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Research article

Associations between obesity, physical fitness, and urinary incontinence in non-institutionalized postmenopausal women: The elderly EXERNET multi-center study

Beatriz Moreno-Vecino[a], Alfredo Arija-Blázquez[a], Raquel Pedrero-Chamizo[b], Julián Alcázar[a], Alba Gómez-Cabello[c,d], Faustino R. Pérez-López[e], Marcela González-Gross[b], José A. Casajús[c], Ignacio Ara[a,*], on the behalf of the EXERNET Group

[a] Growth, Exercise, Nutrition and Development (GENUD) Toledo Research Group, University of Castilla-La Mancha, Toledo, Spain
[b] ImFINE Research Group, Technical University of Madrid, Madrid, Spain
[c] Centro Universitario de la Defensa, Zaragoza, Spain
[d] GENUD Research Group, University of Zaragoza, Zaragoza, Spain
[e] Faculty of Medicine, University of Zaragoza and Lozano Blesa University Hospital, Zaragoza, Spain

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ABSTRACT

Objectives: To investigate the associations between body composition, fitness level, and urinary incontinence (UI) in 471 non-institutionalized women ≥ 65 years of age.
Study design: Cross-sectional study.
Method: UI was assessed using the International Consultation on Incontinence Questionnaire Short-Form and a specific severity UI item. Anthropometric measurements were obtained using standardized techniques and equipment. Body fat percentage (BF%) was measured by bioelectrical impedance. Physical fitness (PF) was evaluated by a set of 8 tests and a fitness index (FI) was calculated. Active and sedentary behaviors were recorded by standardized questionnaires.
Results: UI was reported in 28.5% of the participants. Women with UI showed higher values of body mass index (BMI), BF% and waist circumference (WC) (all $p < 0.05$) compared to urinary continent women, whereas there was a lower fitness index (FI) level in women with UI ($p = 0.08$). Among all fitness capacities, upper body flexibility showed the closest relationship with UI. UI risk increased by 87.0% [95% confidence intervals (1.01–3.17)] in obese women compared to the normal group, according to the BF% while no significant results were found when PF, WC and BMI were included in the model. Mean sitting and walking time per day were 4.3 ± 1.4 and 1.8 ± 0.9 h/d, respectively.
Conclusion: UI was associated with an excess of fat mass and poor PF, especially upper-body flexibility.

1. Introduction

Urinary incontinence (UI) is a common clinical complaint, with major incidence in older women, causing much social and physical morbidity [1,2]. Overall UI prevalence may reach up to 40% in older women, being higher in those institutionalized than in community-residing [2]. In elderly women, age-related changes in the lower urinary tract system are influenced by medical conditions, functional and cognitive impairment and obesity [1–5]. Moreover, incontinent obese women have low cardiorespiratory fitness with a subsequent loss of autonomy and capacity to carry out daily life activities [5].

Abbreviations: UI, urinary incontinence; BMI, body mass index; WC, waist circumference; PF, physical fitness; UB, upper body; BF%, body fat percentage; FI, fitness index; ICIQ-SF, International Consultation on Incontinence Questionnaire-Short Form; CS-UI, I am afraid of performing physical efforts because of my urine leaks; NUI, current number of times that got up during the night to urine; N5UI, number of times that got up during the night to urine 5 years ago in the past; CI, confidence intervals; LB, lower body; SD, standard deviation.

* Corresponding author at: Department of Physical Activity and Sport Sciences University of Castilla-La Mancha, Avda Carlos III s/n, 45071 Toledo, Spain.
E-mail address: ignacio.ara@uclm.es (I. Ara).

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Aging is accompanied by changes in body composition such as, weight gain, redistribution of fat mass especially in women, and a simultaneous loss of muscle mass and strength [3–5]. In addition, obese individuals have a reduced quality of life, mainly due to functional limitations and UI [3]. Physical activity is one of the most useful tools to improve health in elderly people. [4]. Exercise programs for postmenopausal women are effective against obesity and commonly result in increases in both aerobic power and muscle strength, preserving their body weight and lipid profile, decreasing hypertension and reducing central adiposity [5]. Moreover, physical fitness (PF) is a set of attributes (strength, endurance, agility and flexibility among others) that people have or achieve due to physical activity [6]. Many studies have shown a tendency to reduce physical activity and subsequently PF with aging [4,7]. Therefore, assessment of PF and sedentary levels in elderly are health-related to the capacity of undertaking normal everyday activities like standing up, walking and dressing [8].

