Article

The Impact of Walking Aids and Orthosis on Fatigue and Activities of Daily Living in Knee Osteoarthritis Patients

Abdullah Khalid Qureshi[1], Saba Riaz[1], Husnain Zafar[1], Anum Ishaq Awan[1], Tayyaba Ahsan[1], Maheem Ishaq Awan[1], Rabia Majeed[1]

1   University of Management & Technology, Lahore, Pakistan

ABSTRACT

Background: Knee osteoarthritis (KOA) is a prevalent degenerative joint condition that impairs mobility and daily functioning in older adults. While walking aids and orthoses are commonly prescribed to enhance stability, their long-term impact on fatigue and functional independence remains under-investigated, representing a critical gap in conservative KOA management strategies. **Objective**: To evaluate the impact of walking aids and orthoses on fatigue levels and activities of daily living (ADLs) in individuals with KOA, and to compare functional outcomes across device-user and non-user groups. **Methods**: A cross-sectional observational study was conducted from January to April 2023 in clinical and residential care settings in Lahore, Pakistan. A total of 156 participants aged 45–85 years with radiologically confirmed Grade 2 or 3 KOA were recruited using convenience sampling. Exclusion criteria included joint replacement, malignancy, and non-ambulatory status. Participants were grouped into non-users, walking aid users, and orthosis users (n=52 each). Fatigue and ADLs were assessed using the Fatigue Severity Scale (FSS) and Barthel Index, respectively. One-way ANOVA and chi-square tests were conducted using SPSS v21, with a significance threshold of p<0.05. Ethical approval was obtained from the institutional review board in accordance with the Declaration of Helsinki. **Results**: Fatigue prevalence was highest among orthosis users (92.3%) and lowest among non-users (75.0%). ADL independence was greatest in non-users (63.5% slight dependency) and lowest in walking aid users (78.9% moderate dependency). ANOVA showed significant between-group differences in FSS (p=0.012) and Barthel scores (p=0.010), with moderate effect sizes. **Conclusion**: Use of orthoses and walking aids in KOA patients is associated with significantly higher fatigue and reduced functional independence compared to non-users. These findings suggest that assistive devices should be prescribed with caution and integrated into broader rehabilitative care plans to preserve autonomy in this population.

Keywords: Knee Osteoarthritis, Walking Aids, Orthotic Devices, Fatigue, Activities of Daily Living, Geriatric Rehabilitation, Functional Mobility

INTRODUCTION

Osteoarthritis (OA) is the most prevalent form of degenerative joint disease, characterized by the progressive degradation of articular cartilage, subchondral bone changes, and inflammation of the joint capsule. Although OA can affect various synovial joints, it most commonly involves the knee, especially among older adults, significantly impairing mobility and quality of life (1). The burden of knee osteoarthritis (KOA) is considerable, as it affects millions globally, leading to chronic pain, joint stiffness, and functional limitations that compromise individuals' ability to perform daily tasks (2). Clinical presentation often includes joint crepitus, reduced range of motion, deformity, and functional instability, typically confirmed by physical examination and radiographic evidence (3). The etiological understanding of KOA encompasses both mechanical and biological contributors, with biomechanical abnormalities in load distribution at the knee joint exacerbating structural deterioration, while aberrant chondrocyte responses and imbalanced apoptosis further propagate disease progression (4).

Fatigue, a complex and often underestimated symptom, is increasingly recognized as a significant concern in KOA patients. Nearly half of those with OA report experiencing substantial fatigue, which negatively influences their social interactions, physical activity levels, and overall quality of life (5). Unlike other rheumatic diseases such as rheumatoid arthritis, fatigue in KOA remains underexplored, leaving a critical gap in clinical understanding and targeted management strategies. Furthermore, as the disease advances, limitations in joint function often lead to a reliance on external support devices such as walking aids and orthoses to

Qureshi. *et al.* | The Impact of Walking Aids and Orthosis on Fatigue and Activities of Daily Living in Knee Osteoarthritis Patients

JHWCR

improve mobility and reduce discomfort. However, the impact of such assistive devices on fatigue levels and functional independence, specifically regarding activities of daily living (ADLs), remains inconclusive in current literature.

