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Relationship between Foot Disorder, Disability, and Fitness among Older People with Low Back Pain: A scoping review

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Abstract

Foot conditions and low back pain (LBP) are common contributors to mobility decline in older people. This scoping review aimed to explore how foot disorders, physical fitness, and disability relate to LBP in later life. From 1272 records, 12 studies met the inclusion criteria. Foot problems, including deformities, weak toe flexors, and unsuitable footwear, were consistently linked to poorer balance and reduced mobility, while studies on LBP alone showed similar patterns of functional decline. However, to investigate this research gap, this review highlights the limited evidence directly examining foot disorders and LBP together.

Keywords: low back pain; disability; physical fitness; foot disorder

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1.0 Introduction

Low back pain (LBP) is a major cause of pain and functional limitation in older people, often contributing to restricted mobility, reduced physical performance, and poorer quality of life. It is recognised as one of the most common musculoskeletal problems worldwide, with the lifetime prevalence of nonspecific LBP estimated to be as high as 80% (Safiri et al., 2023). Recent global estimates suggest that around 619 million individuals were living with chronic LBP in 2020, and this number may increase to approximately 843 million by 2050 due to population ageing and longer life expectancy (Ferreira et al., 2023). Among older adults, reported prevalence ranges from 12.8% to 75%, depending on the characteristics of the sample and the methods used to define and measure LBP (de Souza et al., 2019). Together, these data point to a substantial and growing burden of LBP within ageing populations and emphasise the need to understand how it contributes to functional decline in later life.

Collectively, the literature indicates that LBP in older patients is a complex disease influenced by muscle weakness, sarcopenia, locomotor impairments, psychological factors, and possibly mechanical problems of the feet. These domains are possibly correlated, and they together play a role in the functional decline and disability pathways of the ageing populations. As the concept of holistic,

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multidisciplinary treatment in geriatrics becomes increasingly vital, the correlation between foot health, physical fitness, and functional disability is critical for enhancing prevention, assessment, and treatment. Therefore, this scoping review aims to explore and summarise the existing evidence on foot characteristics, physical fitness, and disability among older people with LBP, identify knowledge gaps, and guide future research and clinical practice.

2.0 Literature Review

2.1 Physical fitness and LBP in older people (OP)

As many studies have demonstrated, age-related deterioration of characteristics such as muscle weakness, reduced joint mobility, poor control, and overall functional impairment is often associated with chronic LBP in OP (Sato et al., 2021; Yabe et al., 2022). When these impairments interact with each other, they form a cycle of pain, decreased activity and increasing disability, making LBP a significant challenge to the population on the ageing front. There is also longitudinal evidence that LBP relates to long-term functional deterioration and progressive disability over time, especially in the case of older people with persistent symptoms (Coyle et al., 2024; Yabe et al., 2022).

Physical fitness, as a multidimensional factor, is central to the causation of LBP, the determination of functional capacity, and the outcome of rehabilitation. Studies have always shown that older people with chronic LBP have lower muscle strength, worse neuromuscular performance, and sarcopenic signs. It has also been found that weak hip abductors and limited hip range of motion are predictors of lower gait speed, worse chair-rise ability, and greater disability at 12 months post-intervention (Coyle et al., 2021). In the same manner, a surrogate measure of neuromuscular imbalance, namely, asymmetric handgrip strength, has been linked to worse physical performance and a higher risk of sarcopenia, especially in older women with LBP (Kim & Kim, 2024). To support these results, calf circumference is a moderate predictor of sarcopenia in OP with chronic LBP, and this outcome demonstrates the relationship between muscle mass, weakness, and functional impairment (Kim et al., 2024). All this evidence highlights the primary importance of muscle strength and factors associated with sarcopenia in determining functional outcomes in OP with LBP.

Intervention research also argues in favor of physical fitness in chronic LBP management. The use of exercise-based programs, such as core stability training, resistance exercises, group-based sessions, and general physical activity, has demonstrated significant changes to the intensity of pain, disability, trunk muscle thickness, walking speed, and functional capacity, in general (Ge et al., 2022; Silva et al., 2025). In a specific instance, walking has become an easy yet effective approach, and the more people walk, the less likely they are to have chronic LBP (Nah et al., 2022). It is important to note that exercise therapy is effective in OP with and without sarcopenia. However, people with sarcopenia (as opposed to OP) can experience less treatment satisfaction and lower quality of life, which indicates that muscle mass deficits can affect the responsiveness of the rehabilitation (Nakagawa et al., 2020). Overall, these results point to the significance of physical fitness as one of the predictors of the severity of LBP and the effectiveness of rehabilitation processes.