The ability of walking is a key among the variables to assess PF in this population [8–10]. Poor lower-extremity function is related to mobility-related disabilities in elderly [11]. Moreover, the odds ratio of having better perceived health showed in a previous study was associated with better upper body (UB) flexibility compared with those women placed in the medium and lowest tertiles (34 and 77%, respectively) after adjusting for age [12]. Furthermore, obesity interferes with walking ability in older women, not only by reduced aerobic capacity and its association with a sedentary lifestyle, but also by sensations of discomfort and pain [13]. In fact, sitting time increases the overweight and obesity risk independently of walking time in elderly [14]. Additionally, higher odds ratio for having sarcopenic obesity were present in the unfit elderly compared with fit subjects [12].

In older women moderate regular physical activity is related to better PF and body composition [5] and is inversely associated with female UI [15]. However, very little is known about the association between fitness level, body composition and development of UI in postmenopausal women. Thus, the aim of this study was to investigate the relationship between UI and obesity, including body mass index (BMI), waist circumference (WC) and body fat percentage (BF%) measurements.

2. Methods

2.1. Study design

The study was carried out within the frame of the multi-center study on PF and body composition evaluation and its relation with healthy lifestyle among Spanish non-institutionalized elderly (EXERNET) [21]. Briefly, this cohort is a representative sample of community dwelling Spanish seniors selected by means of a multistep, simple random sampling, taking into account the locations (six different regions from Spain: Aragón, Castilla La Mancha, Castilla León, Madrid, Extremadura and Canarias) that ensure the geographical and cultural diversity of the sample. Subjects were recruited from three different cities of each region: the capital of the region and two other cities; one of 10 000–40 000 habitants and other of 40 000–100 000 habitants.

The information was collected through personal interviews using standard procedures and validated questionnaires that include UI-related questions, followed by a physical examination to measure anthropometric and body composition characteristics and PF. Data collection took place from January 2011 to December 2012. The study was approved by the Research Ethics Committees of Aragón (Spain) (18/2008) and performed according to the principles established with the revised Declaration of Helsinki [16]. Written informed consent was obtained from each participant.

2.2. Study sample

The study sample consisted in a sub-cohort of 471 women (aged 66–91 years) from the EXERNET multi-center study that completed all tests and UI questionnaires. To make maximum use of the data, all valid results on PF tests, body composition and questionnaires were included in this report. Consequently, sample sizes vary for different variables. The complete methodology of the study has been described elsewhere [17]. The exclusion criteria were: (1) women under 65 years; (2) those suffering from cancer and/or dementia; (3) those who were living in nursing homes and/or were not independent or able to take care of themselves; and (4) those women using walking aids. After finishing the field study, the subjects who did not fulfill the inclusion criteria were excluded.

2.3. Anthropometric and body composition measurements

Anthropometric and body composition measurements have been described elsewhere [17,18]. Briefly, height was measured using a portable stadiometer (Seca, Hamburg, Germany) with 2.10 m maximum capacity and a 0.001 m error margin. Subjects stood with their scapula, buttocks and heels resting against a wall; the neck was held in a natural non-stretched position, the heels were touching each other with the toe tips spread to form a 45° angle; and the head was held straight with the inferior orbital border in the same horizontal plane as the external auditory tube (Frankfort's plane) [19]. BMI was calculated as weight (kg) divided by height^2 (m^2). The prevalence (%) of overweight and obesity was calculated according to the World Health Organization guidelines, considering the thresholds of overweight as a BMI above 25 kg/m^2 and the thresholds of obesity as a BMI above 30 kg/m^2 [20].

WC was measured using a flexible non-elastic measuring tape. Individuals stood with feet together and arms resting by their sides. According to the International Society for the Advancement of Kinanthropometry, the WC was taken as the narrowest point between the inferior rib border and the iliac crest [21]. The WC was used to identify individuals with central obesity above threshold values of ≥88 cm for women [22].

