

Association between physical activity and urinary incontinence according to menopausal stages

Short title: Physical activity UI and menopause

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Conflict of Interest: nothing to declare.

Funding: nothing to declare.

Author Contributions (CRediT taxonomy)

Belén Carballo-Leyenda: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing.

Concepción E. Tuero-del-Prado: Conceptualization, Investigation, Methodology, Supervision, Validation, Visualization, Writing – review & editing.

Marta Cordero-Fernández: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft.

EDITORIAL INFORMATION

Received: 9 February 2026

Accepted: 28 June 2026

Edited by:

Helder Miguel Fernandes

Polytechnic Institute of Guarda, Portugal

DRAFT

Abstract

Pelvic floor dysfunction (PFD) is a common and multifactorial condition affecting women across the lifespan. Urinary incontinence (UI), its most prevalent symptom, may be influenced by hormonal status and physical activity (PA), although evidence examining menopausal status as a moderator remains limited. This cross-sectional study examined the association between PA level, menopausal status, and UI in 1,294 physically active adult women. Participants completed the IPAQ-SF, the Pelvic Floor Impact Questionnaire–Short Form (PFIQ-7), and screening questions on urinary symptoms and menopausal status. Overall, 56.6% reported UI despite moderate-to-high PA levels. Perimenopausal, menopausal, and postmenopausal women showed a higher prevalence (63.5%) than non-menopausal women (51.5%) ($p < 0.001$). Globally, UI prevalence was 59.5% in women reporting moderate PA, 56.1% in low PA, and 53.7% in high PA ($p = 0.002$). Stratified analyses indicated that PA level was associated with UI only in non-menopausal women ($p < 0.001$), whereas prevalence remained consistently elevated across PA levels in menopausal stages. These findings suggest that general PA alone may not be sufficient to offset menopause-related vulnerability to UI and underscore the need to differentiate between overall PA and targeted pelvic floor interventions. Menopausal status should be considered when designing prevention strategies across the female lifespan.

Keywords: pelvic floor dysfunction, hormonal status, women's health, cross-sectional study

Introduction

Pelvic floor dysfunctions (PFD) comprise a group of functional disorders affecting the muscular, fascial, and neurological structures responsible for supporting pelvic organs and maintaining urinary and faecal continence. These conditions include urinary incontinence (UI), pelvic organ prolapse (POP), lower urinary tract sensory or voiding alterations, defecatory disorders, sexual dysfunction, and chronic perineal pain syndromes (Weber et al., 2001; Lacima & Espuña, 2008). It is estimated that approximately one in three adult women will experience some degree of PFD during their lifetime, and more than 40% of women over 50 years of age present clinically relevant symptoms (Dumoulin et al., 2018; Peinado-Molina et al., 2023). Beyond their physical manifestations, these disorders substantially impair psychological well-being, social participation, and quality of life (Hernández-Escobar et al., 2025).

The development of PFD is multifactorial. Established risk factors include parity, vaginal delivery, ageing, overweight and obesity, gynaecological surgery, and chronic increases in intra-abdominal pressure (Bø & Nygaard, 2020). From a pathophysiological perspective, alterations in connective tissue integrity, pelvic floor muscle weakness, and impaired neuromuscular control play a central role in continence mechanisms (DeLancey, 1993). Hormonal changes during the menopausal transition represent an additional key modulator of pelvic floor health. The decline in oestrogen levels contributes to urogenital tissue atrophy, reduced collagen synthesis, decreased vascularisation, and impaired pelvic floor muscle contractility, increasing susceptibility to urinary symptoms and pelvic organ prolapse (Pérez-López et al., 2021; Allafi et al., 2024; Wasnik et al., 2023).

Physical activity (PA) has been proposed as a potentially modifiable factor influencing pelvic floor function; however, its role remains controversial. Moderate levels of PA have been associated with beneficial effects on general muscle function, circulation, and lumbopelvic

stability, which could theoretically support continence mechanisms (Bø & Nygaard, 2020). Conversely, high-impact or high-intensity activities that generate repeated and marked increases in intra-abdominal pressure have been linked to a higher prevalence of stress urinary incontinence, particularly among young athletes and multiparous women (Almeida et al., 2016; De Mattos Lourenço et al., 2018). This apparent dual effect suggests that exercise intensity, modality, mechanical load, and the integration of pelvic floor muscle activation strategies are critical variables for preserving pelvic floor function.