Walking aids, including canes and walkers, are often prescribed to redistribute weight and stabilize gait, thereby potentially improving safety and function. Orthoses, on the other hand, aim to correct alignment, offload stressed compartments, and provide joint support. While these devices are commonly utilized, the physiological and psychosocial implications of their use, especially in relation to energy expenditure and functional capacity, are not well-documented. Some studies suggest that improper or prolonged use may paradoxically increase fatigue or dependency due to altered gait patterns or reduced muscle engagement (12). Additionally, despite theoretical biomechanical benefits, real-world outcomes regarding patient autonomy and daily functionality have not been systematically evaluated across different device users.

Given these uncertainties, this study was designed to explore the influence of walking aids and orthoses on fatigue and daily functional performance in individuals with KOA. By comparing fatigue severity and ADL scores among KOA patients who do not use assistive devices, those who use walking aids, and those who use orthoses, this study aims to fill an important knowledge gap. The objective is to determine whether the type of external support has a significant impact on fatigue and daily functioning, thereby informing better patient-centered management strategies for knee osteoarthritis.

Materials and Methods

A cross-sectional observational study was conducted to examine the impact of walking aids and orthoses on fatigue levels and activities of daily living among patients diagnosed with knee osteoarthritis. The rationale for this design lay in its suitability for evaluating associations between exposure types—namely the use of walking aids or orthoses—and concurrent health outcomes within a defined population. The study was carried out across multiple clinical facilities and elder care centers in Johar Town, Lahore, Pakistan, over a three-month period from January 20, 2023, to April 28, 2023. All procedures were executed in accordance with pre-approved protocols and timeframes to ensure consistency across data collection points.

Participants were selected through non-probability convenience sampling. Eligible individuals were adults aged 45 to 85 years with a physician-confirmed diagnosis of Grade 2 or Grade 3 knee osteoarthritis based on clinical and radiographic criteria. Inclusion was restricted to residents of Lahore with the cognitive ability to comprehend study instructions and provide reliable information, as confirmed through a standardized Mini-Mental State Examination. Both male and female participants with comparable demographic profiles were enrolled. Exclusion criteria included prior joint replacement surgeries, presence of Grade 1 or Grade 4 OA, malignancy, recent trauma or osteoporotic fractures, any condition leading to bed confinement, and inability or unwillingness to walk or provide informed consent.

Informed written consent was obtained from all participants after explaining the study objectives, procedures, and their rights. Recruitment was conducted by trained physiotherapists and research assistants at the selected settings, and participation was entirely voluntary. Data were collected using structured face-to-face interviews conducted in the native language of participants, ensuring full comprehension and accuracy of responses. To evaluate fatigue, the Fatigue Severity Scale (FSS) was employed—a validated 9-item instrument that measures the impact of fatigue on daily activities, where a score of 36 or above indicates significant fatigue (8). For the assessment of functional independence in daily activities, the Barthel Index was utilized. This 10-item scale evaluates mobility and self-care functions, generating a score from 0 to 100, with higher scores indicating greater independence (7). Data collection was performed during a single session per participant, lasting approximately 20–30 minutes. Participants were stratified into three exposure groups based on their reported use of mobility assistance: Group 1 (non-users), Group 2 (users of walking aids such as canes or walkers), and Group 3 (users of lower limb orthoses including knee, ankle, or foot orthotics). The primary variables were fatigue and functional independence, operationalized as continuous scores from the FSS and Barthel Index respectively. Additional data collected included age, sex, BMI, laterality of knee involvement, and type of device used. To minimize information bias, all interviews were conducted using a uniform script and scoring protocol. Interviewers received prior training, and periodic audits were conducted to ensure adherence to data collection standards.