A portable bioelectrical impedance analyzer Tanita BC 418-MA (Tanita Corp., Tokyo, Japan) with a 200 kg maximum capacity and a ±100 g error margin was used to measure the weight and estimate BF%. Individuals removed shoes, socks, and heavy clothes prior to weighing. The prevalence of high BF% was estimated considering the cut-off points published by Gallagher et al. [23]. Values of ≥38% were considered as overweight, and values of ≥43% were considered as obesity for women.

The anthropometric and body composition variables were respectively measured in 91.1% (height, weight and WC) and 86.6% (fat mass) of participants.

2.4. Physical fitness assessment

PF tests and their reliability are described elsewhere [7]. In short, the following PF components were assessed: static balance by the one leg test [24], lower and UB strength by the chair stand test and arm curl test, respectively [8], lower and UB flexibility by the chair sit-and-reach test and back scratch test, respectively [8], agility/dynamic balance by the 8-foot up-and-go test [8], speed by the 30-m walk [25] and aerobic endurance by the 6-min walk test [8]. All tests were performed only once, except the one leg test, which was performed twice with each leg, the 8-foot up-and-go test and the 30-m walk test, which were also performed twice. In the later cases, the best performance was selected for further analysis. To avoid the age effect on PF, a Fitness Index (FI) was created from the mean values of the eight tests, according to PF percentile values in Spanish elderly [7]. Thereafter, FI was categorized into

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quartiles, having the 1st quartile (Q1) the lowest PF results while the 4th quartile (Q4) was composed of subjects who had the highest fitness results.

2.5. Questionnaires

UI was assessed using the Spanish version of the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF) [26]. Thereafter, UI was divided into three types: urge UI (item 6.2), stress UI (items 6.3 and 6.5) and other UI (items 6.4, 6.6, 6.7 and 6.8). When the sum of questions 3, 4 and 5 was more than 0, it was considered that UI was present. Larger scores indicate worst results for "negative questions". Scores are inversed for "positive questions". The Cervantes Scale item which asks about urinary continence [27,28] was used to assess UI severity (CS-UI). It literally says: "I am afraid of performing physical efforts because of my urine leaks" and it is scored in a Likert fashion from 0 (not at all) to 5 (very much). In addition, two other items were registered: "current number of times that one gets up during the night" (NUI) and "number of times that she got up during the night 5 years ago" (N5UI). Sitting time was recorded through the following question: "How many hours do you usually spend sitting per day?" [14]. The question covered any activity in which the person had to be sitting (i.e. watching television, reading, sewing, etc.) and it referred to the present time. Similarly, walking time was recorded through the following question: "How many hours do you usually spend walking per day?" [14]. For both questions, each participant had to choose one of the following answers: <1 h/day, 1–2 h/day, 2–3 h/day, 3–4 h/day, 4–5 h/day or ≥5 h/day.

2.6. Statistical analysis

Data are presented as mean values ± standard deviation. Kolmogorov–Smirnov tests showed normal distribution of the studied variables. *T*-Test for independent samples was used to compare variables in subjects with and without UI. A one-way analysis of variance with Bonferroni post hoc correction was applied to seek for differences in UI variables among FI quartiles or body composition parameters. Binary logistic regression was used to test the association among PF tests, obesity and the dependent variable (UI). Odds ratios with 95% confidence intervals (CI) are reported for the studying models. All analyses were carried out with the Statistical Package for the Social Sciences (SPSS, Inc. Chicago, USA) Windows software, version 20.0. Statistical significance was set at $p < 0.05$.

3. Results

The prevalence of UI was 28.5% in the studied sample. Descriptive data for anthropometrics and body composition are displayed in Table 1. Age and gender-adjusted physical fitness results and corresponding percentiles according to Spanish reference values [7] are displayed in Table 2.

