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ORIGINAL ARTICLE

# The association between physical activity and urinary incontinence among adults residing in Spain



*Association entre activité physique et incontinence urinaire chez des adultes résidant en Espagne*

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## KEYWORDS

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## Summary

**Objectives.** – To explore the association between physical activity (PA) and urinary incontinence (UI) in Spain.

**Equipment and methods.** – Cross-sectional data from the Spanish National Health Survey 2017 were analyzed. The International Physical Activity Questionnaire (IPAQ) short form was used to measure level of PA (exposure), and sufficient PA corresponded to at least 600 MET-minutes/week. UI (outcome) was self-reported in response to the question “Have you ever been diagnosed with UI?”. Multivariable logistic regression was used to assess associations

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overall, by sex, and by age group (15–40, 41–64, 65–69 years). Logistic regression models were adjusted for sex (except sex-stratified analyses), age, marital status, education, smoking, alcohol, obesity, hypertension, diabetes, osteoarthritis, chronic back pain, injury, asthma, thyroid dysfunction, depression, and anxiety.

**Results.** – This study included 17,777 participants [48.0% of males; mean (SD) age 45.8 (14.1) years]. The prevalence of sufficient PA and UI was 69.8% and 2.4%, respectively. After adjustment for potential confounders, doing at least 600 MET-minutes/week of PA was negatively associated with UI [odds ratio (OR)=0.67; 95%CI=0.55–0.83]. This finding was corroborated in women (OR=0.62; 95%CI=0.48–0.80), participants aged 15–40 years (OR=0.40; 95%CI=0.20–0.79) and those aged 41–64 years (OR=0.71; 95%CI=0.55–0.93), but not in men (OR=0.81; 95%CI=0.57–1.16) and those age 65–69 years (OR=0.72; 95%CI=0.47–1.09).

**Conclusion.** – Participation in PA is negatively associated with UI. Although further research is needed to explore the direction of this association, PA should be promoted in people with UI, especially in women and young and middle-aged adults.

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## MOTS CLÉS

Activité physique ;  
Incontinence  
urinaire ;  
Adultes ;  
Santé publique ;  
Épidémiologie ;  
Espagne

## Résumé

**Objectifs.** – Explorer l'association entre activité physique (AP) et incontinence urinaire (IU) chez des adultes en Espagne.

**Matériels et méthodes.** – Les données transversales de l'Enquête Nationale Espagnole sur la Santé de 2017 ont été analysées. L'*International Physical Activity Questionnaire* (IPAQ) a été utilisé pour mesurer le niveau d'AP (variable indépendante), et une AP suffisante correspondait à un équivalent métabolique d'au moins 600 minutes par semaine. L'IU (variable dépendante) était renseignée par les participants avec la question « Avez-vous déjà reçu un diagnostic d'IU ? ». Une régression logistique multivariée a par la suite été utilisée pour étudier l'association entre AP et IU dans l'ensemble de l'échantillon, par sexe et par groupe d'âge (15–40 ans, 41–64 ans et 65–69 ans). Les modèles de régression logistique étaient ajustés pour le sexe (à l'exception des analyses stratifiées sur le sexe), l'âge, le statut marital, l'éducation, le tabagisme, l'alcool, l'obésité, l'hypertension, le diabète, l'arthrose, les rachialgies chroniques, les traumatismes physiques, l'asthme, les troubles thyroïdiens, la dépression, et l'anxiété.

**Résultats.** – Cette étude a inclus 17 777 participants [48,0 % d'hommes ; âge moyen (ET) 45,8 (14,1) ans]. La prévalence d'une AP suffisante et d'une IU était respectivement de 69,8 % et de 2,4 %. Après ajustement sur l'ensemble des variables de contrôle, une AP suffisante était négativement associée à la présence d'une IU [rapport de cotes (RC)=0,67; intervalle de confiance (IC) à 95 % = 0,55–0,83]. Ce résultat a été corroboré chez les femmes (RC = 0,62 ; IC à 95 % = 0,48–0,80), les participants âgés de 15–40 ans (RC = 0,40 ; IC à 95 % = 0,20–0,79) et ceux âgés de 41–64 ans (RC = 0,71 ; IC à 95 % = 0,55–0,93), mais pas chez les hommes (RC = 0,81 ; IC à 95 % = 0,57–1,16) et les participants âgés de 65–69 ans (RC = 0,72 ; IC à 95 % = 0,47–1,09).