2.2 Functional disability and LBP in older people (OP)

Another important area that is critical to chronic LBP in OP is functional disability. Several longitudinal studies show different disability progression patterns, with subgroups that have more intense pain, more comorbidities, less physical activity, and more psychological distress having worse outcomes (Coyle et al., 2024). It has also been demonstrated that LBP is a predictor of low physical functioning in a dose-dependent manner: the longer the LBP, the more likely is the development of low physical functioning and physical mobility (Yabe et al., 2022). These results demonstrate the trend of disability among OP with LBP and the necessity to consider a combination of interacting factors, such as physical, psychological, and pain-related elements to prevent the deterioration of the functions in the long term.

2.3 Foot health and LBP in older people (OP)

Compared to the extensive research on fitness and disability, there has been a lack of research on the foot-specific aspect of LBP in OP. Available studies indicate that foot problems, including weak toe flexors, foot deformities, and improper footwear, are prevalent and highly correlated with reduced balance and mobility among OP (White et al., 2024). In addition, the flexor strength of the toes was found to be related to gait speed and functional movement, particularly in older women with pronated or supinated foot positions, suggesting that foot mechanics may determine the efficiency of the lower limbs (Kusagawa et al., 2020). The research outcomes of these studies do not directly investigate LBP; however, impaired foot function can also lead to altered gait patterns and compensatory trunk motions, which might increase spinal load and worsen pain. This limited but informative evidence underscores an interesting gap in research, as the interaction between foot biomechanics and LBP in OP is only minimally studied.

3.0 Methodology

This scoping review was conducted using the methodological framework proposed by Arksey and O'Malley (2005), which provides a structured approach for mapping the breadth of available research. This approach was selected to capture and organise studies examining foot disorders, low back pain, disability, and physical fitness among older people. The review followed the five core stages described in their framework: (1) formulating the research question, (2) identifying relevant studies, (3) selecting studies for inclusion, (4) charting key information from the included studies, and (5) collating, summarising, and reporting the results. The reporting process

was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), and the study selection process is outlined in Figure 1.

Following Arksey and O'Malley's (2005) guidance, the main research question for this review was: "What is currently known about the relationship between foot disorders, disability, and physical fitness among older people with low back pain?" Two sub-questions were also specified: "How do foot deformities and foot function relate to postural instability, pain, and mobility limitations?" and "What evidence exists on the interplay between foot disorders, disability, and physical fitness in older people with LBP?" To address these questions, three electronic databases—PubMed, Scopus, and Web of Science—were searched for studies published between 2020 and 2025. The search strategy was developed using the PCC (Population–Concept–Context) framework and combined terms related to LBP ("low back pain", "lumbar pain"), foot-related factors ("foot disorder", "foot posture", "plantar pressure", "foot function"), physical fitness ("physical fitness", "functional performance", "physical activity", "muscle strength"), and disability ("functional limitation", "mobility limitation", "functional decline"). Population terms included "older adult", "elderly", "older people", "geriatric", and "ageing". Search strings were adapted to each database (TITLE-ABS-KEY in Scopus, Title/Abstract in PubMed, and TS in Web of Science), and separate searches were performed for LBP combined with each concept group (LBP + foot, LBP + fitness, LBP + disability). Only full-text articles published in English were considered.

All 1272 papers retrieved were exported into Rayyan, an online systematic review management tool, to facilitate the screening process. Duplicate records were automatically detected and removed, resulting in a final dataset for screening. Studies were included when they involved OP aged 60 years and above, examined low back pain or lumbar pain, and reported outcomes related to foot disorders, foot function, physical fitness, or disability. All peer-reviewed quantitative, qualitative, and mixed-method studies conducted in community, clinical, rehabilitation, or primary healthcare settings were eligible for inclusion. Articles that were published earlier than 2010 and had no full-text access were excluded. They were eliminated when they included younger populations (less than 60 years old), focused on conditions other than low back pain, or did not report outcomes related to foot function, fitness, or disability. Articles were also excluded if they involved post-surgical populations (e.g., laminectomy), athletes, animal studies, or were non-peer-reviewed publications such as case reports, editorials, conference abstracts, dissertations, or book chapters. Non-English publications, studies without an accessible full text, and duplicate records were also excluded from the review.

