Urinary incontinence and waist circumference in older women*

MARESSA P. KRAUSE1, STEVEN M. ALBERT2, HASSAN M. ELSANGEDY3, KLEVERTON KRINSKI3, FREDRIC L. GOSS1, SERGIO G. DA SILVA3

1Center for Exercise and Health-Fitness Research, University of Pittsburgh, Pittsburgh, PA, USA
2Department of Behavioral and Community Health Sciences, University of Pittsburgh, Pittsburgh, PA, USA
3Centro de Pesquisa em Exercicio e Esporte, Universidade Federal do Paraná, Curitiba, Brazil

Address correspondence to: M. Krause, 140, Trees Hall, University of Pittsburgh, Pittsburgh, PA 15260, USA. Tel: (+55) 41 3346 3395; Fax: (+55) 41 3015 6435. Email: mpk19@pitt.edu, maressakrause@hotmail.com

*This investigation was conducted at the Centro de Pesquisa em Exercicio e Esporte, Universidade Federal do Paraná, Curitiba-PR, Brazil.

Abstract

Objective: the study aims to determine the association between adiposity and fitness with urinary incontinence (UI) in older women.

Methods: a cross-sectional study was conducted in southern Brazil. A sample of 1,069 urban women, age 60+, was assessed for UI (in-person interview), adiposity (body mass index [BMI] and waist circumference [WC]) and fitness. Logistic regression models were developed to assess the association between UI and the independent variables—adiposity (BMI and WC) and fitness indicators. All models were adjusted for age, socioeconomic level, diabetes and hypertension.

Results: BMI and functional tests were not significantly associated with UI. WC was an independent and significant predictor. Relative to women in the lowest quartile of WC, odds ratios for UI were 1.98 for WC of 79–86 cm, 2.07 for WC of 86–94 cm and 2.24 for WC >94 cm (P = 0.03).

Conclusion: central adiposity, as indicated by large WC, increases the risk of UI. Intra-abdominal pressure and its effect on urethral structures may be responsible for this increased risk. Older women should be counselled on the risk of central obesity for UI.

Keywords: older women, functional fitness, adiposity, urinary incontinence, elderly

Introduction

Urinary incontinence (UI) is a common medical condition in elderly individuals. Even though effective treatment is available, many individuals do not seek help or treatment [1]. In the United States, the prevalence of UI in non-institutionalised elderly women ranges from 2 to 55%, whereas this prevalence reaches 65% in institutionalised women [2–4]. The prevalence of UI in non-institutionalised older women is similar in other countries [5–7].

UI has been estimated to account for 2% of health care costs in the United States [8], $26.3 billion dollars in annual societal costs [9]. Additionally, since UI is a marker of frailty, incontinent individuals can become more susceptible to other impairments, which in turn, increases costs associated with the condition [1, 10, 11]. For example, incontinent community-dwelling elderly can face a higher rate of mortality (10.9%), nursing homes admission (4.4%) and declines in both the activities of daily living (13.6%) and instrumental activities of daily living (21.2%) than continent women (8.5, 2.6, 9.1 and 13.8%, respectively [11]).

Excessive adiposity and functional impairment have been the focus of recent research on risk factors for UI [12–21]. Central adiposity, estimated by waist circumference (WC), was associated with UI in one study, in which women with WC ≥95.25 cm had a 2-fold increase in risk [15]. Indeed, Subak et al. [12] demonstrated that weight loss of 8% in women reduced incontinent episodes by 47%. Furthermore, functional impairment seems to be associated with UI [18]. Women who experienced declines in walking speed had an increased risk (odds ratio [OR] 1.31), as did women who declined in chair stand (CS) performance (OR 1.40 [14] and OR 1.30 [13]).

To clarify these relationships, this research examined the association between self-reported UI (which served as dependent variable), elicited in an in-person interview, and
standardised assessment of both adiposity, indicated by body mass index (BMI) and WC and fitness (which served as predictor variables) [22] in a large sample of older women, residing in an urban capital city in southern Brazil.

Methods

Study design

This cross-sectional study was conducted in a capital city in the south of Brazil—Curitiba, Paraná. This large, urban community is divided into eight regional districts. The recruitment was stratified by district, with the target sample being 1% of the older female population within each district. This target was achieved through advertisements placed in community centres throughout each regional district. In addition, an investigator attended meetings held at these community centres, during which the study procedures were explained and the members were invited to participate. Additional subjects were informed by word-of-mouth from those previously recruited. To be eligible for this study, individuals were age 60+ and non-institutionalised and that potential subjects with unstable major health conditions (i.e. cardiorespiratory, metabolic, neurological or orthopaedic dysfunction) were excluded from the study.

