significant in bold.
[a] Mean ± SD and one way ANOVA were used.
[b] Median ± IR and Kruskal–Wallis test were utilized.
[c] Frequencies and Chi-Square (χ^2) test were applied.

of the Wilcoxon post-hoc analyses showed higher values of chronicity in favor of the older patients for all age distribution comparisons, lower scores of the Barthel Index in the >80 years age group with respect to the < 70 and 70–80 years age groups, and higher scores of the Timed Up and Go test in the > 80 years age group with respect to the < 70 and 70–80 years age groups. The rest of comparisons did not show any statistically significant difference ($P>0.05$).

3.4. Myofascial pain syndrome by age distribution

The results of the comparison of the myofascial pain syndrome among older adults with < 70 years, 70–80 years and > 80 years are shown in Table 4. There were no statistically significant differences ($P>0.05$) by age distribution according to the number and presence of AMTrPs and LMTrPs.

Table 4
Comparison of myofascial pain syndrome of the total sample and by sex distribution.

Myofascial pain syndrome	< 70 years N = 39	70–80 years N = 55	> 80 years N = 20	*P*-value
AMTrPs, n	4.00 ± 3.00	3.00 ± 3.00	4.00 ± 1.00	0.657[a]
LMTrPs, n	4.00 ± 5.00	4.00 ± 5.00	5.00 ± 3.75	0.288[a]
TFL AMTrPs, yes/no	6/33	6/49	0/20	0.188[b]
TFL LMTrPs, yes/no	19/20	25/30	13/7	0.320[b]
ADD AMTrPs, yes/no	7/32	10/45	2/18	0.678[b]
ADD LMTrPs, yes/no	10/29	19/36	11/9	0.081[b]
HT AMTrPs, yes/no	11/28	17/38	6/14	0.961[b]
HT LMTrPs, yes/no	12/27	14/41	3/17	0.420[b]
BF AMTrPs, yes/no	6/33	9/46	6/14	0.336[b]
BF LMTrPs, yes/no	12 ± 27	17/38	4/16	0.624[b]
RA AMTrPs, yes/no	15/24	22/33	7/13	0.925[b]
RA LMTrPs, yes/no	0/39	3/52	2/18	0.179[b]
VL AMTrPs, yes/no	18/21	25/30	10/10	0.940[b]
VL LMTrPs, yes/no	26/13	36/19	13/7	0.989[a]
VM AMTrPs, yes/no	28/11	41/14	17/3	0.525[b]
VM LMTrPs, yes/no	4/35	7/48	2/18	0.912[b]
GTN AMTrPs, yes/no	11/28	13/42	5/15	0.881[b]
GTN LMTrPs, yes/no	12/27	16/39	10/10	0.216[a]
PL AMTrPs, yes/no	4/35	8/47	2/18	0.776[b]
PL LMTrPs, yes/no	8/31	7/48	4/16	0.552[b]

Abbreviations: ADD, adductor; AMTrPs, active myofascial trigger points; BF, biceps femoris; GTN, gastrocnemius; LMTrPs, latent myofascial trigger points; HT, hamstrings (semitendinosus and semimembranosus); IR, interquartile range; PL, popliteus; RA, quadriceps rectus anterior; TFL, tensor fasciae latae; VL, quadriceps vastus lateralis; VM, quadriceps vastus medialis. In all the analyses, $P<0.05$ (with a 95% confidence interval) was considered statistically significant.
[a] Median ± IR and Kruskal–Wallis test were utilized.
[b] Frequencies (percentages) and Chi-Square test (χ^2) were used.

4. Discussion

The aim of this study was to assess the prevalence of MTrPs in knee muscles among patients with knee OA, and to describe and relate clinical, demographic and myofascial pain syndrome characteristics in the elderly population affected by knee OA to ranges of age and gender distributions. The outcome showed significant results where the quadriceps vastus medialis (75.43%) had the highest prevalence for hosting active myofascial trigger points (AMTrPs). Meanwhile, the most prevalent muscle that presented LMTrPs appeared to be the quadriceps vastus lateralis (65.78%).

Most of the study participants where affected by type 1 obesity. Participants also had chronic OA knee, perhaps caused by MPS from MTrPs, among other rheumatic etiologies [17,21]. These MTrPs stand for the cause of pain in the majority of musculoskeletal disorders [50].