4.0 Results

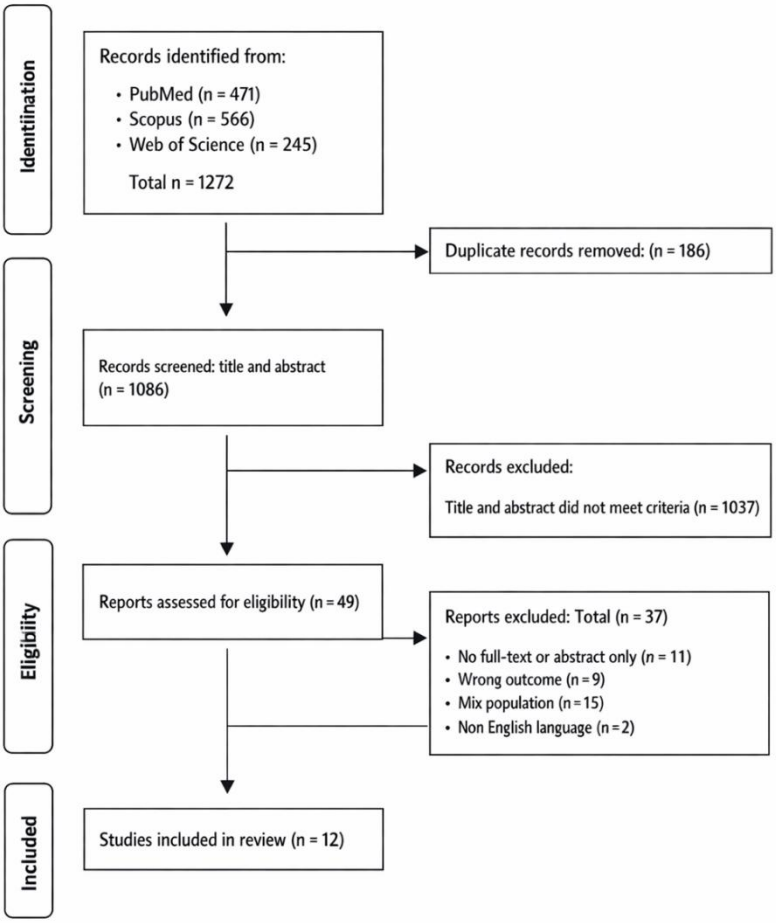

Figure 1: PRISMA flow diagram for the study

The results of the final systematic search are presented in Figure 1. The study selection followed PRISMA-ScR guidelines. Database searched retrieved 1272 records: PubMed (n=41), Scopus (n=986), and Web of Science (n=245). After eliminating 186 duplicate data points, 1086 articles were retained for further screening based on title and abstract. From this, 1037 records were excluded for various reasons; the title and abstract did not meet the criteria. A total of 49 reports were assessed for eligibility. A total of 43 records were excluded due to no full text or abstract only (n=34), wrong outcome (n=9), mixed population (n=12), or non-English language articles (n=2). Ultimately, fifteen (15) studies met all the inclusion criteria and were included in the review. This rigorous process ensured the relevance and quality of the studies analysed. Summaries of each article are presented in Table 1.

