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Influence of knee osteoarthritis on functional performance, quality of life and pain in older women

Osteoartrite de joelhos e funcionalidade, qualidade de vida e dor em idosas

Artrosis de rodilla y rendimiento funcional, calidad de vida y dolor en ancianas

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Abstract

Introduction: Knee osteoarthritis (KOA) is a common degenerative disease in older people, causing pain, stiffness and dysfunction. **Objective:** To determine the influence of KOA on functional performance (FP), quality of life (QoL) and pain in older women. **Method:** This is a cross-sectional study, in which 50 older women diagnosed with KOA and 51 without KOA participated. Participants were assessed using FP tests: Sit-to-stand (STS); Gait speed test (GST); Timed Up and Go (TUG); 6-minute walk test (6 MWT) and the Berg Balance Scale (BBS). Pain was assessed by the visual analog scale (VAS); quality of life by applying the SF-36; and self-perception of the disease by using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). **Results:** No intergroup statistical differences were found in the BBS (p: 0.42), STS (p: 0.59)

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and 6MWT (p: 0.97). However, the KOA group showed slower GS (p < 0.00) and longer time in TUG (p < 0.00). They also presented higher pain levels (p < 0.01), worse perceived health status regarding pain, stiffness and physical function (WOMAC) (p < 0.01), as well as worse QoL indices in functional capacity, physical limitations, pain and overall health status (p < 0.010). **Conclusion:** The results of the study demonstrate that older women with KOA showed a decline in FP, QoL and higher pain levels.

Keywords: Osteoarthritis. Functioning. Aging.

Resumo

Introdução: A osteoartrite de joelho (OAJ) é uma doença degenerativa comum em idosos que causa dor, rigidez e disfunção. Objetivo: Verificar a influência da OAJ sobre o desempenho funcional (DF), a qualidade de vida (QV) e a dor em idosas. Método: Tratou-se de estudo transversal cuja população participante foi composta por 50 idosas diagnosticadas com OAJ e 51 idosas sem OAJ. As voluntárias foram avaliadas com os testes do DF: Teste de sentar-levantar (TSL); velocidade da marcha (VM); Timed Up and Go (TUG); teste de caminhada de 6 minutos (TC6') e Escala de Equilíbrio de Berg (EEB). A dor foi avaliada pela escala analógica visual (EVA) e analisou-se a qualidade de vida pelo SF-36 e a da autopercepção da doença, pelo questionário Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Resultados: Nos testes funcionais não foram verificadas diferenças estatísticas entre os grupos para os testes EEB (p: 0,42), TSL (p: 0,59) e TC6' (p: 0,97). Contudo nota-se que o grupo OAJ teve menor VM (p < 0,00) e maior tempo no TGUG (p < 0,00). Além disso, apresentam maiores níveis de dor (p < 0,01), pior percepção do estado de saúde nos domínios de dor, rigidez e função física (WOMAC) (p < 0,01), bem como piores índices de QV nos domínios capacidade funcional, limitação por aspectos físicos, dor e estado geral de saúde (p < 0,01). Conclusão: Os resultados do estudo demonstraram que idosas com OAJ apresentam redução do DF na QV e maior nível de dor.

Palavras-chave: *Osteoartrite. Funcionalidade. Envelhecimento.*

Resumen

Introducción: La artrosis de rodilla (AR) es una enfermedad degenerativa común en los ancianos que puede causar dolor, rigidez y disfunción. Objetivo: verificar la influencia de la AR en el rendimiento funcional, en la calidad de vida y el dolor en los ancianos. Método: Estudio transversal, y la población fue composta por 50 ancianas, diagnosticadas con AR, y 51 ancianas sin AR. Las voluntarias fueron evaluadas con pruebas de rendimiento funcional: sit-to-stand (STS); gait speed test (GST); Timed Up and Go (TUG); 6-minute walk test (6 MWT) y Berg Balance Scale (BBS). El dolor se evaluó mediante el cuestionario SF-36 y la autopercepción de la enfermedad con el cuestionario Western Ontario McMaster (WOMAC). Resultados: En las pruebas funcionales, no se encontraron diferencias estadísticas entre los grupos para las pruebas BBS (p: 0.42), TSLC (p: 0.59) y TC6'(p: 0.97). Sin embargo, se observa que el grupo AR tuvo una velocidad de la marcha más baja (p < 0.00) y un tiempo de TUG más largo (p < 0.00). Además, presentan niveles de dolor más altos (p < 0.01), peor percepción del estado de salud en los dominios de dolor, rigidez y función física (WOMAC) (p < 0.01), así como peores índices de calidad de vida en los dominios capacidad funcional, limitación por aspectos físicos, dolor y salud general (p < 0.01). Conclusión: Los resultados del estudio mostraron que las mujeres ancianas con AR presentan una reducción en el DF, en la calidad de vida y un mayor nivel de dolor.