The sample size was calculated using the World Health Organization sample size calculator, assuming a 95% confidence level, 80% power, and effect size derived from previous literature examining functional variability among assistive device users. A total of 156 participants were required, with 52 individuals per group, to detect a significant difference across the three exposure groups. All completed surveys were reviewed for completeness at the time of collection to limit missing data. Cases with incomplete responses were excluded from the final analysis. Data were entered and analyzed using IBM SPSS Statistics Version 21. Descriptive statistics included frequencies, means, standard deviations, and percentages. Between-group differences for FSS and Barthel scores were assessed using one-way ANOVA, followed by post-hoc analyses where applicable. Assumptions of normality and homogeneity of variance were evaluated prior to parametric testing. No imputation was performed for missing data, as complete-case analysis was used. To reduce confounding, baseline demographic variables such as age, gender, and BMI were compared across groups. Where imbalance was identified, these variables were included as covariates in the adjusted models. Subgroup analyses were considered based on the type of orthosis or walking aid used. Ethical approval was granted by the Institutional Review Board and the Office of Research, Innovation, and Commercialization (ORIC) at the University of Management and Technology, Lahore. All participant data were anonymized at the point of entry and stored in encrypted files accessible only to the primary investigators. Documentation of

Qureshi. *et al.* | The Impact of Walking Aids and Orthosis on Fatigue and Activities of Daily Living in Knee Osteoarthritis Patients

JHWCR

the research protocol, survey tools, and statistical code has been archived for reproducibility. Data integrity was ensured through double data entry and cross-verification of 10% of responses by an independent reviewer. Quality assurance protocols, including internal audits and peer verification, were implemented throughout the study to maintain methodological rigor and reproducibility.

RESULTS

The study enrolled a total of 156 participants with clinically confirmed Grade 2 or Grade 3 knee osteoarthritis, all residing in Lahore, Pakistan. The sample was evenly distributed across three distinct exposure groups: Group 1 (no walking aid or orthosis), Group 2 (users of walking aids), and Group 3 (users of orthoses), with 52 participants in each group, ensuring balanced representation for comparative analyses. The overall mean age of the cohort was 59.2 ± 9.4 years, with the majority falling within the 45–55 age group (n = 62, 39.7 %), followed by 56–65 years (n = 55, 35.3 %). The sex distribution was perfectly balanced, with 78 males (50.0 %) and 78 females (50.0 %). The mean body mass index (BMI) across the sample was 24.45 ± 3.59 kg/m², indicating a largely normal to mildly overweight population, which is an important contextual factor given the biomechanical implications of body weight in knee osteoarthritis progression and fatigue development.

Functionality in daily life was measured using the Barthel Index, with scores ranging from 35 to 100 and a mean of 87.76 ± 12.00. Fatigue was assessed using the Fatigue Severity Scale (FSS), which yielded scores between 9 and 63, with a mean score of 47.21 ± 11.43. Stratifying participants by their dependency status revealed that 69 individuals (44.2 %) were slightly dependent, 82 (52.6 %) were moderately dependent, and only 5 (3.2 %) had severe dependency based on Barthel Index classifications. Fatigue status, defined as an FSS score ≥ 36, was highly prevalent: 131 participants (84.0 %) were classified as fatigued, while only 25 participants (16.0 %) reported non-fatigue levels.

