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TITLE

INFLUENCE OF VAGINAL BIRTH ON LUMBOPELVIC MUSCLE MECHANICALPROPERTIES ON URINARY INCONTINENCE

RUNNING HEAD

Influence of Vaginal Birth on Lumbopelvic Muscles

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ABSTRACT

Objective: To identify differences in the muscle mechanical properties of the pelvic floor and lumbar paravertebral muscles between young nulliparous and uni/multiparous women. Secondarily, specific behaviors, depending on the presence or absence or UI, were also researched.

Design: Case-control study.

Setting: Higher education institution.

Participants: One hundred young women participated, divided into two groups depending on whether they had vaginal birth (nulliparous or uni/multiparous). Each group included women with and without urinary incontinence.

Main measures: A muscle mechanical properties (tone, stiffness, decrement -inverse of elasticity-, and viscoelastic properties: relaxation and creep) assessment of the pelvic floor and lumbar paravertebral muscles were performed with a hand-held tonometer.

Results: Tone and stiffness of both sides of the pelvic floor presented group by urinary incontinence interaction ($p<0.05$), with uni/multiparous women with urinary incontinence showing higher tone and stiffness compared to multiparous women without urinary incontinence. In lumbar paravertebral muscles, uni/multiparous women showed greater tone and stiffness on the right and left sides [-2.57Hz (95% confidence interval -4.42,-0.72) and -79.74N/m (-143.52,-15.97); -2.20Hz (-3.82,-0.58) and -81.30N/m (-140.66-,21.95), respectively], as well as a decrease in viscoelastic properties compared to nulliparous women [relaxation: 2.88ms (0.31,5.44); creep: 0.15 (0.01,0.30); relaxation: 2.69ms (0.13,5.25); creep: 0.14 (0,0.28), respectively].

Conclusions: Vaginal birth and urinary incontinence have a differential influence on the muscle mechanical properties of the pelvic floor and lumbar paravertebral muscles. The determination of muscle mechanical properties by externally applied hand-held tonometry improves the knowledge of the lumbopelvic status, with applicability in clinical and research fields.

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INFLUENCE OF VAGINAL BIRTH ON LUMBOPELVIC MUSCLE MECHANICALPROPERTIES ON URINARY INCONTINENCE

INTRODUCTION

Vaginal birth and urinary incontinence (UI) are two related processes.[1] Indeed, the number of vaginal births and the type of birth are etiological factors of female UI.[2] Trauma caused by vaginal birth is one of the major contributing factors to the incidence of UI,[3] associated with an increased risk of lower urinary tract symptoms after nine months in primiparous women. In some cases, vaginal birth may lead to chronic UI.[4,5] In addition, the existence of obstetric and neonatal clinical factors such as high birth weight, forceps use and traumatic birth, partially explain the symptomatology of postpartum women,[4] by reducing the force and, among other mechanical properties, increasing the elasticity of the pelvic floor (PF) tissues.[5]

According to data from the International Continence Society, 10% of the female population suffers UI weekly, and between 25%-45% report it regularly.[6] Several types of UI exist: stress UI, which is defined as the involuntary loss of urine through exertion or physical effort, sneezing or coughing; urge UI, which is accompanied by a sudden urge to urinate, preceded or accompanied by urine leakage; and mixed UI, which involves both stress UI and urge UI.[7] Its high prevalence rates, even in young nulliparous women, together with the elevated economic cost and the physical and psychological morbidity associated with the disease, show the needed of more research on female UI.[8]

The pelvic floor muscles (PFM) play an important role in lumbopelvic and trunk stability, and in the preservation of continence.[9] The tissue behavior of the PFM, including tone, biomechanics and viscoelasticity, commonly defined as mechanical muscle properties (MMP), could be relevant to assess the risk of perineal trauma at childbirth, suggesting the potential benefit of incorporating the assessment of MMP in the risk prediction for perineal trauma.[10] However, research on this subject does not provide conclusive data on the effects of gestational stage, childbirth and postpartum for the alteration of the MMP of the PF and lumbar paravertebral (LP) muscles and whether these alterations are related to the existence of UI.[11,12]

Although the assessment of MMP is considered relevant in the clinical settings of different regions, including spinal[13] and PF disorders,[14,15] the previously used methods for muscle assessment have focused exclusively on measuring different types of muscle force[16] and electromyographic activity,[17] or are based on subjective approaches.[18,19] However, valid, reliable, non-invasive, inexpensive, and portable tools, such as hand-held tonometers, are now available to determine MMP, both at PF[20,21] and LP levels.[22,23] Tonometry is based on the application of mechanical impulses to soft biological tissues, with predefined time and pulse force, to record the dynamic tissue response in the form of physical displacement and oscillation acceleration signal. The subsequent computation of parameters characterizes the MMP at rest.[24]

Therefore, our study mainly aimed to identify possible differences in the MMP of the PF and LP muscles between young nulliparous and uni/multiparous women. Secondarily, specific behaviors depending on the presence or absence or UI, were also researched.