Palabras clave*: Osteoartritis. Funcionalidad. Envejecimiento.*

Introduction

Osteoarthritis (OA) is a chronic progressive osteoarticular degenerative disease with multifactorial etiology that manifests itself by arthralgia, stiffness and limited joint function, in addition to progressive cartilage loss and inadequate cartilage repair. It is the most frequent disease found in the population worldwide [1, 2], the most common cause of disability in older people, and the fourth main cause in women [3-5]. Its prevalence is 44 to 70% in people aged 50 years and increases with age. It affects 85% of individuals over 75 years old [6]. It is more common in women [7, 8] and the knee is one of the joints most affected by the disease [9].

The degenerative process observed in joints affected by OA results from mechanical and biological disorders that unbalance cartilage synthesis and degrade in joints [10]. Anatomical changes caused by OA cause joint pain and a decline in muscle function, impacting the activities of daily living [11], such as prolonged standing, sitting and squatting [12], climbing stairs and activities involving flexion and knee extension [13].

A number of studies have demonstrated the influence of KOA on quality of life (QoL) [3, 14-16]. However, little is known about the impact of KOA on different functional components. As such, it is important to understand which functional components are more compromised in individuals with KOA in order to contribute to prevention and treatment strategies. Thus, this study aimed to determine the influence of KOA on functional performance (FP), quality of life (QoL) and pain in older women.

Methods

This is a cross-sectional study of a non-probability sample of 50 older women with KOA and 51 without KOA. The study was approved by the Human Research Ethics Committee of the Federal University of Santa Catarina (CAAE no. 57009516.6.0000.0121) under protocol number 1.721.267.

Participants

A total of 101 older women aged 60 years or older participated in the study. The women met the inclusion criteria described below and provided written informed consent.

Individuals with 60 years old or older and women were included in the study. The women were diagnosed with OA in at least one knee based on American College of Rheumatology clinical criteria [17]. Older women with the following disorders were excluded: knee or hip replacement; recent knee trauma; severe orthopedic, neurological, respiratory or cardiovascular diseases; cognitive impairment according to the Mini-Mental State Examination (MMSE) [18]; vestibular disturbances; severe systemic or non-controlled disease such as autoimmune diseases, rheumatoid arthritis, diabetes mellitus or kidney failure; immunosuppressed or immunodeficient individuals; procedures with intra-articular injections of corticosteroids, hyaluronic acid or chondroprotective agents in the previous 6 months; diagnosed with infection, neoplasia or hemorrhage; poor overall health status that could interfere with physical-functional assessments and the use of any locomotion assistance device (walkers, crutches, walking sticks).

Sample size calculation

Gpower statistical software (version 3.1) was used to calculate sample size. Sample calculation considered the α value (0.05), effect size (0.60), statistical power (0.80) and Group 2/Group 1 allocation (1:1), resulting in a sample size of 45 subjects.

Procedures

The participants gave written informed consent and personal and sociodemographic data were collected on an assessment form. Next, the following items were assessed: cognitive capacity by the MMSE; pain by applying the visual analog scale (VAS); indirect assessment using the sit-to-stand test (SST); assessment of muscle power according to the gait speed test (GST); assessment of mobility by the Timed Up and Go (TUG) test; cardiorespiratory aptitude using the 6-minute walk test (6MWT); body balance assessment by the Berg balance scale (BBS); quality of life assessment by the SF36 and assessment of self-perception of the disease by applying WOMAC. The assessment tests were conducted in all the volunteers in the same order by a previously trained experienced examiner.

Instruments

The visual analog scale (VAS), used to measure pain intensity, consists of a ruler numbered 0 to 10 cm, where 0 corresponds to absence of pain and 10 to the most intense pain possible [19].

The sit-to-stand test (SST) was used to assess lower limb power and strength. Individuals were instructed to sit with their back straight and feet on the floor. After the examiner's command, subjects crossed their arms in front of their chest and were told to stand up, completely extending their knees, and return to a sitting position, repeating the procedure as many times as possible in 30 seconds [20].

To perform the gait speed test (GST), the participants were asked to walk ten meters as fast as possible, but without running. The time spent walking from the second to the eighth meter was measured in seconds, since the first two (acceleration) and the last two meters (deceleration) were not included in the calculation. Each subject was instructed to repeat this procedure three times, with a 30-second rest period between repetitions, and the final result was the mean of the three measures [21].