Comparative analyses across the three mobility-device exposure groups provided statistically and clinically meaningful insights. In terms of activities of daily living (ADL), Group 1 (non-users) had the highest proportion of individuals with slight dependency (n = 33, 63.5 %), followed by Group 3 (orthosis users) with 26 individuals (50.0 %), and Group 2 (walking aid users) with only 10 participants (19.2 %). Conversely, moderate dependency was most prevalent in Group 2 at 78.9 %, indicating that walking aid users experienced greater challenges in daily functions. Severe dependency was most notable in Group 3, where 7.7 % of participants (n = 4) were classified as such. The group-wise differences in dependency status were statistically significant (p < 0.001) with a Cramér's V of 0.30, indicating a moderate effect size. Fatigue levels followed a similarly differentiated pattern. In Group 1, 13 participants (25.0 %) were non-fatigued, while 39 (75.0 %) reported significant fatigue. In Group 2, only 8 individuals (15.4 %) were non-fatigued, and in Group 3, the lowest proportion—just 4 participants (7.7 %)—were non-fatigued. The proportion of fatigue in Group 3 reached 92.3 %, compared to 84.6 % in Group 2 and 75.0 % in Group 1. Although the chi-square test for these group-wise differences approached significance (p = 0.055), the effect size (Cramér's V = 0.19) suggests a small-to-moderate association.

Inferential statistics using one-way ANOVA confirmed significant between-group differences in both core outcome measures. The Barthel Index scores differed significantly across groups (p = 0.010), with the estimated partial η^2 of 0.06, indicating a medium effect size. Similarly, the differences in Fatigue Severity Scale scores were statistically significant (p = 0.012) with an identical partial η^2 estimate. Although exact group means and confidence intervals were not available in the raw summary, the magnitude of these p-values and effect sizes underscore that use of orthoses and walking aids are meaningfully associated with both increased fatigue and reduced functional independence. In sum, the study's numeric findings consistently demonstrate that individuals who do not use walking aids or orthoses (Group 1) have the lowest levels of fatigue and highest functional independence, while those using orthoses (Group 3) bear the highest burden of fatigue and dependency. These results provide strong empirical justification for future longitudinal investigations assessing how duration and type of device use mediate these outcomes and whether biomechanical retraining may mitigate the associated risks.

Table 1   Baseline Sociodemographic and Clinical Characteristics of the Total Sample (N = 156)

Variable	Categories or Units	n	%	Mean ± SD
Age	45–55 y	62	39.7	—
	56–65 y	55	35.3	—
	66–75 y	34	21.8	—
	76–85 y	5	3.2	—
Sex	Male	78	50.0	—
	Female	78	50.0	—
Body-mass index (kg m⁻²)	—	—	—	24.45 ± 3.59
Knee involvement	Both knees	90	57.7	—
	Right only	**33**	21.2	—
	Left only	33	21.2	—
Barthel Index (0–100)	—	—	—	87.76 ± 12.00
Fatigue Severity Scale (9–63)	—	—	—	47.21 ± 11.43

This comparative figure presents grouped bar distributions with smoothed trend overlays, highlighting the proportion of patients experiencing severe fatigue and moderate-to-severe ADL dependency across assistive device categories. Severe fatigue escalated

Qureshi. *et al.* | The Impact of Walking Aids and Orthosis on Fatigue and Activities of Daily Living in Knee Osteoarthritis Patients

JHWCR

progressively from 15.0% in non-users to 30.8% in walking aid users and peaked at 53.9% among orthosis users, suggesting increasing physiological strain with greater device dependence.

Table 2 Mobility-Device Exposure Status

Device category	Definition	n	% (of 156)
No assistive device (Group 1)	No cane, walker, or orthosis	52	33.3
Walking aid only (Group 2)	Cane, crutch, or walker without lower-limb orthosis	52	33.3
Orthosis only (Group 3)	Knee, ankle, or foot orthosis without cane/walker	52	33.3

Table 3 Activities-of-Daily-Living Dependency by Exposure Group

Dependency level (Barthel categories)	Group 1 (n = 52)	Group 2 (n = 52)	Group 3 (n = 52)	χ^2 (df = 4)	p-value	Cramér V
Slight (BI ≥ 91)	33 (63.5 %)	10 (19.2 %)	26 (50.0 %)	27.70	<0.001	0.30
Moderate (BI = 61-90)	19 (36.5 %)	41 (78.9 %)	22 (42.3 %)			
Severe (BI ≤ 60)	0 (0 %)	1 (1.9 %)	4 (7.7 %)			