3.1. UI and body composition

Obese women had significantly higher means ICIQ-SF score for Other UI as compared to overweight women ($p < 0.05$) and CS-UI score as compared to women with normal BMI ($p < 0.05$). Women with central obesity had significantly higher (worse) scores as compared to those with normal WC for the following variables: Never leaks urine ($p < 0.05$), Stress UI ($p < 0.05$), CS-UI ($p < 0.01$) and NUI ($p < 0.05$). When body composition was expressed as BF%, significantly higher mean scores were found in obese women as compared to either overweight or normal for the following variables: Presence of UI ($p < 0.05$), Never leaks urine ($p < 0.01$), Urge UI ($p < 0.01$), Stress UI ($p < 0.05$), and NUI ($p < 0.01$) (Table 3).

Table 1
Women's age and anthropometric variables.

Variables	Mean ± SD	*N*
Age (y)	74.6 ± 5.2	471
Age of menopause (y)	49.0 ± 5.0	444
Height (cm)	151.6 ± 5.4	430
Weight (kg)	67.4 ± 10.2	429
Body mass index (kg/m^2)	29.3 ± 4.3	429
Overweight (%)	46.0	
Obesity (%)	39.9	
Waist circumference (cm)	92.6 ± 11.7	430
Central Obesity (%)	63.5	
Lean mass (kg)	40.3 ± 4.1	411
Fat mass (%)	39.6 ± 4.8	408
Overweight (%)	41.4	
Obesity (%)	26.0	

Table 2
Fitness and physical activity levels.

Variables	Mean ± SD	Percentile	*n*
Static balance (s)	23.9 ± 20.4	50.05 ± 32.1	443
LB extremities strength (rep)	14.3 ± 3.8	45.19 ± 27.9	447
UB extremities strength (rep)	17.9 ± 4.1	51.5 ± 27.4	444
LB flexibility (cm)	−1.3 ± 10.6	50.6 ± 30.6	448
UB flexibility (cm)	−7.6 ± 9.5	55.5 ± 27.0	449
Dynamic balance (s)	6.2 ± 2.2	57.0 ± 27.8	451
Walking speed (s)	18.7 ± 5.2	64.6 ± 28.1	443
Endurance (m)	492.6 ± 108.5	44.3 ± 28.7	429
FI		55.1 ± 18.0	371
Sitting time (h/day)	4.2 ± 1.3		454
Walking time (h/day)	1.8 ± 0.9		454

Lower body (LB); upper body (UB); fitness index (FI).

Women with UI had significantly higher BMI ($p < 0.01$), WC ($p < 0.05$), and BF% ($p < 0.05$) than those without UI (Fig. 1).

3.2. UI and fitness level

A trend to significantly higher fitness level in urinary continent women was found compared with those with UI ($p = 0.08$). Women with and without UI did not show statistical differences in any PF test except for UB flexibility ($p < 0.01$). Walking time per day was significantly higher in continent women ($p < 0.01$) compared to women with UI, whereas sitting time was similar in both groups (Fig 1).

Significantly higher values for other UI were found in the 2nd FI quartile women compared to those from the 4th ($p < 0.05$), and for the NUI in women in the 1st FI quartile women compared to those women in either their 2nd ($p < 0.01$), 3rd ($p < 0.001$) and 4th ($p < 0.001$).

When each physical test was independently considered, there were significantly lower results for women in the 1st dynamic balance and walking speed quartile compared to those in the 3rd ($p < 0.05$) and also to those in the 4th dynamic balance, walking speed and endurance quartile.

When lower body (LB) strength was considered, urge UI was higher in the 1st quartile than in the 2nd ($p < 0.05$), and the NUI was higher in the 1st quartile compared to the 2nd ($p < 0.01$) and to the 4th ($p < 0.05$). When LB flexibility was selected, other UI was lower in the 1st quartile compared to the 2nd ($p < 0.05$), to the 3rd ($p < 0.01$) and to the 4th quartile ($p < 0.01$). CS-UI was higher in the 1st quartile than in the 3rd ($p < 0.05$). UB Flexibility significant differences are shown in Table 4.

UB flexibility was significantly different between women with and without UI. Quartiles were significantly different for the variables never leaks urine ($p < 0.001$), urge UI ($p < 0.05$), stress UI ($p < 0.05$), CS-UI ($p < 0.05$) and NUI ($p < 0.05$), as well as for the item how UI affects your life ($p < 0.01$) (Table 4).