The Timed Up and Go (TUG) test assesses mobility and involves moving from sitting to standing, remaining in the orthostatic position, walking, pivoting, and standing to sitting, measuring the time taken to perform these tasks [22].

The 6-minute walk test (6MWT) assesses aerobic endurance and functional capacity over a 30-meter course. At a sound signal, the individual walks as fast as possible (without running) along the course, and the distance walked is recorded [23].

The Berg balance scale (BBS) contains 14 items that assess static and dynamic balance during common functional activities of daily living [24, 25].

The WOMAC (Western Ontario McMaster Universities) questionnaire analyzes self-perceived disease status specific for knee and hip osteoarthritis. The instrument includes 24 questions divided into three subscales–pain, joint stiffness and physical activity on a Likert scale (none, mild, moderate, strong and very strong). Each dimension is attributed a score that is transformed into a scale varying from 0 (best health status) to 100 (worst health status) [26, 27].

The SF-36 questionnaire (Medical Outcome Study 36 Short Form – MOS SF-36) is composed of 36 items, divided into 8 health domains, as follows: functional capacity (FC), physical (PL) and emotional limitations (EL), socialization (SO), body pain (BP) and overall health status (OHS), mental health (MH) and vitality (VIT). The higher the score, the better the quality of life [14, 28].

Statistical Analysis

The SPSS software (IBM®, Chicago, IL, USA), version 20.0, was applied to descriptive and inferential statistics. A significance level of 0.05 was established. Then, the differences between the conditions were tested using the independent t-test.

Results

There was no statistical intergroup difference in age ($p = 0.81$) or anthropometric characteristics (Table 1).

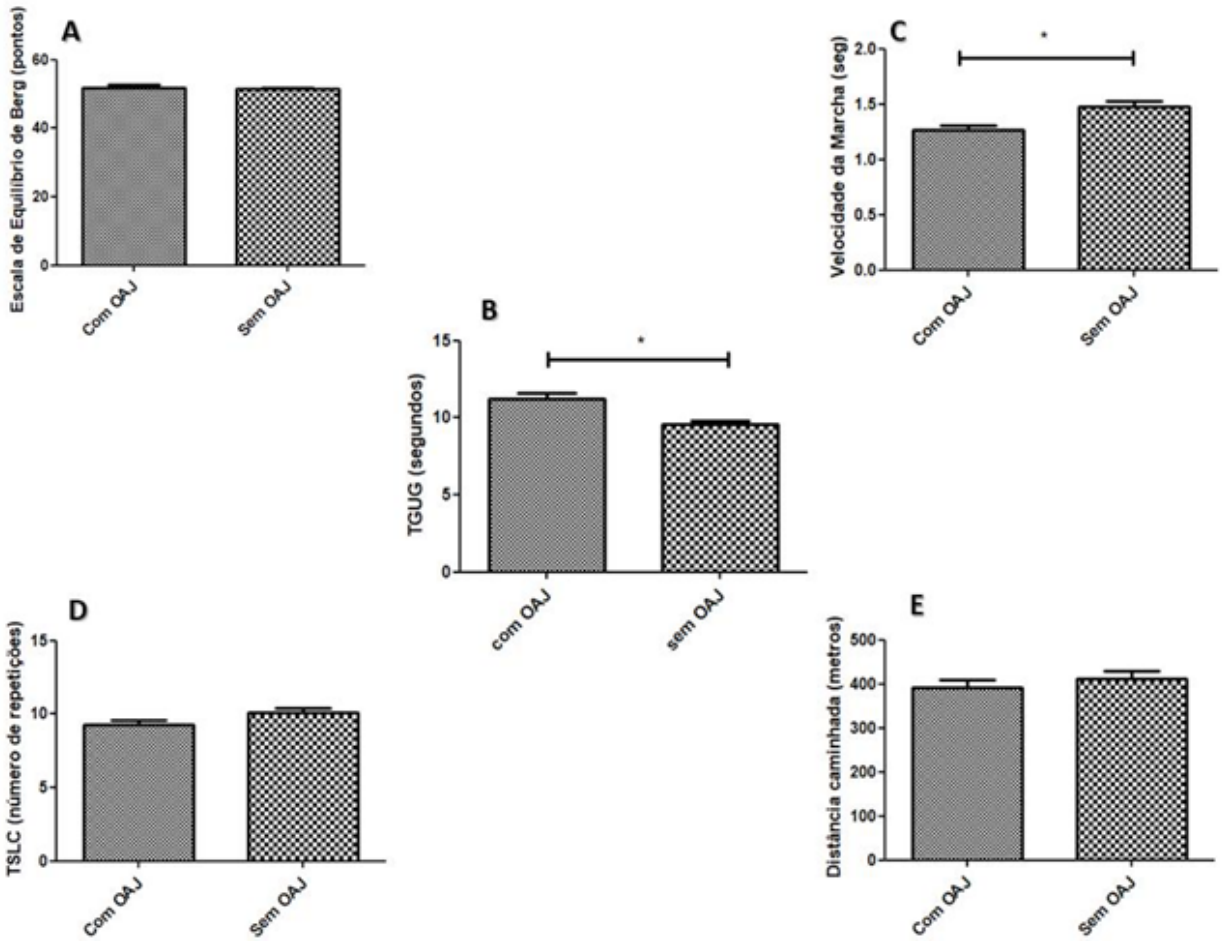
Regarding self-perception of the disease, the KOA group obtained higher values for pain ($p < 0.01$), stiffness ($p < 0.01$) and functionality ($p < 0.01$), as assessed by WOMAC, indicating worse self-perception of the disease. In addition, the KOA group had higher VAS values ($p < 0.01$), indicating more exacerbated symptoms (Table 1).