Among pelvic floor dysfunctions, urinary incontinence is the most prevalent symptom in adult women and one of the main contributors to functional limitation and reduced quality of life (Dumoulin et al., 2018). Although some evidence suggests that moderate levels of PA may contribute to symptom prevention or mitigation (Woodley et al., 2020), other studies have reported no significant association or even a higher prevalence of stress urinary incontinence among highly physically active women (Almeida et al., 2016). Notably, prevalence rates of stress urinary incontinence have been estimated between 30% and 80% among elite female athletes, compared with 10% to 30% in non-athletic women (Almeida et al., 2016). These discrepancies highlight the complexity of the relationship between habitual physical activity and continence status.

Menopausal status has received comparatively less attention as a potential moderator of the association between PA and urinary incontinence. While pelvic floor muscle training is widely recognised as an effective intervention across the female lifespan (Hay-Smith et al., 2024), it remains unclear whether general PA exerts similar effects in women at different hormonal stages. Existing studies report heterogeneous findings, and few have examined this relationship through a stratified approach according to menopausal stage (Woodley et al., 2020; Almeida et al., 2016).

Given the heterogeneity of findings in the literature, the present study aimed to explore the association between physical activity level, menopausal status, and urinary incontinence in adult women, examining whether this association differed according to menopausal stage.

Method

An observational and exploratory cross-sectional study was conducted, with data collection carried out between April and August 2025. Data were collected using an anonymous, self-administered online questionnaire disseminated via Google Forms and distributed through social media platforms and QR codes.

Sample

The sample was obtained through non-probabilistic chain-referral (snowball) sampling and included women aged 18 years and older. This sampling strategy was selected to facilitate access to a large and heterogeneous group of adult women and to explore associations between physical activity, menopausal status, and urinary incontinence across different stages of adult life. Data collection was structured through two distinct channels. First, the questionnaire was disseminated through social and community networks. Second, fitness centres, yoga studios, and Pilates centres from different Spanish cities were contacted to facilitate participation among women engaged in organised physical activity. No exclusion criteria were applied regarding physical activity level, health status, or menopausal stage. All participants provided informed consent prior to participation. Participation was voluntary, and anonymity and confidentiality of responses were guaranteed throughout the data collection process.

Instruments

Data were collected using a structured, self-administered questionnaire composed of validated instruments and study-specific items. Although the survey addressed broader health domains, the present study analysed the sections related to sociodemographic characteristics, menopausal status, physical activity habits, and self-reported urinary and pelvic floor symptoms.

Physical activity was assessed using the Spanish validated version of the International Physical Activity Questionnaire–Short Form (IPAQ-SF) (Román-Viñas et al., 2010), which evaluates physical activity performed during the previous seven days, including walking, moderate-intensity, and vigorous-intensity activities. Total physical activity was quantified as energy expenditure expressed in metabolic equivalent task minutes per week (MET-min/week), calculated according to the IPAQ scoring protocol (Craig et al., 2003). Participants were classified into three physical activity levels based on total MET-min·week⁻¹ values as low (<600 MET-min·week⁻¹), moderate (600–2999 MET-min·week⁻¹), and high (≥ 3000 MET-min·week⁻¹).

Pelvic floor-related symptoms and their functional impact were assessed using the Spanish version of the Pelvic Floor Impact Questionnaire–Short Form (PFIQ-7), culturally adapted and validated by Sánchez-Sánchez et al. (2013). The PFIQ-7 is a self-administered questionnaire composed of 7 items, each evaluating which symptoms related to pelvic floor disorders affect daily activities, emotional well-being, and social participation. The instrument comprises three symptom-specific domains: i) Urinary Impact Questionnaire (UIQ-7), which evaluates the impact of urinary symptoms; ii) Pelvic Organ Prolapse Impact Questionnaire (POPIQ-7), which assesses the impact of prolapse-related symptoms; and iii) Colorectal-Anal Impact Questionnaire (CRAIQ-7), which measures the impact of bowel and anal symptoms. Each item is rated on a 4-point Likert scale, ranging from 0 (“not at all”) to 3 (“quite a bit”),

with higher scores indicating greater impact on quality of life. In addition, two study-specific screening questions were included to identify the presence and type of urinary incontinence, allowing participants to be classified according to self-reported urinary leakage patterns for categorical analyses. These screening items were based on previously validated questionnaires for the assessment of urinary incontinence in women (Vila Coll et al., 1997).

Menopausal status was self-reported and classified as non-menopausal, perimenopausal, menopausal, postmenopausal, or unknown (Yap et al., 2022). Sociodemographic and anthropometric information, including age, body mass, and height, was collected using study-specific closed-ended questions.