Table 3
Mean ± SD scores for UI variables according to BMI, WC and body composition (BF%).

Variables	BMI			WC		BF%		
	Normal	Overweight	Obese	Normal	Obese	Normal	Overweight	Obese
n	61	198	171	158	274	152	193	121
Never leaks urine	0.7 ± 0.46	0.73 ± 0.44	0.63 ± 0.48	0.75 ± 0.43	0.66 ± 0.48*	0.74 ± 0.44	0.71 ± 0.46	0.57 ± 0.50*,†
UI	0.22 ± 0.42	0.17 ± 0.38	0.3 ± 0.46	0.19 ± 0.4	0.24 ± 0.43	0.19 ± 0.39	0.19 ± 0.4	0.36 ± 0.48*,†
Stress UI	0.32 ± 0.6	0.28 ± 0.62	0.4 ± 0.75	0.26 ± 0.59	0.37 ± 0.72*	0.32 ± 0.68	0.27 ± 0.58	0.47 ± 0.82†
Other UI	0.13 ± 0.47	0.1 ± 0.39	0.12 ± 0.44†	0.08 ± 0.39	0.12 ± 0.44	0.1 ± 0.41	0.11 ± 0.42	0.14 ± 0.49
NUI	1.25 ± 0.99	1.4 ± 1.15	1.55 ± 1.22	1.27 ± 1.07	1.51 ± 1.18*	1.15 ± 0.98	1.61 ± 1.21*	1.47 ± 1.22
N5UI	0.79 ± 0.82	0.88 ± 0.91	0.94 ± 1.01	0.79 ± 0.88	0.94 ± 0.96	0.77 ± 0.81	0.9 ± 0.99	0.93 ± 0.98
CS-UI	0.00 ± 0.00	00.21 ± 0.91	0.38 ± 1.21*	0.11 ± 0.62	0.31 ± 1.13*	0.2 ± 0.89	0.17 ± 0.8	0.43 ± 1.28

Note—UI: urinary incontinence; NUI: current number of times that one gets up during the night; N5UI: number of times that got up during the nights 5 years ago; CS-UI: severity score according to the Cervantes Scale UI item.