Table 1. Summary of the articles

Author / Year	Study Design	Country	Sample Population	Outcome Measures	Summary of Findings
Coyle et al., 2021	Prospective cohort	USA	n = 245 Older adults with chronic LBP ≥ 60 years	Hip ROM, hip strength, gait speed, 6MWT, disability	Hip ROM & strength predicted 12-month functional outcomes; deficits linked to disability progression.
Coyle et al., 2024	Longitudinal cohort	USA	n = 245 Older adults with chronic LBP ≥ 60 years	LLFDI function/disability, LBP disability	Persistent disability trajectories identified over 12 months.
Ge et al., 2022	Randomized controlled trial	China	n = 31 Older women with chronic LBP ≥ 65 years	trunk endurance, Core stability metrics, TrA thickness, pain, mobility	Core stability training significantly improved trunk muscle thickness, pain levels, and mobility measures.
Kim & Kim, 2024	Retrospective cross-sectional	South Korea	n = 575 Older adults with chronic LBP ≥ 65 years	Handgrip asymmetry, sarcopenia indicators, physical performance	Higher handgrip asymmetry linked to poorer physical performance and higher sarcopenia prevalence, especially in older women with LBP
Kim et al., 2024	Retrospective cross-sectional	South Korea	n = 592 Older adults with chronic LBP ≥ 65 years	Calf circumference, sarcopenia indicators	Calf circumference moderately predicted sarcopenia; sex differences noted in predictive accuracy among older adults with CLBP.
Kusagawa et al., 2020	Cross-sectional	Japan	n = 70 Community-dwelling older adults Mean age:76.8	Toe grip strength, foot posture, mobility	Toe flexor strength was associated with walking speed among pronated or supinated foot types.
Nah et al., 2022	Cross-sectional (KNHANES)	South Korea	n = 5233 Community older adults ≥ 65 years	Walking frequency, resistance training, CLBP prevalence	Walking ≥5 days/week significantly reduced the risk of chronic LBP; resistance training showed no association.
Nakagawa et al., 2020	Prospective cohort	Japan	n = 28 Elderly LBP patients ≥ 65 years	Pain, disability, gait, QoL	Exercise therapy improved pain, disability, and gait; sarcopenic individuals reported lower QoL and treatment satisfaction.
Sato et al., 2021	Cross-sectional	Brazil	n = 512 Community-dwelling elderly ≥ 60 years	LBP prevalence, disability, comorbidities	LBP prevalence was high (55.7%); disability was associated with smoking, comorbidities, and low physical activity.
Silva et al., 2025	Randomized controlled trial	Brazil	n = 120	Pain, disability, falls, physical activity	Group exercise substantially reduced pain and disability and

			Older adults with nonspecific LBP		produced sustained improvements at 12 months
Yabe et al., 2022	Longitudinal (4 years)	Japan	≥ 60 years n = 914 Older adults after earthquake	Disability progression, LBP	Longer LBP duration significantly increased the odds of low physical function in a dose-dependent pattern.
White et al. (2024)	Cohort Study	Australia	≥ 65 years n = 102; Mean age:79.3	Foot problems, toe strength, SPPB, footwear	Toe weakness and inappropriate footwear were associated with poorer balance and reduced mobility in older adults.

Abbreviations: ROM, range of motion; 6MWT, six-minute walk test; LLFDI, Late-Life Function and Disability Instrument; TrA, transversus abdominis; CLBP, chronic low back pain; QoL, quality of life; SPPB, Short Physical Performance Battery; KNHANES, Korea National Health and Nutrition Examination Survey.

4.1 Extend, Range, and Nature of Evidence

This scoping review identified 12 studies that examining foot characteristics, physical fitness, and functional disability among older people aged 60 years and older with LBP. The evidence represents a wide range of areas, including Japan, Brazil, China, South Korea, Hong Kong, and the United States, indicating a growing global concern regarding the musculoskeletal health of aging populations. These articles employed diverse designs, including randomised controlled trials, longitudinal cohorts, cross-sectional studies, and an intervention-based cohort design, which provides a general discussion of factors affecting LBP in older people. Most of the research investigated physical fitness and markers of sarcopenia, and research on the foot-related characteristics was the least prevalent among the available data. Across all domains, the included studies consistently reported associations between LBP and reduced strength, impaired mobility, decreased physical activity, and long-term functional decline. Overall, the evidence supports the idea of the multidimensional nature of LBP in older people, suggesting contributions from muscular, anatomical, and biomechanical factors.

4.2 Key Themes

4.2.1 Foot disorders among older people *with LBP*

Evidence on foot-related factors among older people remains limited, with only two studies having met the inclusion criteria. Both articles were concerned with the subject of foot deformities, the strength of the toe flexor, and foot posture; however, they did not directly investigate how these relate to LBP. The findings nevertheless demonstrate meaningful biomechanical patterns that may indirect cause of LBP. White et al. (2024) reported that older people attending a falls and balance clinic had foot issues, including hallux valgus or lesser-toe deformities, and improper footwear, which were closely associated with balance and mobility deficits, as reflected in lower Short Physical Performance Battery scores (SPPB). Similarly, Kusagawa et al. (2020) showed that abnormal foot posture and weak toe flexor strength were associated with reduced mobility, particularly in older people aged 65 years and older. Although these studies did not include pain-related outcomes, their findings suggest possible pathways through which age-related foot impairments may influence lower limb mechanics, balance and overall functional capacity, all of which are factors commonly linked to LBP in the older people. Collectively, the evidence suggests that foot function is an underexplored yet relevant domain that may contribute to altered biomechanics and functional limitations commonly observed in older people with chronic LBP.