Procedures

Data collection was conducted between April and August 2025. The self-administered online questionnaire was distributed via social media platforms and QR codes. Prior to accessing the questionnaire, participants were presented with an online informed consent form describing the study objectives, procedures, voluntary participation, and data confidentiality. Only participants who provided informed consent were allowed to proceed.

Statistical analysis

Data analysis included descriptive statistics, with quantitative variables expressed as mean $\pm$ standard deviation and qualitative variables reported as absolute frequencies and percentages. Pearson's Chi-square test was used to evaluate the association between physical activity levels, categorised based on total MET-min $\cdot$ week⁻¹, self-reported menopausal status and the presence of urinary incontinence symptoms (yes/no/unsure). Adjusted standardised residuals were calculated to identify which cells of the contingency table contributed significantly to the overall association. Residuals with absolute values greater than 1.96 were

considered statistically significant. Effect size for significant associations was estimated using Cramer's V, and its magnitude was interpreted according to conventional benchmarks (0.10 small, 0.30 medium, 0.50 large) (Cohen, 1988). Statistical significance was set at $p < 0.05$, and the analyses were conducted using IBM SPSS Statistics (version 29.0; IBM Corp., Armonk, NY, USA).

Results

The final sample comprised 1,294 adult women (body mass: 65.15 ± 11.67 kg, height: 163.75 ± 6.40 cm; body mass index (BMI): 24.30 ± 4.21 kg·m⁻²). Age group distribution was relatively balanced across the sample: 18–29 years (15.2%), 30–39 years (26.2%), 40–49 years (23.4%), 50–59 years (21.9%), and ≥ 60 years. (13.2%). In terms of menopausal stage, the participants represented 56.6% non-menopausal, 11.7 % perimenopausal, 4.3% menopausal, 24.2% postmenopausal and 3.2% reported an unknown status. According to IPAQ criteria, 47.1% of participants reported high PA, 46.6% moderate PA, and 6.3% low PA.

Overall, 56.6% of participants reported UI, 36.9% reported no urinary symptoms, and 6.6% were unsure (Table 1). Women in the perimenopausal, menopausal, and postmenopausal groups reported a higher prevalence of UI (63.5%) compared with non-menopausal women (51.5%) ($\chi^2 (4) = 20.360$, $p < 0.001$; Cramer's V = 0.10).

Table 1. Prevalence of urinary incontinence according to menopausal status

Menopausal status	UI n (%)	No UI n (%)	Unsure (%)
Non-menopausal (n = 732)	377 (51.5) [†]	305 (41.7)	50 (6.8)
Peri/post/menopausal (n = 521)	331 (63.5)*	156 (29.9)	34 (6.5)
Unsure (n=41)	24 (58.5)	16 (39.0)	1 (2.4)
Total (n = 1292)	732 (56.6)	477 (36.9)	85 (6.6)

Note: UI = urinary incontinence. *, observed proportion significantly higher than expected ($p < 0.001$). [†], observed proportion significantly lower than expected ($p < 0.001$).

Physical activity level, urinary incontinence, and menopausal status showed a statistically significant association ($\chi^2 (4) = 17.547$; $p < 0.001$; Cramer's $V = 0.09$) (Table 2). Overall, the prevalence of UI was highest among women reporting moderate levels of PA (59.5%), compared with those engaging in low (56.1%) or high (53.7%). A significant association between physical activity level and urinary incontinence was observed in non-menopausal women ($\chi^2 (4) = 27.786$; $p < 0.001$; Cramer's $V = 0.14$). In this group, women reporting moderate physical activity exhibited a higher prevalence of urinary incontinence (55.6%) compared with those reporting high (48.3%) or low (45.7%) PA. No significant differences in UI across physical activity levels were observed among perimenopausal, menopausal, and postmenopausal women ($\chi^2 (4) = 2.847$; $p = 0.584$; Cramer's $V = 0.05$), with a prevalence of UI of 68.6%, 65.3% and 61.1% for low, moderate and high PA, respectively.

Table 2. Physical activity level and pelvic floor dysfunction symptoms by menopausal status

Menopausal status	PA	UI (%)	No UI (%)	Unsure (%)
Non-menopausal (n = 732)	Low	21 (45.7)	14 (30.4)	11 (23.9)**
	Moderate	190 (55.6)**	138 (40.4)	14 (4.1)†
	High	166 (48.3)	153 (44.5)	25 (7.3)
Peri/post/menopausal (n = 521)	Low	24 (68.6)	9 (25.7)	2 (5.7)
	Moderate	156 (65.3)	65 (27.2)	17 (7.5)
	High	151 (61.1)	82 (33.2)	17 (5.7)
Unsure (n=41)	Low	1 (100)	0	0
	Moderate	13 (59.1)	8 (36.4)	1 (4.5)
	High	10 (55.6)	8 (44.4)	0
Total (n = 1292)	Low	46 (56.1)	23 (28.0)	13 (15.9)
	Moderate	359 (59.5)*	211 (35.0)	33 (5.5)
	High	327 (53.7)†	243 (39.9)	39 (6.4)