The study protocol was approved by the Ethics Committee of the Universidade Federal do Paraná. All participants signed informed consent before assessment (for more details regarding the study procedures, see Krause et al. [23]).

Measurements

Descriptive variables

Socioeconomic level was determined by a validated national socioeconomic questionnaire. This instrument included assessment of years of education and ownership of home appliances [24]. Diabetes and hypertension were determined by a standardised questions (i.e. Has your physician ever told you that you are hypertensive or diabetic?).

UI classification

UI was determined by in-person interview using the following standardised question: “In the previous year, have you ever had some problem to control your bladder that led to urine leakage or ‘occasional accidents’?”. Functional fitness test [22]

Prior to the tests, all participants were given the same instructions about the procedures of each test in accordance with the recommendations proposed by Rikli and Jones [22].

The six-minute walk (6MW) test was administered to measure aerobic endurance. This test involves determining the maximum distance in metres that can be walked in 6 min along a rectangular course (54.4 m—18 length × 9.2 width) {test−retest reliability, r = 0.91 [95% confidence interval (CI) 0.84–0.95]; criterion validity, r = 0.71}.

The arm curl (AC) test was administered to assess upper body strength. This test involves determining the number of times a hand weight (5 lb) can be curled through a full range of motion in 30 s. This protocol includes holding the weight in a handshake grip at full extension (to the side of the chair), then supinating during flexion so that the palm of the hand faces the biceps at full flexion (test−retest reliability, r = 0.80 [95%CI 0.67–0.89]; criterion validity, r = 0.78).

The 30-second CS test was administered to assess lower body strength. This test involves counting the number of times within 30 s that an individual can rise to a full standing position from a seated position without pushing off with the arms (test−retest reliability, r = 0.92 [95%CI 0.87–0.93]; criterion validity, r = 0.71).

The chair sit-and-reach (CSR) test was administered to measure lower body flexibility (primarily hamstrings, in centimetres). The participant sat on the front edge of a chair and extended one leg straight out in front of the hip, with foot flexed and heel resting on the floor (the other leg was bent, foot flat on the floor). With the extended leg as straight as possible, the participant slowly bent forward at the hip joint sliding the hands (one on top of the other with the tips of the middle fingers even) down the extended leg in an attempt to touch the toes. This position was held for at least 2 s. The distance between the starting and ending positions was measured by a ruler (test−retest reliability, r = 0.96 [95%CI 0.93–0.98]; criterion validity, r = 0.86).

The 8-foot up-and-go (8-ft) test was administered to measure power, speed, agility and dynamic balance. This test involves getting out of a chair, walking 8 ft to and around a cone and returning to the chair in the shortest time possible (test−retest reliability, r = 0.90 [95%CI 0.83–0.95]; criterion validity has not been determined because there is no single criterion available).

Statistical analyses

The Kolmogorov–Smirnov test of normality was used to determine that the distribution of the sample data was parametric. Subsequently, descriptive statistics (means, standard deviations and frequency distribution) were calculated for all measures. Two age groups, women aged 60–69 years and aged 70+ were investigated separately by using independent t-tests because UI differs in prevalence and perhaps aetiology by age. Binary logistic regression models were developed to
Table 1. Demographic characteristics of the population and sample of older women residents in Curitiba-Pr

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Population (n = 79,012)</th>
<th>Sample (1,069)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 to 69.9 years old</td>
<td>43,665 (55.3%)</td>
<td>604 (56.5%)</td>
</tr>
<tr>
<td>&gt;70 years old</td>
<td>35,347 (44.7%)</td>
<td>465 (43.5%)</td>
</tr>
</tbody>
</table>

Socioeconomic level

<table>
<thead>
<tr>
<th>Level</th>
<th>Population (%)</th>
<th>Sample (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (≤3x minimum wage)</td>
<td>76.5%</td>
<td>75.4%</td>
</tr>
<tr>
<td>Medium (3 to 10x minimum wage)</td>
<td>17.3%</td>
<td>22.6%</td>
</tr>
<tr>
<td>High (&gt;10x minimum wage)</td>
<td>6.2%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>


explore the relation between UI and adiposity (BMI and WC) and fitness indicators, adjusting for age, socioeconomic level, diabetes and hypertension. UI was treated as a dichotomous variable. For these analyses, adiposity (BMI and WC) and all functional fitness measurements were divided into quartiles. OR and 95% CI were calculated (adjusted for age, socioeconomic status, diabetes and hypertension). Statistical significance was set a priori, with an alpha level set at P < 0.05. The statistical analyses were performed using SPSS version 16.0 (Inc., Chicago, IL).