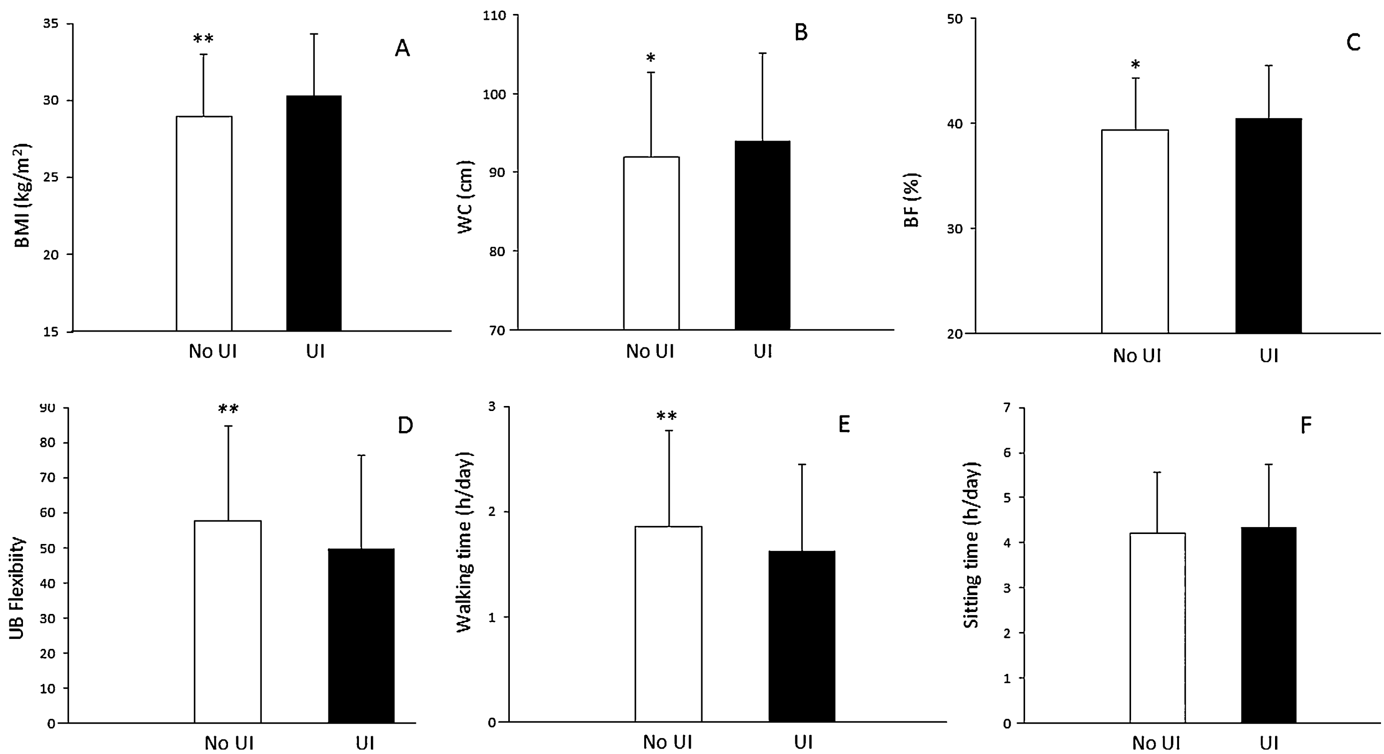

Fig. 1. BMI (A), WC (B), %BF (C), age percentile for UB flexibility (D), walking time (E), and sitting time (F) in women with and without UI. *$p < 0.05$ compared to UI, **$p < 0.01$.

Table 4
Mean ± SD scores for UI variables according to the UB flexibility test.

Variables	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
N	75	127	106	141
Never leaks urine	0.56 ± 0.5	0.67 ± 0.47	0.64 ± 0.48	0.80 ± 0.4*#
Urge UI	0.33 ± 0.47	0.22 ± 0.42	0.26 ± 0.44	0.15 ± 0.36*
Stress UI	0.47 ± 0.76	0.31 ± 0.68	0.40 ± 0.73	0.22 ± 0.54
Other UI	0.17 ± 0.58	0.16 ± 0.53	0.10 ± 0.34	0.04 ± 0.20
NUI	1.52 ± 1.26	1.35 ± 1.12	1.66 ± 1.18	1.22 ± 0.99#
N5UI	0.77 ± 0.92	0.83 ± 0.91	1.04 ± 0.97	0.81 ± 0.93
CS-UI	0.35 ± 1.19	0.39 ± 1.23	0.28 ± 1.04	0.03 ± 0.27†

* $p < 0.05$ compared to 1st quartile values.
† $p < 0.05$ compared to 2nd quartile values.
\# $p < 0.05$ compared to 3rd quartile values.

3.3. Body composition and Fitness index

There were lower FI values in obese women compared to the normal or the overweight groups both in terms of BMI and BF% ($p < 0.001$) (Fig. 2). In addition, women in the overweight BF% group had lower FI than those in the normal BF% group ($p < 0.5$). Central obesity women had significantly lower FI values than those with normal WC ($p < 0.001$).

3.4. Risk of suffering from UI

UI risk is increased an 87% in obese women (using BF%) compared to those with normal BF% [OR = 1.87; 95%CI (1.099–3.173)] while no significant results were found when fitness, WC and BMI were included in the odds ratio model.

4. Discussion

UI is a highly prevalent clinical problem, having serious social, personal and family life, and economic consequences. The major findings of this study were: (1) the prevalence of UI was 28.5% in a representative Spanish non-institutionalized sample; (2) women with increased fat mass had higher risk of suffering UI; (3) higher FI and daily walking time were inversely associated with presence of UI and with UI-related variables and; (4) lower performance in the UB flexibility test was associated with worse results in the majority