**Conclusion.** – Une AP suffisante est négativement associée à la présence d'une IU. Bien que des études supplémentaires soient nécessaires pour explorer la direction de cette association, une AP correspondant à un équivalent métabolique d'au moins 600 minutes par semaine devrait être promue chez les personnes avec une IU, en particulier chez les femmes et les adultes jeunes et d'âge moyen.

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## 1. Introduction

Lower urinary tract symptoms (LUTS) are common among adults. It is estimated that the proportion of those affected by at least one LUTS is 45.8% worldwide, of which 18.4% were caused by urinary incontinence (UI), affecting 423 million people in 2018 [1]. It is known that in both men and women, age is the most important risk factor for the development of UI. For example, in a study conducted exclusively on women, it was found that the frequency of UI increased by 13% between 1991 and 2007 [2], and in a study involving only men, UI increased from 4.5% to 10.5% between 1992

and 2003 [3]. Thus, it is clear that with the aging of the world's population, the number of people affected by UI will increase.

Patients with UI have lower quality of life, lower labor productivity, and higher risk of major depressive disorder and social isolation [4]. Their risks of various adverse outcomes, including falls and fractures, skin infections, functional impairment, caregiver burden, institutionalization and mortality are higher [5–11]. Considering both the indirect costs associated with these complications and the health expenditure required for the diagnosis and treatment of UI, the annual cost-of-illness for UI in European

populations was calculated as €7 billion [12], and it is estimated to cause an average economic burden of \$ 82.6 billion in the United States in 2020 [13]. For such reasons, appropriate treatment of people with UI or taking the measures for predisposing factors is necessary to improve the adverse outcomes associated with UI.

In the past decades, there has been a large body of literature on the relationship of physical activity (PA) and sedentary behaviour with UI [14–17]. It was found that some chronic medical conditions such as diabetes and hypertension are related to UI development, and obesity is a particularly well-established factor likely to cause UI or contribute to the severity of the condition [18]. It has been verified that regular PA is effective in the primary and secondary prevention of such chronic diseases or conditions. PA's strengthening effect on pelvic floor muscles and abdominal muscles, as well as its ability to improve overall health, can reduce UI. However, since PA can also aggravate UI, most people may prefer to stay sedentary, resulting in a vicious circle [14,15,19]. Unfortunately, studies to date have not been able to clearly demonstrate how PA is associated with UI development in different age groups and both sexes.

Therefore, this representative population-based study aimed to investigate the relationship between PA and UI in Spain. Given that the prevalence of UI differs by sex and age, the PA-UI association was further analyzed in sex and age groups [2,3,20]. Investigating the association between PA and UI in Spain is of particular importance, as the prevalence of insufficient PA and UI is high in this country [21,22].

## 2. Subjects and methods

### 2.1. The survey

Data from the Spanish National Health Survey 2017 were analyzed. This survey was undertaken in Spain between October 2016 and October 2017. Details of the survey method are published elsewhere [23]. In brief, for the data collection, a stratified three-stage sampling was used in which the census sections were first considered, then the family dwellings, and then an adult (15 years or more) was selected within each dwelling. The dwellings were selected by systematic sampling and to select the person who had to complete the questionnaire, the random Kish method was used. The sample was representative of the adult population residing in Spain and consisted of 17,777 adults aged 15–69 years. The age group of adults  $\geq 70$  years was not considered in this study, as they did not complete the International Physical Activity Questionnaire (IPAQ) short form. Indeed, IPAQ short form is an instrument designed primarily for population surveillance of PA among adults, and it has been developed and tested for use in adults (age range of 15–69 years) [24,25], and until further development and testing is undertaken the use of IPAQ with older and younger age groups is not recommended. The method of data collection used was computer-assisted personal interviewing (CAPI), conducted in the homes of the selected participants. The interviewers, previously trained, completed the questionnaires with the information provided by the participants. All of them signed an informed consent form before responding to the survey questions. This research was conducted in accordance with

the Declaration of Helsinki of 1961 (revised in Tokyo in 1989 and in Edinburgh in 2000).

### 2.2. Physical activity (exposure)

IPAQ short form was used to measure PA. Total PA MET-minutes/week were calculated through the following formula: *sum of Walking + Moderate + Vigorous MET-minutes/week scores* [26]. Participants were divided in two categories according to the guidelines for data processing and analysis of the IPAQ:

- fewer than 600 MET-minutes/week;
- at least 600 MET-minutes/week, equivalent to meeting current PA recommendations [27].