Results

The study sample was composed of 1,069 non-institutionalised women, 60 years and above (age range, 60.0–91.4 years). Subjects were predominantly white (Caucasian), and the majority was classified as low or middle socioeconomic level; 16% self-reported a previous diagnosis of diabetes and 50.0% of hypertension. The sample was representative of older women in the Curitiba population. The distribution of age and socioeconomic status in the sample was similar to that of the source population, as indicated by official census statistics (Table 1) [24].

Self-reported UI was 9.4% in women aged 60–64 to 16.9% and increased across age strata until its maximum of 16.9% in women aged 75–79. In women over age 80, the prevalence was 11.6%.

Among women aged 60–69, women reporting urinary continence had a significantly lower WC (86.6 ± 10.4 cm) and a higher performance in the CS test [13.5 ± 2.4 repetitions (reps)] than incontinent women (WC of 90.8 ± 11.7 cm and CS of 12.5 ± 3.2 reps) (P < 0.05) (Table 2). Differences were less pronounced among women aged 70+. Continent women had a higher performance in the AC test (13.4 ± 3.1 reps) than incontinent women (AC of 12.5 ± 2.5 reps). No other significant differences were found between groups for BMI or functional tests (P > 0.05).

Binary logistic regression analysis adjusted by age, socioeconomic level, diabetes and hypertension was conducted to determine the association between adiposity and functional fitness with UI. Only WC was a significant predictor for women (P < 0.033) in the univariable model. OR increased progressively as WC increased. Relative to women with WC < 79.0, the odds of reporting UI increased to 1.98 (1.13–3.45) for 79–86.0 cm, 2.07 (1.16–3.69) for 86–94 cm and 2.24 (1.26–3.99) for 95 cm or greater (Table 3). BMI and fitness indicators were not significant predictors in the univariable model (Appendix).

Discussion

The purpose of this investigation was to examine the association between UI and adiposity and functional fitness in older Brazilian.

The main finding in this study was the significant association of WC with UI. Recent investigations support our findings, since a similar association between adiposity with

Table 2. Adiposity and functional fitness measurements—data are present as mean and standard deviation

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>WC (cm)</th>
<th>BMI (kg/m²)</th>
<th>6MW (m)</th>
<th>AC (rep)</th>
<th>CS (rep)</th>
<th>CSR (cm)</th>
<th>8-ft (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60–69</td>
<td>86.8 ± 10.4</td>
<td>28.7 ± 4.7</td>
<td>511.5 ± 71.1</td>
<td>14.9 ± 3.3</td>
<td>13.3 ± 2.4</td>
<td>4.22 ± 11.14</td>
<td>6.00 ± 1.06</td>
</tr>
<tr>
<td>70+</td>
<td>86.8 ± 10.4</td>
<td>28.2 ± 4.6</td>
<td>456.0 ± 89.1</td>
<td>13.4 ± 3.1</td>
<td>12.3 ± 2.9</td>
<td>1.65 ± 11.13</td>
<td>6.93 ± 1.73</td>
</tr>
</tbody>
</table>


Table 3. Binary regression analysis to predict UI—final model

<table>
<thead>
<tr>
<th>WC (cm)</th>
<th>UI cases</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤79.0</td>
<td>21 (7.7%)</td>
<td>1.000</td>
<td>0.000–0.000</td>
<td>0.033</td>
</tr>
<tr>
<td>&gt;79 to ≤86</td>
<td>42 (13.9%)</td>
<td>1.98</td>
<td>1.13–3.45</td>
<td></td>
</tr>
<tr>
<td>&gt;86 to ≤94</td>
<td>36 (14.9%)</td>
<td>2.07</td>
<td>1.16–3.69</td>
<td></td>
</tr>
<tr>
<td>&gt;94</td>
<td>39 (15.3%)</td>
<td>2.24</td>
<td>1.26–3.99</td>
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</table>

Adjusted by age (P = 0.77), socioeconomic level (P = 0.17), diabetes (P = 0.18) and hypertension (P = 0.62).