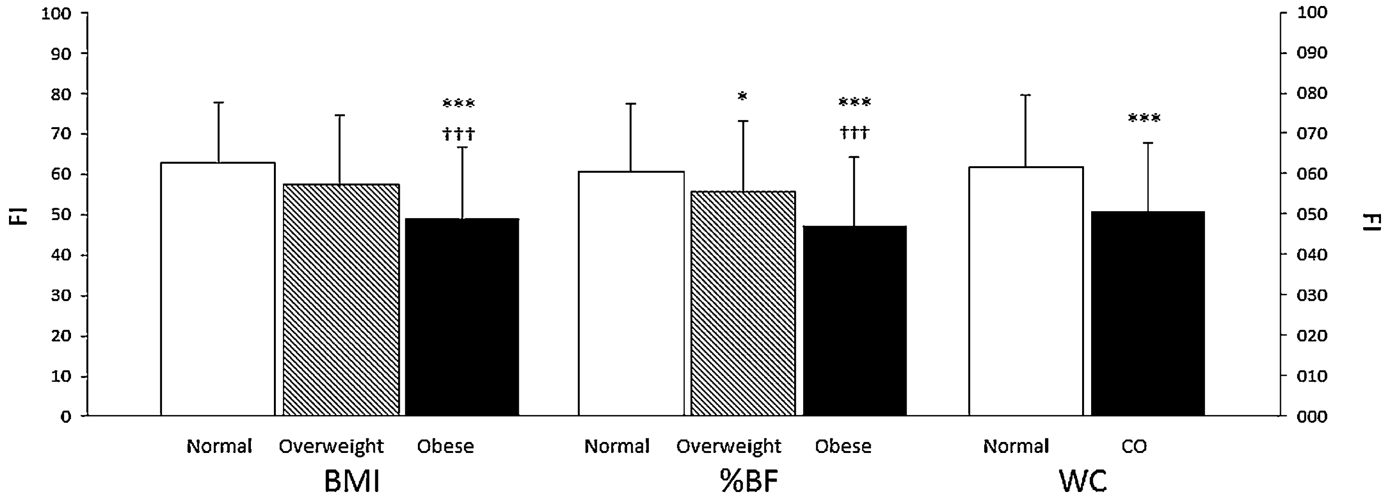

Fig. 2. Fitness index (FI) by BMI, WC and %BF. *$p < 0.05$ compared to normal women. ***$p < 0.001$ compared to normal women. †††$p < 0.001$ compared to overweight women.

of UI variables, being the sole test in which results were different for continent women and those with UI.

In the studied sample 28.5% of women had some form of urinary leakage which may be considered lower to some published data. This may be due to the fact that urodynamic studies show that the UI prevalence is underestimated when assessment is only based on symptoms [29–31]. Feeling of shame and the common belief – even among some physicians- that UI is a normal or inevitable consequence of the aging process, determine that many women postpone looking for clinical solutions to improve their quality of life. This situation should be curved by increasing information and education both to aged patients and healthcare providers.

There is a strongly support about the relation between overweight/obesity and prevalence of UI in women [32,33]. Perimenopausal hormonal changes result in an increase in total and abdominal body fat contributing to the accumulation of BF% in postmenopausal women [34]. BMI is the easiest and widest extended method to estimate overweight and obesity. Our data provide new insight and more exhaustive information on the matter. Obese women had a risk of suffering from UI increased by 87.0% compared to those with normal BF%. Overfat women have high values of intra-abdominal pressure [3] which may increase the intra-vesical pressure and urethral mobility, and affect pelvic floor muscles [3,32,33,35]. Another anatomical explanation would be the association between retropubic space and stress UI since overweight women have more retropubic space than their normal-weight counterparts [36]. Limited individual mobility and sedentarism may influence severity and type of UI [37]. In addition, female UI is also related with other factors such as parity, type of delivery, previous hormone therapy and urogenital surgery, constipation, existence of pelvic floor disorders or other chronic diseases [29,31,38–40]. Non-surgical weight loss interventions (diet, exercise or a combination of both) may improve female UI [41] and recently it has been shown that under extreme obese conditions, bariatric surgery has been proposed to improve urinary continence [42].

Aging women with higher levels of low-impact and no strenuous physical activities, showed a reduction of risk for UI up to 25% [15]. However, older women exposed to an intervention that improved their physical performance did not reduce their UI, maybe because the intervention was not enough for an objective change in UI or there were other more dominant factors [43]. In the present study, women belonging to the higher PF quartiles showed better results in some UI-related variables compared to their less fit counterparts. Thus, FI showed a tendency to lower values ($p = 0.08$) when comparing women with and without UI. Due to the lack of urodynamic assessment, it cannot be excluded that the dominant cause of UI might be the overactive bladder syndrome which requires a specific pharmacological treatment to improve vesical continence and nocturia.