The IPAQ has been validated in adult populations from different countries showing acceptable validity (Spearman's  $\rho = 0.30$ , 95% CI: 0.23–0.36) and reliability (Spearman's  $\rho = 0.81$ , 95% CI: 0.79–0.82) [24].

### 2.3. Urinary incontinence (outcome)

Those who answered affirmatively to the question “Have you ever been diagnosed with urinary incontinence?” were considered to have UI.

### 2.4. Co-variables

The selection of the control variables was based on past literature [17,18]. Sociodemographic variables included sex, age, marital status (single/separated/divorced/widowed or married), and education. Education was based on the highest educational level achieved and was categorized as  $\leq$  primary, secondary, and  $\geq$  tertiary. Smoking status was self-reported and categorized as never, past, and current smoking. Alcohol consumption in the last 12 months was self-reported and categorized as yes (any) and no (none). Height and weight were self-reported. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Obesity was defined as  $BMI \geq 30 \text{ kg/m}^2$ . Those who answered affirmatively to the questions “Have you ever been diagnosed with hypertension/diabetes/osteoarthritis/chronic back pain (cervical or lumbar)/injury/asthma/thyroid dysfunction/depression/anxiety?” were considered to have those conditions.

### 2.5. Statistical analysis

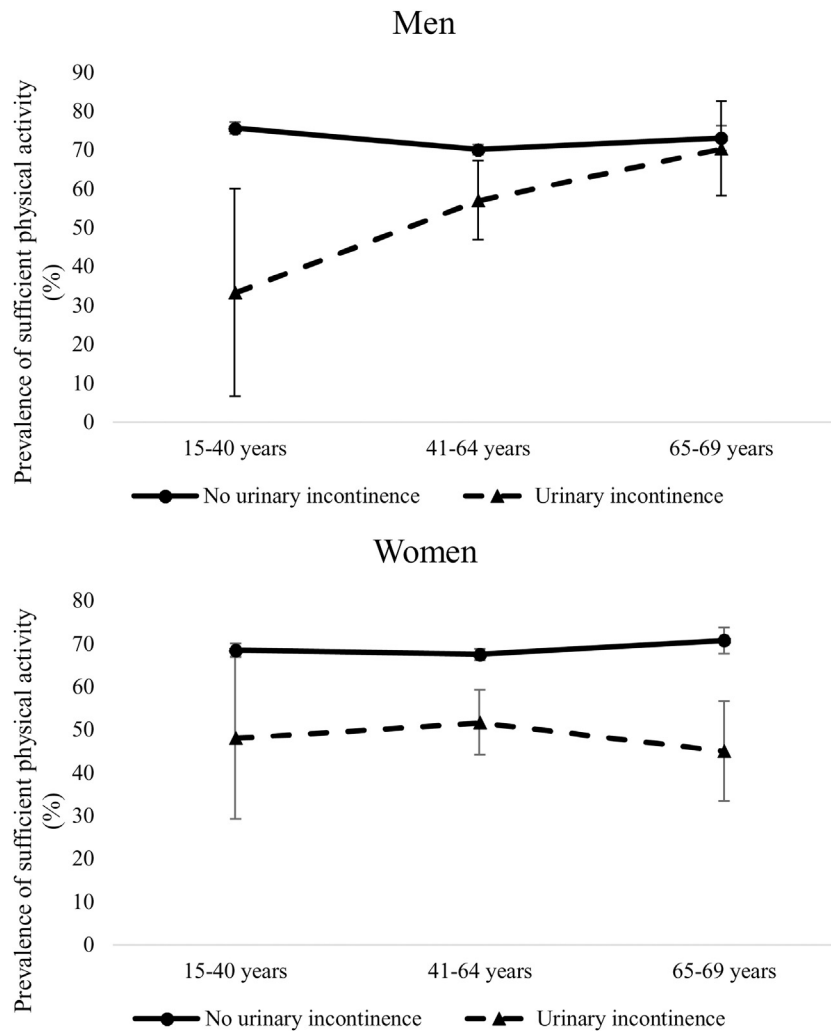
The statistical analysis was performed with R 3.5.2 (The R Foundation) [28]. Differences in sample characteristics by UI status were assessed by Chi-squared tests, except for age (t-tests). We conducted multivariable logistic regression analyses to assess the association between PA (exposure) and UI (outcome). Analyses were conducted for the overall sample, and separately by sex and by age group (15–40, 41–64, 65–69 years). Logistic regression models were adjusted for sex, age, marital status, education, smoking, alcohol, obesity, hypertension, diabetes, osteoarthritis, chronic back