No statistical intergroup differences were found in BBS ($p = 0.42$), SST ($p = 0.59$) and 6MWT ($p = 0.97$). However, the KOA group had slower GS ($p < 0.00$) and longer TUG time ($p < 0.0$), demonstrating worse functional performance (Figure 1).

Table 1 – Age and anthropometric data of the KOA Group and Group without KOA

	KOA Group	Group without KOA	p
Age (years)	69.32 ± 9.99	68.76 ± 6.65	0.81
Weight (kg)	72.53 ± 10.70	67.12 ± 10.77	0.07
Height (m)	1.56 ± 0.07	1.57 ± 0.08	0.66
Pain (WOMAC)	211.75 ± 103.95	13.10 ± 35.01	0.00*
Stiffness (WOMAC)	82.68 ± 49.79	0.00 ± 0.00	0.00*
Function (WOMAC)	702.45 ± 332.35	34.52 ± 69.14	0.00*
VAS (score)	4.89 ± 2.59	2.63 ± 2.82	0.00*

Note: Data are expressed as mean and standard deviation. * $p < 0.05$; KOA: Knee osteoarthritis; VAS: Visual analog scale.



Note: Berg Balance Scale: points; SST: number of repetitions; TUG: seconds; Distance walked: meters; Gait speed: seconds; with KOA; without KOA.

Figure 1 – Comparison of functional performance in older people with and without knee osteoarthritis. Berg Balance Scale; B) Timed Up and Go; C) Gait Speed; D) Sit-To-Stand Test and E) Distance Walked in the 6-minute Walk Test.

A significant difference was observed between FC domains ($p < 0.01$), PL ($p < 0.01$), pain ($p < 0.01$) and OHS ($p = 0.04$), demonstrating that the KOA group exhibited worse quality of life indices. There was no significant difference for the VIT domains ($p = 0.30$), SO ($p = 0.52$), EL ($p = 0.18$) and MH ($p = 0.63$) (Table 2).

Table 2 – Quality of life assessment of the KOA group and group without KOA

SF36 domain	KOA Group	Group without KOA	p
Functional Capacity	36.90 ± 21.50	70.71 ± 19.25	0.00*
Physical Limitations	47.30 ± 42.35	77.38 ± 36.14	0.00*
Pain	43.82 ± 22.83	67.66 ± 17.00	0.00*
Overall Health Status	57.02 ± 20.83	68.57 ± 21.69	0.04*
Vitality	56.58 ± 17.96	61.19 ± 14.65	0.30
Social Aspects	74.35 ± 25.24	78.57 ± 24.41	0.52
Emotional Limitations	64.67 ± 42.28	79.36 ± 38.69	0.18
Mental Health	63.62 ± 18.40	66.00 ± 19.88	0.63

Note: Data shown as mean and standard deviation. * $p < 0.05$; KOA: Knee osteoarthritis; SF-36: Medical Outcome Study 36 Short Form Questionnaire.

Discussion

This study aimed to determine the influence of KOA on FP, QoL and pain in older women. The results show that KOA compromises FP in GS, and TUG time worsens QoL and increases pain.

