

Influence of anthropometric variables on pelvic floor muscular strength in Urinary Incontinence

Influência das variáveis antropométricas sobre a força muscular do assoalho pélvico na Incontinência Urinária

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RESUMO | INTRODUÇÃO: A Incontinência Urinária (IU) é definida como qualquer perda involuntária de urina. O aumento do peso e as medidas de circunferências elevadas são fatores de risco para o desenvolvimento destes sintomas. **OBJETIVO:** Avaliar a influência das variáveis antropométricas (VAs) na força muscular do assoalho pélvico de mulheres com IU. **MATERIAIS E MÉTODOS:** Estudo transversal com amostragem de conveniência. Iniciada a avaliação com a anamnese, após aferição das VAs seguiu-se para avaliação funcional do assoalho pélvico (AFA). Aplicada correlação de Spearman, e para avaliar a influência das VAs na AFA realizou-se regressão linear múltipla. **RESULTADOS:** Avaliadas 12 voluntárias com IU, média de idade $56,9 \pm 13,2$ anos e maior frequência 10 (83,3%) de incontinência urinária de esforço. Encontradas correlações moderadas e negativas entre VAs e a AFA [Índice de massa corporal (IMC) vs AFA ($r = -0,582$ $p = 0,020$); Circunferência da Cintura (CC) vs AFA ($r = -0,567$ $p = 0,033$); Circunferência do Quadril (CQ) vs AFA ($r = -0,593$ $p = 0,050$); Circunferência Abdominal (CA) vs AFA ($r = -0,657$ $p = 0,001$)]. Estes achados foram ratificados através da análise de regressão linear múltipla, onde há influência direta de 37% do IMC e CA na AFA das voluntárias com IU. **CONCLUSÃO:** Valores elevados das VAs estão relacionadas diretamente com um pior desempenho na AFA, em mulheres com incontinência urinária.

PALAVRAS-CHAVE: Incontinência urinária. Assoalho pélvico. Índice de massa corporal. Saúde da mulher.

ABSTRACT | INTRODUCTION: Urinary Incontinence (UI) is defined as any involuntary loss of urine, weight gain and high circumference measures are risk factors for UI symptoms development. **OBJECTIVE:** To evaluate the influence of anthropometric variables on the pelvic floor muscular strength of women with UI. **MATERIALS AND METHODS:** Cross-sectional study with convenience sample. Data were collected during anamnesis and after obtaining anthropometric variables, pelvic floor functional evaluation (PFE) was done. A Spearman correlation was performed and to evaluate anthropometrics variables' influence on PFE we did a multiple linear regression. **RESULTS:** 12 volunteers with UI were evaluated, mean age of 56.9 ± 13.2 years with a frequency of 10 (83.3%) with stress urinary incontinence. Moderate and negative correlations between anthropometrics variables and PFE were found [Body mass index (BMI) vs PFE ($r = -0,582$ $p = 0,020$); Waist circumference (WC) vs PFE ($r = -0,567$ $p = 0,033$); Hip circumference (HC) vs PFE ($r = -0,593$ $p = 0,050$); Abdominal circumference (AC) vs PFE ($r = -0,657$ $p = 0,001$)]. The correlations findings can be ratified through a multiple linear regression analysis, where there is a direct influence of 37% of BMI and AC on PFE in the volunteers with UI. **CONCLUSION:** Higher values of the anthropometric measures are directly related to a worse performance on PFE, High VA values are directly related to poor performance in AFA in women with urinary incontinence.

KEYWORDS: Urinary incontinence. Pelvic floor. Body mass index. Women's health.

Introduction

Urinary Incontinence (UI) is defined by the International Continence Society as any involuntary loss of urine, which affects men and women of all age groups and can have repercussions on the physical, psychological and social well-being of these subjects^{1,2}. Among the main risk factors for UI are pregnancy and childbirth, especially vaginal delivery, use of oral estrogen, genetics, and body mass index (BMI)³. Increased weight and high circumference can also lead to the risk of developing UI, since fat accumulation, especially in the abdominal area, overload pelvic floor (PF) structures by increasing intra-abdominal pressure, leading to a lesser activation of the pelvic muscles⁴⁻⁷.