**Table 1** Sample characteristics by urinary incontinence status (overall and by sex group).

Characteristics	Category	Overall (n = 17,777)			Men (n = 8529)			Women (n = 9248)		
		No urinary incontinence	Urinary incontinence	P-value <sup>a</sup>	No urinary incontinence	Urinary incontinence	P-value <sup>a</sup>	No urinary incontinence	Urinary incontinence	P-value <sup>a</sup>
Age	Mean (SD)	45.6 (14.1)	56.9 (10.8)	< 0.001	45.5 (14.1)	58.2 (10.7)	< 0.001	45.6 (14.1)	56.1 (10.8)	< 0.001
Marital status	Single	43.6	43.3	0.950	42.7	42.0	0.950	44.4	44.0	0.950
	/separated/ divorced/ widowed									
Education	Married	56.4	56.7		57.3	58.0		55.6	56.0	
	≤ Primary	18.2	40.2	< 0.001	18.2	36.3	< 0.001	18.1	42.5	< 0.001
	Secondary	50.9	41.9		53.0	45.9		48.9	39.6	
Smoking	≥ Tertiary	31.0	17.9		28.8	17.8		33.0	17.9	
	Never	46.3	41.2	< 0.001	38.8	23.6	< 0.001	53.2	51.5	0.493
Alcohol	Past	25.1	34.1		29.7	51.6		20.8	23.9	
	Current	28.6	24.7		31.4	24.8		26.0	24.6	
Obesity	No	29.8	46.1	< 0.001	21.2	42.0	< 0.001	37.9	48.5	< 0.001
	Yes	70.2	53.9		78.8	58.0		62.1	51.5	
Hypertension	No	83.9	68.4	< 0.001	82.2	69.7	< 0.001	85.5	67.7	< 0.001
	Yes	16.1	31.6		17.8	30.3		14.5	32.3	
Diabetes	No	82.9	57.6	< 0.001	80.9	49.7	< 0.001	84.8	62.3	< 0.001
	Yes	17.1	42.4		19.1	50.3		15.2	37.7	
Osteoarthritis	No	94.6	81.2	< 0.001	93.6	75.8	< 0.001	95.6	84.3	< 0.001
	Yes	5.4	18.8		6.4	24.2		4.4	15.7	
Chronic back pain	No	87.5	59.3	< 0.001	91.4	70.7	< 0.001	83.8	52.6	< 0.001
	Yes	12.5	40.7		8.6	29.3		16.2	47.4	
Injury	No	78.3	45.2	< 0.001	82.5	56.1	< 0.001	74.4	38.8	< 0.001
	Yes	21.7	54.8		17.5	43.9		25.6	61.2	
Asthma	No	94.1	88.7	< 0.001	92.3	86.6	0.014	95.7	89.9	< 0.001
	Yes	5.9	11.3		7.7	13.4		4.3	10.1	
Thyroid dysfunction	No	94.4	88.0	< 0.001	95.1	88.5	< 0.001	93.8	87.7	< 0.001
	Yes	5.6	12.0		4.9	11.5		6.2	12.3	
Depression	No	93.9	86.4	< 0.001	98.2	95.5	0.037	90.0	81.0	< 0.001
	Yes	6.1	13.6		1.8	4.5		10.0	19.0	
Anxiety	No	91.8	62.1	< 0.001	94.9	66.2	< 0.001	89.0	59.7	< 0.001
	Yes	8.2	37.9		5.1	33.8		11.0	40.3	
Anxiety	No	91.8	70.8	< 0.001	94.8	77.7	< 0.001	89.1	66.8	< 0.001
	Yes	8.2	29.2		5.2	22.3		10.9	33.2	

SD: standard deviation. The presence of urinary incontinence and all other chronic physical conditions except obesity was evaluated with questions with "yes" and "no" options. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared based on self-reported weight and height. Using the standard World Health Organization (WHO) definition, obesity was defined as  $\geq 30 \text{ kg/m}^2$ . There were missing data only for the following variables: smoking (0.06%), alcohol (0.08%) and obesity (2.83%).

<sup>a</sup> P-values were based on chi-squared tests except for age (t-tests). P-values were corrected using the Benjamini and Hochberg procedure.