4.2.2 Physical Fitness among older people *with LBP*

Physical fitness was the most widely represented theme, and several studies explored muscle strength, sarcopenia indicators, physical activity participation, and exercise interventions older people aged 60 years and older. Several cross-sectional studies identified strong associations between muscle weakness and functional vulnerability in older people with LBP. Kim & Kim (2024) and Kim et al. (2024) identified that handgrip strength asymmetry and reduced calf circumference were effective markers of sarcopenia and associated with poorer physical performance. Nakagawa et al. (2020) also found that sarcopenia significantly reduced the effectiveness of exercise therapy, indicating that muscle mass plays a crucial role in treatment outcomes for chronic LBP. This theme was reinforced by an intervention study. Ge et al. (2022) demonstrated that core stability training improved pain, trunk endurance, and function among women with chronic LBP, while Silva et al. (2025) showed that group-based exercise significantly reduced pain and disability and improved quality of life. In addition, a population-level study by Nah et al. (2022) observed that older people who engaged more frequently in walking and resistance training demonstrated a lower prevalence of chronic LBP. Taken together, these findings show that physical fitness, particularly muscle strength, core stability and regular physical activity, is closely associated with pain severity, mobility and overall functional ability in older people with LBP.

4.2.3 Disability and Functional Decline among older people *with LBP*

The disability theme was supported by four studies, in which high-quality longitudinal evidence was present. Disability was consistently associated with chronic LBP, functional decline, and reduced mobility in older people. Coyle et al. (2021) demonstrated that reduced hip

strength and limited range of motion are indicators of worse physical functioning over 12 months. In a follow up study, Coyle et al. (2024) identified distinct disability trajectories, with many older people experiencing persistent or worsening disability despite ongoing care. Similarly, Yabe et al. (2022) showed that older people with chronic LBP had long-term worsening in terms of functionality that lasted up to four years, regardless of initial severity. Community-based data from Sato et al. (2021) reinforced this theme, showing that LBP was strongly associated with disability in activities of daily living (ADLs) and mobility limitations. Collectively, these studies suggest that functional disability is both a consequence and predictor of chronic LBP, and that older people with persistent pain are at high risk for accelerated functional decline.

5.0 Discussion

5.1 Gaps in Evidence

5.1.1 Foot disorders among older people *with LBP*

Although the two studies have focused on foot-related factors specifically, both have raised critical biomechanical concerns that may affect LBP. An older person might have impaired balance and mobility due to foot deformities, foot weakness, and abnormal foot posture (White et al., 2024; Kusagawa et al., 2020). These impairments may contribute to altered gait mechanics, compensatory trunk movements, and increased spinal loading, which are mechanisms previously described in geriatric musculoskeletal research. However, neither study directly evaluated LBP outcomes, indicating that the potential foot–spine relationship remains underexplored. Nevertheless, the findings support the relevance of foot function screening in older people with mobility decline or balance disturbances.

5.1.2 Physical Fitness among older people *with LBP*

Evidence for physical fitness was the most substantial and showed consistent associations between muscle weakness, sarcopenia markers, and adverse outcomes in older people with LBP. Handgrip strength asymmetry and reduced calf circumference both established indicators of sarcopenia, were strongly linked to poorer physical performance and functional capacity (Kim & Kim, 2024; Kim et al., 2024). Nakagawa et al. (2020) also showed that the sarcopenic older people resorted to exercise therapy more poorly, which indicated that muscle mass loss can be a threshold to poor rehabilitation. Intervention research supported the significance of physical fitness. Trunk endurance and pain levels were enhanced with the help of core stability training (Ge et al., 2022), whereas group-based exercise reduced disability and improved the quality of life (Silva et al., 2025). The population-level results also indicated that older people who were engaged in regular walking or resistance training had a lower likelihood of chronic LBP (Nah et al., 2022). Overall, these findings highlight physical fitness as a major determinant of functional capacity, pain severity, and treatment responsiveness among older people.