Note: PA = physical activity level categorised according to the International Physical Activity Questionnaire (IPAQ): low (<600 MET-min/week), moderate (600–2999 MET-min/week), and high (≥ 3000 MET-min/week); UI= urinary incontinence. **, observed proportion significantly higher than expected ($p < 0.001$). *, observed proportion significantly higher than expected ($p = 0.002$); †, observed proportion significantly lower than expected ($p = 0.002$).

The mean PFIQ-7 score was 17.45 ± 29.51 , indicating a low overall functional impact of pelvic floor-related symptoms, albeit with high inter-individual variability. The mean UIQ-7 score for the overall sample was 7.18 ± 6.47 , reflecting a low average urinary-related

functional impact. The most frequently reported symptoms of UI included urinary leakage when coughing (40%), during physical exertion or exercise (25%), and before reaching the bathroom (15%). Other symptoms, such as leakage after voiding and getting dressed (7%), leakage without an apparent cause (5%) and continuous leakage (1%), were much less frequent. Notably, 25.9% of women reported experiencing more than one type of urinary leakage.

Discussion

The present study examined the association between physical activity, menopausal status, and urinary incontinence in a large sample of adult women. The results indicate a high prevalence of urinary incontinence despite generally adequate levels of physical activity. Menopausal status emerged as a key factor, with perimenopausal, menopausal and postmenopausal women showing a higher prevalence of UI compared with non-menopausal women. Although physical activity was significantly associated with UI in the overall sample, it became evident primarily in non-menopausal women, suggesting a differential pattern according to hormonal stage.

A central finding of this study is the higher prevalence of UI among perimenopausal, menopausal and postmenopausal women compared with non-menopausal women. This pattern is consistent with the well-established role of oestrogen decline in pelvic floor physiology. During the menopausal transition, hypoestrogenism contributes to structural and functional changes in urogenital tissues, including reduced collagen content, decreased vascularisation, and alterations in neuromuscular function, all of which may compromise urethral closure mechanisms and pelvic support (Bø & Nygaard, 2020; Woodley et al., 2020). These biological changes increase vulnerability to stress and mixed urinary incontinence and may explain the marked difference observed between hormonal stages in our sample.

Although menopausal status emerged as a key factor in the present study, it is important to acknowledge that other established risk factors may also have contributed to the observed associations. Ageing is associated with structural and functional changes in the lower urinary tract and pelvic floor, while higher body mass index increases mechanical loading on pelvic support structures. Similarly, parity and vaginal delivery have been consistently linked to pelvic floor dysfunction and urinary incontinence due to cumulative neuromuscular and connective tissue damage (Mishra et al., 2008; Gibson et al., 2021). Therefore, part of the increased prevalence observed among peri-, menopausal, and postmenopausal women may reflect the combined influence of these factors rather than menopausal status alone.

When physical activity was analysed in relation to UI, the association was present at the global level but modest in magnitude. This finding is consistent with previous research suggesting that the relationship between general physical activity and urinary incontinence is complex and not uniformly protective (Bø & Nygaard, 2020). Among non-menopausal women, UI prevalence differed across physical activity levels. Women reporting moderate levels of activity exhibited a higher proportion of UI compared with those reporting high levels. This finding suggests that the volume of physical activity alone does not determine continence status. Instead, the type, intensity, and mechanical demands of activity may be decisive (Bø & Nygaard, 2020). Activities involving repetitive increases in intra-abdominal pressure, particularly in the absence of targeted pelvic floor muscle training, have been associated with stress urinary leakage in physically active women (Bø & Nygaard, 2020; Sebastian-Rico et al., 2025). Therefore, continence outcomes may depend not only on overall activity level but also on whether specific pelvic floor conditioning is integrated into training routines.

In perimenopausal, menopausal and postmenopausal women, UI prevalence remained consistently elevated regardless of physical activity level. This observation supports the hypothesis that once structural support is compromised by hormonal decline and connective

tissue remodelling (Allafi et al., 2024), general physical activity may be insufficient to counteract continence-related vulnerability (Bø., 2004). Previous evidence differentiates clearly between general physical activity and targeted pelvic floor muscle training (PFMT), with the latter consistently recommended as first-line conservative treatment for UI (Hay-Smith et al., 2024; Marcellou et al., 2025). Our findings align with this distinction, suggesting that general physical activity should not be assumed to exert a protective effect in menopausal women without specific pelvic floor intervention.