Walking often represents a useful and accessible tool for weight management without negative effects over UI [15]. In the present study, women with UI presented less amount of daily walking time than those continent, possibly due to an interaction between proper bladder function and control gait [44]. An increase on moderate physical activity would likely help to maintain body weight and reduce body fat by diminishing intra-abdominal pressure and strengthening pelvic floor muscles [33]. Physical exercise suppress BMI, BF%, and improves the blood lipid profile, reducing the urinary symptoms [45]. However, urine leaking during exercise limits adherence to physical activity programs.

The relation between fitness level and body composition has been widely reported at all ages [33,46]. In our study overfat women (independently of assessment methods) had lower PF levels than participants with normal BMI, WC or BF%. The high prevalence of obesity and overweight in elderly women could be explained by a reduction on physical activity, an increased lipoprotein lipase activity in abdominal and gluteal adipocytes or a decreased lipolysis [4,7,18,34]. In the prospective study by Koster et al. [47], the less fit older participants had worse body composition parameters that their fitter counterparts. In obese subjects, there are a reduction of muscle strength and cardio-pulmonary capacity, together with higher metabolic costs [48]. Those changes affect physical performance and increase functional decline with age.

Recent data in older people living in a long-term care setting [49] suggested that poor performance on the agility and LB flexibility were the predominant risk factors of UI. In our study, the association between UB flexibility and UI could be linked with central obesity. Obese people have a significantly reduced range of motion for shoulder extensions and adductions (which are the mechanical movements involved in the UB flexibility test), mainly caused by the mechanical interposition and obstruction of inter-segmental rotations at joints due to their excess of fat, especially in chest and abdomen areas [50]. Therefore, our results support the negative association between poor PF level and unhealthy body composition.

Some limitations of the study should be acknowledged: (a) the classification and type of UI was based on self-reported validated questionnaires instead of clinical or urodynamic assessment. However, the validated Spanish ICIQ-SF version has satisfactory psychometric properties and is adequate to use in both clinical

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and research practice [26]. (b) The FI represents a set of physical tests which do not measure the pelvic floor area. However, the standardized set of tests was selected due to its wide use and safety. Nevertheless, measurements including pelvic floor muscle performance should be included in future studies. (c) Due to its cross-sectional design the nature of the association between the main variables of the study (fitness and UI) cannot be determined. Thus, a reverse causation bias for this relationship cannot be excluded. (d) Although we controlled for several potential confounders such as age and several body composition variables, we cannot be certain that other unmeasured confounders such as number of pregnancies, offspring, number of siblings or genetic variation, have not influenced our observations.

5. Conclusion

In conclusion, unhealthy changes in body composition increase the risk of suffering UI in elderly women. Additionally, UI is associated with low physical fitness levels, especially with poor upper body flexibility and low physical activity levels. Therefore, interventions involving weight loss and increase physical activity levels in elderly women could be an effective method to improve urinary continence. Further studies are warranted on this topic.

Conflict of interest

The authors declare they have no conflict of interest

Ethical approval

The study was performed according to the principles established with the revised Declaration of Helsinki, and approved by the Research Ethics Committees of Aragón (Spain) (18/2008). Written informed consent was obtained from each participant.

Contributors

Ignacio Ara, Faustino R. Pérez-López, Marcela González-Gross and José A. Casajús were involved in the conception and design of the research. Beatriz Moreno-Vecino, Raquel Pedrero- Chamizo, Julián Alcázar, Alba Gómez-Cabello were involved in collecting data. Ignacio Ara and Alfredo Arija-Blázquez performed statistical analysis. Beatriz Moreno-Vecino, Ignacio Ara, Alfredo Arija-Blázquez, Faustino R. Pérez-López, Marcela González-Gross and Alba Gómez-Cabello performed drafting of the manuscript. All the authors were involved in critically revising the manuscript for its intellectual content and approving the final version.

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