Pain is a common symptom in older women with KOA and a limiting factor in FP. The World Health Organization (WHO) estimates show that around 25% of older women aged 65 years and older experience pain and functional disability related to OA. These findings are confirmed in this study, since older women with KOA show higher pain levels in the SF36, WOMAC and VAS questionnaires. Im et al. [29] found that the pain reported by patients with KOA is associated with the central sensitization of nociceptive pathways due to the production of inflammatory cytokines, in which the affected joint sends nociceptive signals to the stimulated central regions, resulting in pain.

The influence of pain associated with changes characteristic of KOA, such as the joint stiffness, inflammation, joint degeneration and musculoskeletal alterations present in older individuals with KOA, cause a series of physicochemical changes. These include a decline in muscle strength and changes in balance and coordination, leading to functional disabilities [30] such as difficulty in prolonged standing, sitting or squatting [12], climbing stairs and in activities involving knee flexion and extension [13], such as gait.

Gait speed (GS) is a practical assessment tool that represents an important factor in functional decline [31]. In this study, older women with KOA had slower GS when compared to those without KOA. Similar findings were reported by Mundermann et al. [32], who reported slower GS in individuals with KOA. They infer that this change in the functional test may be associated with greater knee abduction, in addition to KOA severity. White et al. [33] found that older women with KOA exhibited slower gait, which could mean loss of strength and muscle function. In addition, individuals with KOA display muscle atrophy mainly in type II or fast contracting fibers, causing a decline in muscle strength and power and joint stabilization during gait.

Regarding mobility, assessed by TUG, the results of our study demonstrated a significant intergroup difference, with longer execution time in older women with KOA. The time spent on the test is directly related to the degree of functional mobility [21]. One of the reasons for the longer time required to execute the test may be the fear of falling, which could affect physical function [34]. In addition, there seems to be a significant correlation between pain intensity and FP tests, such as the TUG. The inflammation, decreased voluntary muscle activation and hypotrophy found in individuals with KOA lead to lower muscle power, causing a significant loss in functionality.

With respect to static and dynamic balance assessed by the BBS, no statistically significant intergroup differences were found. This may be explained by the maximum effect found in BBS (when the score of a test reaches its upper limit), demonstrating that it may not be a good clinical instrument in identifying the risk of falling in community-dwelling older adults or those engaged in physical activities [35].

In this study, no statistically significant differences were found in the 6MWT. Similar findings were reported by Mattos et al. [36], who compared FP on the 6MWT in older women with and without KOA. The authors observed that performance in the 6MWT was similar in older women with KOA and asymptomatic individuals, since the test is significantly more influenced by age and the anthropometric characteristics of individuals than by joint condition. Thus, given that the subjects of our study were matched for age and anthropometric characteristics, no statistical differences were observed.

This study shows that the QoL of older individuals with KOA scored lower in the following domains: FC, PL, pain and OHS, showing the negative influence KOA has on QoL perception in older people. Similar data were obtained by Alves and Bassitt [15], who assessed the QoL and FP of older women with KOA and found that functional capacity is related to lower QoL scores. Smith et al. [37] found that most individuals with KOA have a negative perception of the disease, due to pain and fear of losing their independence. Similar results were reported by Fang et al. [38], where the authors observed that the physical domains of women with KOA were compromised.

Physical disability levels can be assessed by applying functional performance tests, where examiners directly assess the execution of daily tasks, as well as self-perception of the disease using scales and/or questionnaires. Self-perceived health

has been widely used in population studies and is a useful tool in assessing health status, since it is simple and easy to apply. WOMAC is often used to assess the self-perception of the disease in individuals with KOA.

Burgos-Vargas et al. [7] observed a direct correlation between self-reported functionality and the presence of KOA in older women. They also demonstrated that 74% of individuals with KOA showed functional limitations. Neto, Queluz and Freire [16] observed worse QoL in the associations between SF-36 domains and the WOMAC score, primarily because of pain.

Functional disability in OA is a complex process involving the interaction of several factors, including disease severity, diseases associated with social and environmental factors [39], in addition to pain level, obesity and decreased lower limb muscle strength [40]. Thus, the results obtained should be interpreted in the context of the study design. A study limitation is the lack of radiological classification of the degrees of KOA. However, literature shows no significant relation between FP and the radiological findings [41]. Mat et al. [42] concluded that radiological evidence is not directly related to the severity of the physical symptoms of OA. In addition, there are divergences between radiographic changes and the symptoms shown by patients. It is important to highlight that the subjects in this study are older individuals, and only older women were assessed because the disease is most common in females [7, 8].

Future studies with other assessment methods that include the standard error of measurement, minimum detectable change, and minimally important clinical difference are needed to establish the influence of KOA on FP and QoL.

Conclusion

The results of this study demonstrate that older women with KOA showed reduced FP, QoL and higher pain levels.

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