The study hypothesis was only partially supported by the findings. Although physical activity was associated with UI at the global level and among non-menopausal women, this relationship was not observed in the group of perimenopausal, menopausal, and postmenopausal women. These results indicate that menopausal status modulates the association between physical activity and urinary incontinence, but not in a uniformly protective direction. While regular physical activity contributes to overall health and general muscle function, strong evidence supports PFMT as the first-line conservative intervention for urinary incontinence in women (Woodley et al., 2020). Therefore, the protective role of physical activity appears to depend on its specificity rather than its volume.

Despite the relatively high prevalence of UI, the mean PFIQ-7 and UIQ-7 scores indicated a low overall functional impact. This apparent discrepancy suggests that many women experience symptoms that are mild, intermittent, or perceived as non-disabling. Community-based studies have similarly reported that a substantial proportion of women do not seek medical consultation for urinary leakage, even when symptoms are recurrent (Milsom et al., 2013).

In line with epidemiological data, stress urinary incontinence was the predominant symptom pattern, with leakage during coughing and during physical exertion being the most frequently reported situations. Population studies have consistently identified stress UI as the

most common subtype in adult women, particularly in midlife (Milsom et al., 2013; Woodley et al., 2020). The distribution of symptoms observed in our sample is therefore coherent with current epidemiological estimates.

An additional and noteworthy finding concerns the proportion of women who reported being unsure either about their menopausal status or about the presence of urinary symptoms. Although numerically smaller than the symptomatic groups, this subgroup is clinically relevant. Lack of awareness regarding one's hormonal stage or uncertainty about continence symptoms may reflect limited health literacy in relation to female pelvic health. Previous reports have highlighted substantial gaps in knowledge regarding menopause and pelvic floor disorders in the general female population (Bø & Nygaard, 2020). This underscores the need for structured educational strategies aimed at improving awareness, early identification of symptoms, and timely preventive interventions across the female life course.

This study has several limitations. First, the non-probabilistic sampling strategy limits the generalisability of the findings. Recruitment was partially conducted through fitness, yoga, and Pilates centres, which may have contributed to the high proportion of physically active participants in the sample and may not fully reflect the characteristics of the general female population. Secondly, urinary incontinence was assessed through self-reported screening questions rather than clinical evaluation, which may affect comparability with studies using standardised diagnostic tools. Another limitation is the absence of adjustment for age, BMI, and obstetric history, all recognised risk factors for urinary incontinence. Higher BMI and multiparity have been associated with increased pelvic floor loading and greater UI prevalence, whereas ageing is linked to structural and functional changes in the lower urinary tract. Consequently, these factors may have influenced the associations observed in the present study and should be considered in future research.

Despite these limitations, the study includes a large sample of adult women across distinct hormonal stages, enabling stratified analyses rarely addressed in population-based research. The integration of physical activity level and menopausal status provides a nuanced perspective on pelvic floor health across the female lifespan. From a practical perspective, the findings suggest that clinicians and exercise professionals should not assume that general physical activity alone is sufficient to reduce urinary incontinence risk in menopausal women. Educational strategies and the incorporation of pelvic floor muscle training may be particularly relevant during the menopausal transition and postmenopausal stages, where urinary incontinence prevalence remained elevated regardless of overall physical activity level.

Conclusions

Urinary incontinence showed a notable prevalence in this sample of physically active adult women and was more frequently reported in the perimenopausal, menopausal and postmenopausal women. Although physical activity level was related to urinary incontinence in the overall sample, this association was modest and was primarily evident among non-menopausal women. For menopausal participants, higher levels of general physical activity were not associated with a lower prevalence of urinary incontinence symptoms.

These findings should be interpreted with caution given the cross-sectional design and the absence of adjustment for potential confounding factors. Nevertheless, they suggest that general physical activity alone may not be sufficient to offset menopause-related vulnerability to urinary incontinence and highlight the importance of distinguishing between overall physical activity and targeted pelvic floor interventions. In addition, the coexistence of high symptom prevalence with low perceived functional impact, as well as uncertainty regarding menopausal status and urinary symptoms in a subset of participants, underscores the importance of improving awareness and preventive strategies across the female lifespan.

Acknowledgements

The authors sincerely thank all the women who generously participated in the survey, as well as the training centres, yoga and Pilates studios that selflessly collaborated in disseminating the questionnaire.

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