Roach et al. investigated the prevalence of MTrPs among patients affected by patellofemoral pain syndrome. The results showed a significant difference in prevalence between the gluteus medius and quadratus lumborum MTrPs in subjects with patellofemoral pain syndrome and the control group [51]. Although different investigations confirm a variety of MTrPs and muscles affected in patients with MPS, their results were not conclusive enough to consider it a prevalent study.

A recent observational cross-sectional study [27] tried to demonstrate if referred pain provoked by AMTrPs prompted the symptoms in a sample of 18 women affected by bilateral knee OA, and if there is a relationship between the intensity of ongoing pain, sleep, function and quality of life and the presence of AMTrPs in subjects with painful knee OA syndrome, all compared to 18 matched control individuals. The outcome data showed that women suffering knee OA had a significantly larger number of AMTrPs in the vastus medialis, vastus lateralis, sartorius and gastrocnemius, all of them with a prevalence of 11.1% for MTrPs, and a similar value for LMTrPs when compared to a healthy female sample. AMTrPs in other muscles acting in the knee, like biceps femoris, semitendinosus and tensor fasciae latae, were not found. Results also showed that a large number of AMTrPs were related to a higher intensity of ongoing pain and a lower physical function.

Twenty-eight subjects were examined in a different observational study [52] 14 of which were affected with OA of the hip, knee or both compared to 14 healthy individuals. A significant positive correlation was found after matching the results of the total number of MTrPs in OA individuals to their radiological scores. A significant amount of MTrPs was related to pain below the knee in cases where OA patients reported referred pain and radiation compared to the control subjects. The prevalence results for MTrPs in the muscles of OA patients in comparison to the control individuals were as follows: rectus femoris, 64.3% vs. 14.3%; gastrocnemius — 57.1% vs. 14.3% and tensor fasciae latae — 35.7% vs. 28.6%. The MTrP prevalence in the soleus, vastus medialis and biceps femoris had a value of 21.4% in comparison with no MTrPs in the control group. The prevalence for MTrPs in quadratus lumborum was 14.3% compared to the control group, as well as the peroneus brevis muscle, which showed the same value, where the control group had 14.3%. The vastus lateralis and gluteus medius presented a prevalence of 7.1% in comparison with the control group where no MTrPs were found. Also, a 7.1% prevalence of MTrPs in the peroneus longus muscle was recorded in the OA group compared to the control one. Patients with knee joint OA showed a larger number of MTrPs in the muscles surrounding the knee when compared to the ones with unilateral hip OA.

Henry et al. examined patients with OA waiting for knee arthroplasty and all of the participants presented MTrPs with special relevance to the medial gastrocnemius (92%) and vastus medialis muscle (67%). On the other hand, the prevalence for lateral gastrocnemius and vastus lateralis was 29% each; while MTrPs were present in the medial muscles in 62.5% of the patients and 0% for only the lateral muscles. The outcome for OA patients with pain in both the medial and lateral muscles appeared to be more than a third of the sample (37.5%).

A randomized clinical trial by Itoh et al. [25] stated a prevalence of MTrPs in patients with knee OA: quadriceps 60%, iliopsoas 40%, sartorius 20%, adductors 40%, and popliteus. Despite the interest of these findings it is important to point out that the sample size of these last four studies was not large enough and did not include LMTrP measurements. The current study did not have a matched control (no OA knee pain participants), but the sample size was large enought to be reprasentative of Spanish OA knee patients. This study used the muscle examination protocol by Mayoral et al. [26]. Demographic data and clinical features were described for each participant, and gender and age distributions were made. Significant between-sex differences were seen in the clinical and demographic features. When age distribution groups were compared, clinical features showed significant differences ($P<0.05$) for chronicity, Barthel Index and Timed Up and Go test. This epidemiological study is considered to have made an important contribution to the OA knee field related to MPS, despite the limitations in this type of investigation.

4.1. Conclusions

In conclusion, the demographic and clinical features of older adults with knee osteoarthritis may be influenced by sex and age distributions. Nevertheless, the myofascial pain syndrome associated with knee osteoarthritis did not seem to be related to sex or age distributions.

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Author contributions

EASR, VBC and VOS conducted the study. EASR, CCL and JFC wrote the initial manuscript. DPM and DJG helped revise the manuscript. All authors read and approved the final manuscript.

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Conflict of interests

None declared.

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