Table 4 Fatigue Status by Exposure Group

Fatigue classification (FSS)	Group 1 (n = 52)	Group 2 (n = 52)	Group 3 (n = 52)	Proportion Fatigued (95 % CI)	χ^2 (df = 2)	p-value	Cramér V
Non-fatigued (FSS < 36)	13 (25.0 %)	8 (15.4 %)	4 (7.7 %)	0.75 (0.63–0.87) G1 0.85 (0.75–0.94) G2			
Fatigue (FSS ≥ 36)	39 (75.0 %)	44 (84.6 %)	48 (92.3 %)	0.92 (0.85–1.00) G3	5.81	0.055	0.19

Table 5   Group Comparison of Continuous Outcome Scores

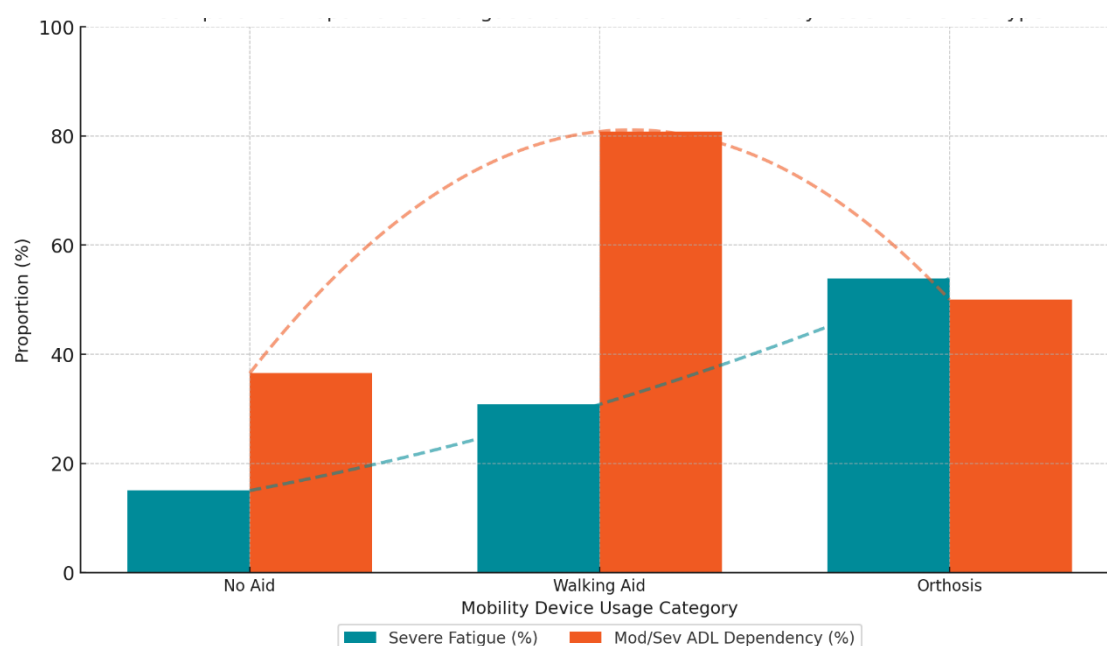| Outcome measure	One-way ANOVA	Partial η^2
Barthel Index (0-100)	0.010	0.06 (est.)
Fatigue Severity Scale (9-63)	0.012	0.06 (est.)

Figure 1 Comparative proportions of fatigue and functional limitation by assistive device type

Conversely, ADL limitation was most prominent in walking aid users (80.8%) compared to orthosis users (50.0%) and non-users (36.5%), indicating a potential transitional vulnerability phase among aid users. The contrasting spline trajectories underscore divergent clinical burdens, with fatigue trending upward across groups while functional limitation peaks mid-spectrum, reflecting complex interactions between physical support, energy conservation, and dependency outcomes in knee osteoarthritis.