The pelvic floor is formed by a set of muscles, ligaments and fascias, and the pelvic floor muscles (PFMs) are responsible for the support of the pelvic organs and abdominal viscera, resisting the intra-abdominal pressure, supporting the pelvic and abdominal viscera, thus promoting urinary and fecal continence⁸. Intra-abdominal pressure, present in patients with obesity, does not allow PFMs to perform a voluntary contraction, a reason that may explain the loss of urine at these times⁹.

The decrease in the muscular strength (MS) of the PFMs, associated with the presence of different risk factors precedes the appearance of symptoms related to the PF¹⁰ disorders. Thus, it is essential to understand the possible effects of body mass index and anthropometric variables [waist, abdomen and hip circumferences] on the MS of PF in women with UI. Therefore, the objective was to evaluate the influence of anthropometric variables on pelvic floor's muscular strength of women with UI.

Methods

Study design

Cross-sectional and descriptive study of a quantitative nature, with convenience sample. The volunteers, participants in the Women's Health project, were formally invited to participate in the research. The study was approved by the Research

Ethics Committee of the University of Santa Cruz do Sul (UNISC) under protocol no. 2,127,940; 62855816.3.0000.5343. The research site was held at the FisiOUNISC clinic, located in the city of Santa Cruz do Sul (RS), between October and November 2017.

Study population

Women with at least 18 years of age with a diagnosis of UI were included, who had a urodynamic study confirming the diagnosis of the condition, and classifying the incontinence in: stress, mixed or overactive bladder. Who were apt to understand and answer questions from the researchers, participants in the UNISC Women's Health extension project and who signed the informed consent term (ICT). Exclusion criteria included those participants who had had urinary tract infection during the intervention period, who presented anatomical restrictions to the physical examination, such as vulvo-vaginal lesions, and those with cognitive deficit or pelvic organ prolapse.

Methodological procedures

Anamnesis

After the signing of the ICT, the evaluations were started in one of the offices of the clinic FisiOUNISC. The data were collected through an interview during the anamnesis, initially using a form developed by the researchers to obtain the basic information about the participants: name, date of birth, age, city of birth, schooling and medical history.

Anthropometric evaluation

BMI was calculated from the formula: current weight (kg)/height (m)². The weight and height of the volunteers were measured using an anthropometric scale (Welmy R-110, Welmy SA, Santa Bárbara do Oeste, Brazil), later classified according to the Brazilian Guidelines for Obesity¹¹. Waist circumference (WC) and waist-to-hip ratio (WHR) were calculated using the ratio between WC and hip circumference (HC)^{12,13}, with WC being obtained at the narrowest point between the last rib and the iliac crest, while the HC was measured in the largest gluteal circumference¹². The abdominal circumference (AC) was measured with the participant in orthostasis, being asked to take a deep breath, and at the end

of the expiration, the measurement was obtained on the largest abdominal perimeter between the last rib and the iliac crest¹². All previously mentioned measurements were performed using an inelastic tape measure and performed by the same evaluator.

Functional evaluation of the pelvic floor (FEPF)

FEPF was performed through digital palpation with the aim of measuring the strength of the PFMs. To perform the test the volunteer laid in dorsal decubitus, with her legs in a flexion-abduction position and the feet supported; to the bidigital touch (2nd and 3rd fingers) intravaginal, making use of gloves properly smeared in lubricating gel, a maximal voluntary contraction was applied around the examiner's fingers. A physiotherapist specialized in women's health performed all the evaluations, where the contraction was sustained for as long as possible, the force was graded according to the Ortiz scale¹⁴.

Statistical analysis

Data was allocated in the IBM SPSS Statistics software (version 20.0). Initially the normality of the data was analyzed by the Shapiro Wilk test. For the continuous variables the results were presented in a descriptive way by mean and standard deviation and for categorical variables expressed in frequency. To analyze the association between variables, we applied Pearson's correlation. A $p \leq 0.05$ was considered significant.