**Figure 1** Prevalence of sufficient physical activity by urinary incontinence status in men (upper panel) and women (lower panel). Physical activity was dichotomized into insufficient and sufficient using the World Health Organization recommendations (cut-off of 600 MET-minutes per week). The presence of urinary incontinence was evaluated with questions with ‘yes’ and ‘no’ options.

pain, injury, asthma, thyroid dysfunction, depression, and anxiety. All variables were included in the models as categorical variables with the exception of age which was included as a continuous variable. There were missing data only for the following variables: smoking (0.06%), alcohol consumption (0.08%) and obesity (2.83%). Complete-case analysis was carried out. Results from the logistic regression analyses are presented as odds ratios (ORs) with 95% confidence intervals (CIs). *P*-values were corrected using the Benjamini and Hochberg procedure, and *P*-values < 0.05 were considered statistically significant.

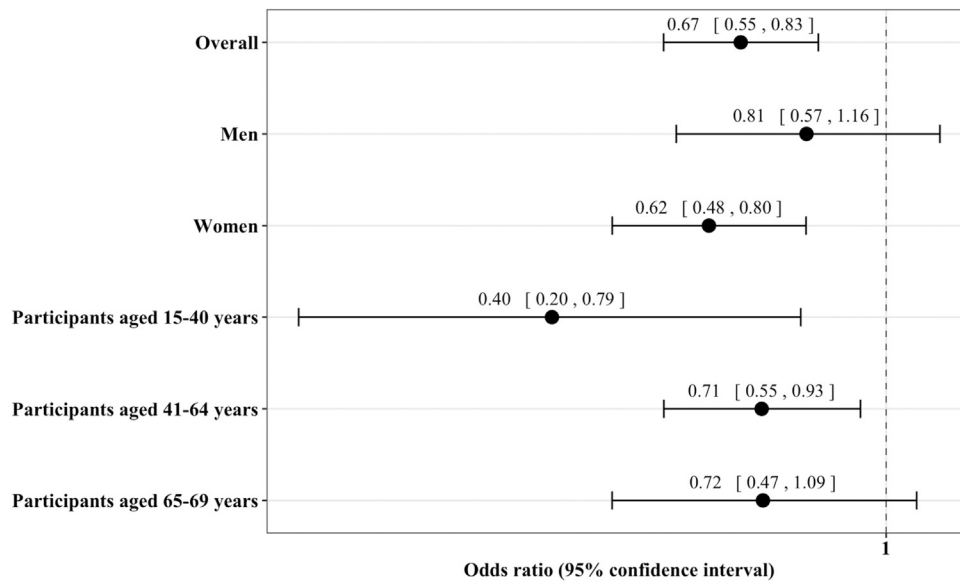
### 3. Results

The present retrospective study included 17,777 participants [48.0% of males, mean (SD) age 45.8 (14.1) years]. The overall prevalence of UI was 2.4% (men: 1.8%; women: 2.9%). Low education, no alcohol, obesity, hypertension, diabetes, osteoarthritis, chronic back pain, injury, asthma, thyroid dysfunction, depression, and anxiety were more frequent in men and women with than those without UI,

while age was significantly higher in the UI than in the no UI groups (Table 1). The prevalence of sufficient PA (at least 600 MET-minutes per week) was further found to be lower in men and women with than in those without UI, although this difference was not significant in men aged 65–69 years (Fig. 1). Finally, the results of the multivariate regression models are displayed in Fig. 2. Overall, PA was negatively associated with UI [odds ratio (OR)=0.67; 95% confidence interval (CI)=0.55–0.83]. This finding was corroborated in women (OR=0.62; 95%CI=0.48–0.80), participants aged 15–40 years (OR=0.40; 95%CI=0.20–0.79) and those aged 41–64 years (OR=0.71; 95%CI=0.55–0.93), but not in men (OR=0.81; 95%CI=0.57–1.16) and those aged 65–69 years (OR=0.72; 95%CI=0.47–1.09).

### 4. Discussion

In this population-based study, the relationship between PA and UI was investigated in both sexes and across different age groups. A negative association was found between PA and UI in the whole population, and this was corroborated



**Figure 2** Association between physical activity (exposure) and urinary incontinence (outcome) estimated by multivariate logistic regression models (overall and by sex and age groups). The presence of urinary incontinence was evaluated with questions with “yes” and “no” options. Logistic regression models were adjusted for sex (except sex-stratified analyses), age, marital status, education, smoking, alcohol, obesity, hypertension, diabetes, osteoarthritis, chronic back pain, injury, asthma, thyroid dysfunction, depression, and anxiety.

in women and young and middle-aged adults, but not in men and older adults.