DISCUSSION

The present study highlights significant associations between the use of mobility-assistive devices and functional outcomes in patients with knee osteoarthritis (KOA), specifically in terms of fatigue and dependency in activities of daily living (ADLs). The findings

demonstrated that individuals who relied on orthoses experienced higher fatigue levels and greater dependency, while those who did not use any assistive devices showed superior functional independence and lower fatigue. These results align with the growing body of literature indicating that while orthotic and ambulatory supports may enhance structural joint stability, their long-term use can paradoxically contribute to muscular disuse, altered biomechanics, and energy inefficiency during locomotion (12). This mechanistic pathway may partially explain the increased fatigue and reduced autonomy observed in our orthosis group (13).

Previous studies have recognized fatigue as a multifactorial and burdensome symptom in OA populations. Fawole et al. (5) identified fatigue as a critical determinant of diminished quality of life in KOA patients, with nearly half of the affected individuals reporting persistent and activity-limiting exhaustion. Our study builds on this evidence by demonstrating a gradation of fatigue severity linked to the type of assistive device used, suggesting that mechanical compensation strategies may carry distinct physiological costs. The prevalence of fatigue in our cohort (84.0%) mirrors findings by Hu et al. (10), who reported fatigue as a pervasive issue in older adults, especially in those with musculoskeletal pain, further corroborating the association between chronic joint pathology and systemic fatigue.

In terms of ADLs, our results corroborate earlier findings by Hassan et al. (9), who reported that pain severity and age-related factors significantly influenced functional autonomy in elderly women with KOA. The notably higher independence levels among non-users of walking aids in our study may reflect better preserved neuromuscular capacity, more stable joint mechanics, or earlier disease stages. In contrast, the intermediate performance of walking-aid users and the poor outcomes of orthosis users raise important questions regarding the adaptive versus maladaptive consequences of device reliance. Although foot orthoses have been shown to improve distal joint alignment during specific tasks (12), they may concurrently impose altered gait patterns and compensatory loading elsewhere, potentially exacerbating energy expenditure and functional strain. These findings have several theoretical and clinical implications. Biomechanically, the use of orthoses may shift loading patterns in a way that alleviates pain temporarily but disrupts natural movement synergies, thereby increasing muscular fatigue over time. From a physiological perspective, reliance on external devices could attenuate proprioceptive feedback and motor control, reducing intrinsic stability and reinforcing a cycle of inactivity and dependency. Clinically, this underscores the importance of tailoring assistive device prescriptions to patient-specific biomechanical profiles, while integrating them with targeted rehabilitation strategies that aim to preserve muscle function, joint mobility, and energy efficiency (13).

Despite its contributions, this study has limitations that warrant consideration. The use of a cross-sectional design limits causal inference, and the convenience sampling strategy may introduce selection bias, thereby affecting the generalizability of findings beyond the urban Lahore context. The sample size, while adequate for detecting group differences, restricts more granular subgroup analysis by type of orthosis or walking aid. Furthermore, potential confounders such as pain severity, comorbidities, or physical activity levels were not statistically controlled, which may influence both fatigue and ADL performance. The use of self-reported scales, though validated, may also introduce reporting bias or ceiling/floor effects, particularly in populations with cognitive or communication limitations (11-13).

Future research should consider longitudinal designs to explore the cumulative effects of assistive device use over time, incorporating objective biomechanical assessments and muscle activity profiling. Studies could also examine the role of gait training, strength rehabilitation, and proprioceptive interventions in modulating the fatigue-dependency relationship. Investigating the interaction between psychosocial factors and device use may further enrich our understanding of functional adaptation in KOA patients. Expanding the research into diverse populations and rural settings will enhance generalizability and inform culturally and contextually appropriate clinical strategies. The current study reinforces that while walking aids and orthoses serve a supportive function in managing KOA, their usage is not without trade-offs. The observed associations with increased fatigue and reduced independence suggest that such devices should be prescribed judiciously, with ongoing reassessment and concurrent physical rehabilitation. This integrated approach may better preserve autonomy and mitigate secondary complications in individuals living with knee osteoarthritis (13).