Results

A total of 12 volunteers with UI met the inclusion criteria and were assessed. The clinical, anthropometric, UI and FEPF characteristics are described in Table 1. We can observe same distribution of BMI classification and usage of accessory muscles, an increase in WC and WHR measurements, and predominance of stress UI.

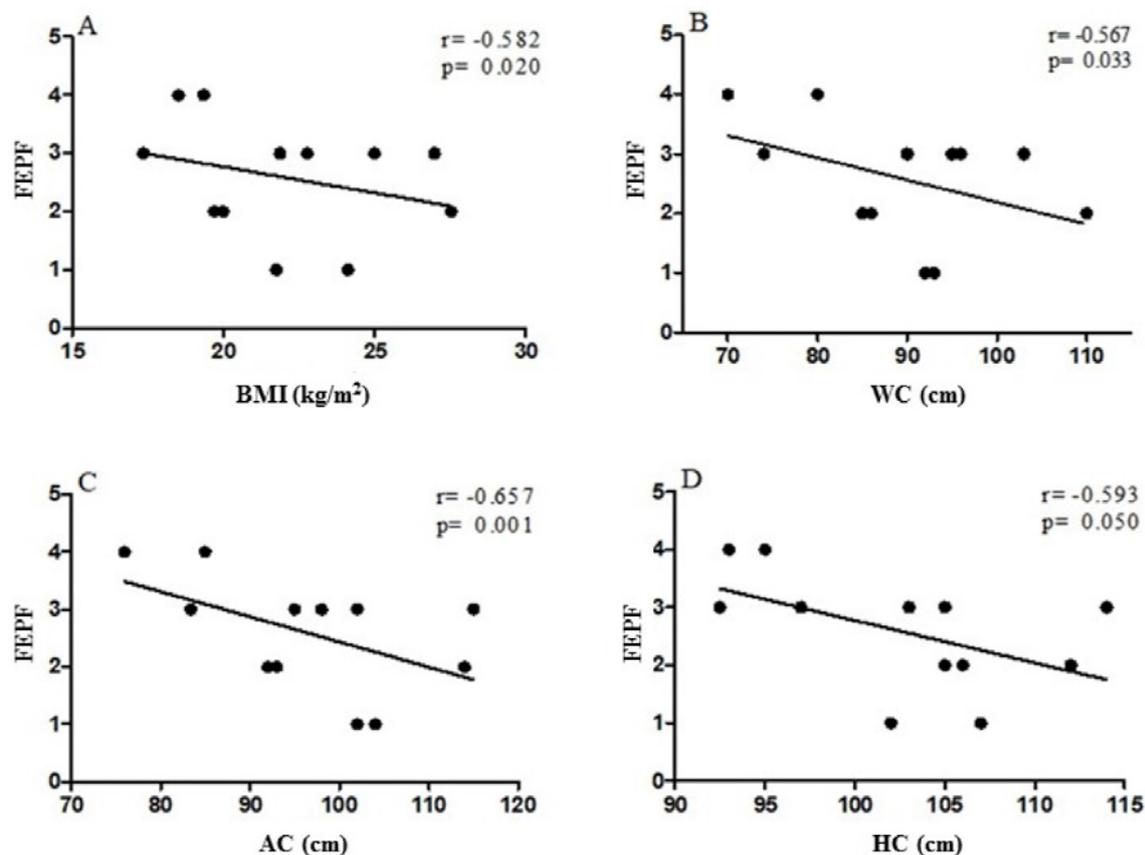
Table 1. Clinical and anthropometric characterization, type of UI and FEPF of the volunteers. Santa Cruz do Sul (RS), 2017. N=12

Variables	(mean/standard deviation)
Age (years)	56,9±13,2
BMI (kg/ m ²)	24,5±3,3
BMI classification, n (%)	
Normal	6 (50,0)
Obese;	6 (50,0)
WC (cm)	89,2±11,3
WC classification, n (%)	
Normal	3 (25,0)
Increased risk	9 (75,0)
AC (cm)	96,5±11,8
HC (cm)	102,5±6,9
WHR (cm)	1,1±0,1
WHR classification, n (%)	
High risk	12 (100,0)
UI type, n (%)	
Stress	10 (83,3)
Mixed	2 (16,7)
FEPF	2,5±0,9
Usage of accessory muscles, n (%)	
Yes	6 (50,0)
No	6 (50,0)

Data expressed as mean and standard deviation or sample number and frequency; BMI: Body mass index; WC: waist circumference; AC: abdominal circumference; HC: hip circumference; WHR: waist-hip ratio; UI: urinary incontinence; FEPF: Functional evaluation of the pelvic floor.