5.1.3 Disability and Functional Decline among older people *with LBP*

Research on disability has always shown that LBP in older people is a cause and predictor of functional deterioration as time goes by. Coyle et al. (2021, 2024) reported that reduced hip strength and range of motion predicted poorer mobility and long-term disability trajectories over 12 months. Yabe et al. (2022) extended this understanding by showing that chronic LBP predicted functional decline for up to four years. These results were consistent with those of community-based evidence by Sato et al. (2021), which supported these findings, linking LBP with limitations in activities of daily living. Collectively, these studies highlight that disability is a central component of the clinical presentation of LBP in older people and reflects cumulative effects of strength loss, mobility impairment, and pain-related avoidance.

5.2 Future Directions

This scoping review has several significant important implications for future research and clinical practice. The future research must focus on three key directions. First, studies should directly examined the association between foot function and LBP using advanced assessment techniques such as gait analysis, plantar pressure mapping, and biomechanical modelling to clarify the role of foot mechanisms in pain and functional outcomes. Second, prospective longitudinal research is required to determine the time sequences between muscle weakness, sarcopenia, and LBP, and composite models that combine foot function, physical fitness, and disability may offer a more comprehensive understanding of the multidimensional factors contributing to LBP in older people. Third, intervention trials targeting toe flexor strength, balance training, and sarcopenia management could provide novel rehabilitation strategies, while multi-centre studies are recommended to improve generalisability of future findings.

From a clinical perspective, these findings highlight the importance of assessing lower limb strength, balance, and foot posture when managing older people with LBP. Simple screening tools, such as calf circumference and handgrip strength, can be used to identify individuals with sarcopenia who are at risk of poorer outcomes. Multicomponent exercise programmes that incorporate core strengthening, balance exercises, and resistance training should be prioritised to enhance physical function and reduce disability. The early detection of functional deterioration is crucial to prevent mobility loss in the long term, and rehabilitation approaches should adopt a holistic focus that extends beyond the lumbar spine to include lower limb and foot function as part of comprehensive geriatric care.

6.0 Conclusion

This review synthesised existing evidence on foot disorders, physical fitness, and disability among older people with LBP. Overall, this study highlights a strong association between physical fitness, disability, and LBP among older people. Particularly, indicators of physical fitness, including muscle strength, sarcopenia markers, and trunk stability, have the most consistent association with pain severity,

mobility, and functional outcomes. Apart from that, disability is also strongly associated with LBP, with several articles demonstrating persistent or worsening decline over extended follow-up periods. Conversely, few studies have examined foot-related considerations. Yet, available sources indicate that foot deformities, toe flexor weakness, and inappropriate footwear are associated with balance and mobility impairments in older people. This evidence showed a significant gap in the literature, given the biomechanical importance of functioning to gait and posture.

These findings highlight the need for multidimensional assessment models incorporating foot function, muscle strength, sarcopenia markers, and disability profiles. Future research, particularly biomechanical, longitudinal, and interventional studies, should be focused on foot characteristics such as foot posture and plantar pressure; lower limb strength; sarcopenia markers; and functional deficits to better understand their role in LBP management, especially in older people.

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Disclaimer

The authors declared the use of AI (ChatGPT, Grammarly, and Rayyan AI) to improve the structure and meaningfulness of sentences throughout the writing, conduct grammar and similarity checks, and enhance the process for inclusion paper selection.

Conflict of Interest

The authors declared no conflict of interest.

Paper Contribution to Related Field of Study

This scoping review contributes to the field by bringing together three areas that are often studied separately on foot disorders, physical fitness, and disability to better understand low back pain in older people. The review highlights a major gap in existing research: very few studies examine how foot posture or foot function may influence back pain, despite the clear biomechanical connection between the feet and the spine. It also confirms that physical fitness and sarcopenia-related factors are strong determinants of pain, mobility, and long-term function in older people. By combining these findings, the review can support the more holistic approach to assessment and care that involves the strength, movement, disability levels, and foot mechanics. This article provides a clearer direction for future studies and helps inform more comprehensive rehabilitation strategies for older people with low back pain.

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