In our study, the prevalence of UI was found to be 2.4% (men: 1.8%; women: 2.9%), which is a low rate compared to previous studies [29,30]. In a study involving Canada and four different European countries, the prevalence of UI was reported at 5.4% in men and 13.1% in women [30]. According to another study involving only women, the prevalence of UI between the ages of 20–70 ranged from 10% to 30% [29]. It is difficult to explain why the prevalence of UI is lower in Spain, since no risk factors such as ours are presented in these studies. However, in a study involving only older people over 60 years of age in Spain, the prevalence of UI was below that of other countries, which supports our results [31]. The difference may be explained by Spain’s high socioeconomic and cultural level.

Both multifactorial etiopathogenesis and the adverse effects of pharmacological agents used in treatment, particularly anti-muscarinic agents, and difficulties in tolerating drugs by patients, render non-pharmacological approaches to UI management significant [32]. PA is one of the leading non-pharmacological interventions. In our study, adequate PA was found to be associated with decreased UI in women. Indeed, PA is known to reduce all LUTS, especially stress type UI (although there is yet no strong evidence showing the efficacy of exercise regimens other than pelvic floor muscle training [33]), in middle-aged women [34]. Increased PA may reduce UI by increasing overall strength, regularly engaging the pelvic floor muscle system, and decreasing weight [34]. Previous research has also showed that depression predicts UI [35]. Thus, the protective effects of PA on UI may be mediated by a decreased risk for depression [36]. In our study, although PA was associated with UI between 15–64 years of age, this relationship could not be detected between 65

and 69 years of age, which may be due to the fact that polypharmacy likely plays a relatively important role in the occurrence of UI at older age, and that PA alone may not be enough to mitigate the deleterious effects of polypharmacy on UI [18,37]. On the other hand, from the opposite angle, UI can be a barrier to exercising. Women with UI are known to avoid PA because they fear falls, post-exercise pain, and incontinence during exercise, and therefore are more sedentary [19]. Additionally, UI may lead indirectly to less PA in such people, especially as it is associated with falls, fear of falling, depression, frailty, and reduced functional capacity, especially at later ages [6,7,35].

In men, UI occurs much less frequently than in women, and its etiopathogenesis is different from that in women. As in women, the underlying pathology may be due to either detrusor over activity or sphincter weakness, or a combination of both (mixed UI) [38]. In our study, no relationship was found between PA and UI in men, which may be due to the fact that mixed-type UI is more common in men than in women (which is evidence that UI is more complicated in men), or that stress-type UI, which most benefits from PA, is rarely seen in men [38]. Additionally, one of the most important causes of male UI is bladder outlet obstruction due to benign prostatic hypertrophy or prostate cancer and prostatectomy operations performed for this purpose [38]. Thus, while the pelvic muscles play a more important role in women for UI development, the presence of additional prostate-related pathologies in men may reduce the positive effect of PA on UI [39]. However, there is not enough data in the relevant literature, and more studies on the effects of PA on male UI are needed to corroborate or invalidate this hypothesis.

The strengths of our study include the use of population-based data with a large sample size, evaluating both sexes

and different age groups separately. However, as there were a small sample size including people who were aged between 65–69, the insignificant relationship between UI and PA among older people may have been due to lack of statistical power. Our study has also some other limitations. First, it is a cross-sectional study, and therefore, causality and temporal associations cannot be established. Second, individuals over the age of 70 could not be included in the study because the IPAQ short form is not recommended for persons aged 70 years and over. Third, analyses were not stratified by type and intensity of PA, although the association between PA and UI may vary between strenuous and non-strenuous activities [40]. Finally, since data on the subtypes of UI were not available, we could not determine the association between specific types of UI and PA. For example, it is possible that stress-type UI may be more strongly associated with PA.

In conclusion, participation in PA is negatively associated with UI in adults residing in Spain. Whereas there is a relationship between PA and UI in women, this relationship is probably absent in men due to the different underlying pathophysiological mechanisms. Further research is needed to clarify the potentially complex interplay of factors that underlie the association between PA and UI, and to assess causality and temporality of this relationship.

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## Disclosure of interest

The authors declare that they have no competing interest.

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