Urinary incontinence and waist circumference in older women
UI risk has been reported. For example, Townsend et al. [15] conducted a large investigation with women aged 54–79 years. Overweight women (BMI 25–27.4 kg/m²) had a 16% higher risk for UI, while obese women (BMI ≥35 kg/m²) achieved the highest risk of 125%. They found a similar association with WC, in which the UI risk was 2-fold higher for women with WC ≥95.25 cm. Interestingly, they compared these associations in two age groups, <65 years and ≥65 years, but the results previously presented did not change significantly [18, 26].

Similar to our results, Han et al. [16] conducted a study with Korean women ≥30 years and also found an association between UI and WC. The adjusted OR for WC were 1.79 for 78–83.9 cm, 3.50 for 84–89.9 cm and 6.1 for ≥90.0 cm. A larger study conducted in three cities of France, with 8,966 elderly community dwellers, also found that BMI was associated with UI [17].

Functional fitness was not a predictor of UI in this investigation. However, comparisons between continent and incontinent groups suggested that functional fitness could differ between groups. The incontinent youngest women had a lower performance on the CS test, and the incontinent oldest women performed lower in the AC test. Both functional tests are indicators of body strength—lower and upper body, respectively. Thus, it is reasonable to assume a relationship between strength with mobility in women, which in turn, has been associated with UI. This conclusion is supported by previous studies [13, 14, 27]. For example, women who had a recent decline in walking speed and CS increased their risk of monthly UI by 3 and 8%, weekly UI by 22 and 23% and daily UI by 42 and 64%, after adjustment for age, health status, diabetes, geriatric depression score, BMI, stroke, alcohol use and baseline walking speed and CS time [14]. Similarly, a prospective population-based study cohort, involving black and white community-dwelling older adults, reported that a slower time for CS was a predictor of incident incontinence [13]. Indeed, upper body strength, assessed by handgrip, can be a superior indicator of health-related quality of life because of its association with sarcopenia and generalised frailty. Older adults who had a lower grip performance were significantly more likely to report poor health (after adjusted for confounder variables) [27].

The association between adiposity and UI may be due to increases in inter-abdominal and intravesical pressures [28]. General obesity may also be a factor, as it leads to disturbance in oxidative metabolism and insulin resistance, which in turn, may damage the vascular system in the pelvic floor and lead to a dysfunction of the detrusor and sphincter muscles. Indeed, a high BMI can increase intravesical pressure that may reduce the continence gradient between the urethra and the bladder. In this circumstance, the magnitude of increased intra-abdominal pressure necessary to force urine through the urethra is reduced, because the static pressure within the bladder is higher. In addition, an elevated body weight can mimic some effects of pregnancy, such as stretching, weakness in muscles and effects on nerves and other structures, which also can increase intra-abdominal pressure. The combination of these factors with the increased central adiposity can also compress the bladder, leading to strain on urethral structures and pelvic floor disorders. Excessive body adiposity may cause an increase in the risk for pelvic organ prolapse and incontinence [8, 15, 19, 29].

Moreover, weight loss and increased pelvic floor muscle strength have been shown to improve continence [18, 28, 29]. A recent randomised clinical trial conducted by Subak et al. [12] showed that an intensive weight-loss intervention resulted in a 47% reduction in incontinence episodes. For this reason, geriatricians and physicians should advise their patients to engage in a regular exercise programme to improve the strength of pelvic muscle and promote weight loss.

Results from this study should be viewed in light of its study design. The cross-sectional design does not allow statements about causality. Additionally, the self-report of UI can be considered a limitation and may represent an underestimate. However, there is still no standard definition of UI, and self-report is used by most of epidemiologic studies. It is important to recognise as well that the participants in this study may represent more active elderly, since the sample was recruited from participants in community centres, non-institutionalised subjects. However, the sample was broadly representative of the demography of the source population. Lastly, the low BMI variability among the participants and/or the changes in stature due to osteoporosis may be responsible for the weak association between BMI and UI in this sample.

Key points

- Incontinent community-dwelling older adults face an increased risk of mortality, nursing home admission and disability.
- In a Brazilian sample, 9.4% of women aged 60–64 reported UI, 16.9% of women aged 75–79 and 11.6% of women aged 80+.
- Central adiposity, as indicated by large WC, increased the risk of UI. BMI and fitness indicators were not independent predictors of UI in this sample.
- The association between adiposity and UI may be due to increases in inter-abdominal and intravesical pressure.

Conflicts of interest

The authors have no conflict of interest to disclose.

Supplementary data

Supplementary data mentioned in the text is available to subscribers at the journal website http://ageing.oxfordjournals.org.
References


Received 20 May 2009; accepted in revised form 23 September 2009