Moderate and negative correlations were found between anthropometric measures and FEFP (figure 1), showing that the higher the BMI, WC, AC and HC the lower is the muscular strength of the PF of the volunteers with UI.

Figure 1. Association between anthropometric variables and FEFP. (A) negative correlation between BMI (kg/ m2) and FEFP; (B) negative correlation between WC (cm) and FEFP; (C) negative correlation between AC (cm) and FEFP; (D) negative correlation between HC (cm) and FEFP; BMI: Body mass index; WC: waist circumference; AC: abdominal circumference; HC: hip circumference; WHR: waist-hip ratio; UI: urinary incontinence; FEFP: Functional evaluation of the pelvic floor. Pearson's correlation



Discussion

The study highlights as the main findings the predominance of stress UI in the sample and that higher values in the anthropometric measurements, represented lower PF's muscle strength of women with UI. The results revealed the influence of the anthropometric variables on PF's muscular strength of women with UI.

The findings of the research concerning the prevalence of UI typology are in line with other studies such as Khullar et al. (2014)¹⁵ and Benício et al (2016)¹⁶ who investigated the presence and type of UI in a sample similar to the current research. It is worth noting that the higher prevalence of stress UI is also present in different populations^{17,18}. Stress UI is characterized by involuntary loss of urine to increased abdominal

pressure associated with exertion. The main etiology is related to poor functioning of urethral closure and is associated with loss of anatomical support, trauma during vaginal delivery, obesity and situations that repeatedly increase intra-abdominal pressure, affecting 32-64% of the female population^{1,19}. As the increase in abdominal pressure may be directly associated with high BMI and central obesity due to WC and WHR, it presents a continuous pressure on the muscles of the PF²⁰. Therefore, the vesical pressure rises, increasing the mobility of the urethra and bladder neck, thus causing UI symptoms. This rationale reinforces the supposition that stress UI is strongly related to the high values of these measures²¹. Thus, we can hypothesize the presence of this association in our findings, since the volunteers with UI who presented lower strength of the PF are those with higher BMI, AC and HC.

Ritcher et al.²¹ carried out a randomized clinical trial with 650 women with stress UI, where they found a positive association between the severity of stress UI and BMI. Another study evaluating 9,197 nulliparous women highlighted an increase in the prevalence of UI in volunteers with BMI ≥ 35 kg / m² and in older people²². Suskind et al. (2017)²³ found a reduction in stress UI symptomatology with a decrease of $\geq 5\%$ in BMI. Our study stands out because it presents as a differential, the association between the anthropometric measurements of volunteers with UI and FEPP.

Since PFM's are a set of muscles responsible for supporting the pelvic organs and maintaining continence, their strength and coordination are related to the severity of UI⁸. Numerous are the resources used to adequately assess the function, strength and integrity of PFM's, including digital palpation, which identifies muscle strength and weakness and its severity, assisting in the construction of specific exercise programs and to monitor the progress of urological rehabilitation^{24,25}. Therefore, considering the mechanism of abdominal pressure production, the recommendation to reduce circumference measures should be part of UI prevention and treatment programs. Also, it is extremely important to understand the influence of the anthropometric variables on the PF's muscular strength, since it enables the health professional to devise strategies for the management, control, and reduction of UI symptoms, improvement of the quality of life and health promotion.

This study presented as a limitation the small sample size and the lack of the body composition evaluation, through bioimpedance.

Conclusion

Higher values of the anthropometric measures are related to a worse performance in the functional evaluation of the pelvic floor, being possible to affirm that these variables have influence in the pelvic floor's muscle strength.

Authors contribution

All authors have contributed to the conception, design, collection of research data, statistical analysis of data, interpretation of results and writing of the scientific article.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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