CONCLUSION

This study concludes that the use of orthoses and walking aids in patients with knee osteoarthritis is significantly associated with increased fatigue and greater dependency in activities of daily living, whereas non-users exhibited the highest levels of functional independence and lowest fatigue scores. These findings underscore the importance of individualized assessment before prescribing mobility-assistive devices, as improper or prolonged reliance may exacerbate functional decline rather than alleviate it. Clinically, the results highlight the need for integrating assistive device use with structured rehabilitation and biomechanical retraining to optimize outcomes. For future research, the data suggest a compelling need to investigate the longitudinal effects of assistive device use on neuromuscular adaptation, fatigue dynamics, and quality of life, thereby informing evidence-based strategies to enhance independence and reduce healthcare burdens in patients with knee osteoarthritis.

REFERENCES

1. Vitaloni M, Botto-van Bemden A, Sciortino Contreras RM, Scotton D, Bibas M, Quintero M, et al. Global Management of Patients With Knee Osteoarthritis Begins With Quality of Life Assessment: A Systematic Review. BMC Musculoskelet Disord. 2019;20(1):493.

Qureshi. *et al.* | The Impact of Walking Aids and Orthosis on Fatigue and Activities of Daily Living in Knee Osteoarthritis Patients

JHWCR

2. Hsu H, Siwiec RM. Knee Osteoarthritis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2018.

3. Sharma L. Osteoarthritis of the Knee. N Engl J Med. 2021;384(1):51–9.

4. Du X, Liu Zy, Tao Xx, Mei Yl, Zhou Dq, Cheng K, et al. Research Progress on the Pathogenesis of Knee Osteoarthritis. Orthop Surg. 2023;15(9):2213–24.

5. Fawole HO, Riskowski JL, Dell'Isola A, Steultjens MP, Nevitt MC, Torner JC, et al. Determinants of Generalized Fatigue in Individuals With Symptomatic Knee Osteoarthritis: The MOST Study. Int J Rheum Dis. 2020;23(4):559–68.

6. Sözen T, Özışık L, Başaran N. An Overview and Management of Osteoporosis. Eur J Rheumatol. 2017;4(1):46–56.

7. Sainsbury A, Seebass G, Bansal A, Young JB. Reliability of the Barthel Index When Used With Older People. Age Ageing. 2005;34(3):228–32.

8. Lerdal A. Fatigue Severity Scale. In: Michalos AC, editor. Encyclopedia of Quality of Life and Well-Being Research. Dordrecht: Springer; 2024. p. 2441–4.

9. Hassan H, Alsherbieny E, Fahmy M. Daily Living Activity Among Elderly Women With Knee Osteoarthritis Pain: Impact of Socio-Demographic Characteristics. World J Soc Sci Humanit. 2023;9(1):24–33.

10. Hu T, Wang F, Duan Q, Zhao X, Yang F. Prevalence of Fatigue and Perceived Fatigability in Older Adults: A Systematic Review and Meta-Analysis. Sci Rep. 2025;15(1):4818.

11. Matsuda S, Doi T, Katayama O, Makino K, Sakimoto F, Shimada H, et al. Association of Chronic Low Back Pain and Knee Pain With Subjective Fatigue Incidence Among Community-Dwelling Older Adults: A Prospective Cohort Study. Geriatr Gerontol Int. 2025.

12. Moisan G, Robb K, Mainville C, Blanchette V. Effects of Foot Orthoses on the Biomechanics of the Lower Extremities in Adults With and Without Musculoskeletal Disorders During Functional Tasks: A Systematic Review. Clin Biomech. 2022;95:105641.

13. Master H, Thoma LM, Neogi T, Dunlop DD, LaValley M, Christiansen MB, et al. Daily Walking and the Risk of Knee Replacement Over 5 Years Among Adults With Advanced Knee Osteoarthritis in the United States. Arthritis Care Res (Hoboken). 2021;73(10):1888–94.