METHODS

Design

A cross-sectional descriptive observational study, with non-probabilistic recruitment of consecutive cases, was performed between June 2021 and December 2022. The research was conducted according to the Declaration of Helsinki, the recommendations of the STROBE recommendations, and approved by the Cordoba Research Ethics Committee (reference 4074, 2018). All participants signed an informed consent.

Participants

Uni/multiparous and nulliparous women matched 1:1 by BMI (±3Kg/m^2) were recruited through social networks and flyers at the Faculty of Medicine and Nursing of Cordoba. The following inclusion criteria were applied: for the subgroup of uniparous or multiparous women, having had at least one vaginal birth; for the subgroup of young nulliparous women, not having experienced any vaginal birth. In addition, both groups identified whether each woman had a previous diagnosis of UI of any type, forming two subgroups in each study group, depending on the presence or absence of UI. Women were excluded from the study if they presented: BMI greater than 30kg/m^2; anatomical alterations that prevent the PF evaluation; fecal incontinence, pelvic organ prolapse, any abdominopelvic surgical procedure; having had a cesarean birth(s); menopause; being under medical treatment or seeking medical treatment for UI or any other disease which may interfere with the characteristics of the PF tissues; high level of physical activity according to the Global Physical Activity Questionnaire;[25] scoliosis; as well as any systemic disease that may interfere with the anatomy and physiology of the PF of LP muscles.

To estimate the sample size, a minimum detectable difference of 0.86 Hz and a pooled standard deviation of 1.23 Hz were used for the PF frequency,[20] resulting in a medium effect size (f=0.35). Assuming a power of 0.9 and a significance level of 0.05, for a one-covariate ANCOVA model, the number of subjects needed per subgroup is at least 22 (G*Power 3.1.9.2). The sample was increased by 10% in anticipation of possible data loss.

Procedures

All volunteers were informed of the study procedure and emptied their bladder before the measurement. Sociodemographic data were collected, and two PF health questionnaires were completed (validated Spanish versions). The Pelvic Floor Distress Inventory (PFDI-20) includes 20 questions divided into three parts according to the symptoms: questions 1 to 6, symptoms of genital prolapse (POPDI-6); questions 7 to 14, colorectal-anal symptoms (CRADI-8); and questions 15 to 20, urinary symptoms (UDI-6). Each question shows four levels of dysfunction: not at all, somewhat, moderately, or quite a bit. The minimum score for each block is 0 points (no dysfunction), and the maximum is 100 points (maximum dysfunction). The total score is the sum of the three blocks (maximum score: 300 points); the Pelvic Floor Impact Questionnaire Short Forms (PFIQ-7) includes seven questions about the impact of symptoms on activities, relationships, or feelings about urinary prolapse (UIQ-7), colorectal-anal conditions (CRAIQ-7) and genital conditions (POPIQ-7). Each question has four levels of participation: not at all, somewhat, moderately, or quite a bit. The minimum score for each block is 0 points (no implication), and the maximum is 100 points (maximum implication). The total score is the sum of the three blocks (maximum score: 300 points).[26] A Visual Analog Scale (VAS) was also applied to identify any pain or discomfort due to the measurements.[20]

Afterwards, MMP measurements of the PF and LP muscles were performed bilaterally with a hand-held tonometer (MyotonPRO Myoton AS, Estonia).[27] During the assessment of the MMP of the PF, the volunteers were positioned supine on a table with the knees flexed and the feet resting on the table (modified lithotomy position). The volunteers were instructed to remain relaxed, and if they became tired from remaining in this position, the measurement was stopped. A 100 mm long probe was placed perpendicular to the skin surface, directly over the central core of the perineum (first left and then right), located by visual observation and superficial palpation after contraction of the perineal musculature,[20] and was maintained while the MyotonPRO performed the measurement. The central core of the perineum was the optimal location for obtaining accurate measurements of the external perineal muscles because it contains the most contractile portion of the perineal muscles.[28] For the measurement of the MMP of the LP muscles, the volunteers were placed in prone position, without using any equipment that could stress the evaluated musculature. In this position, the evaluator located the L4 vertebra and subsequently measured the MMP of paravertebral muscles of both sides with a 30 mm long probe, first on the right and then on the left[13] (Figure 1). All measurements were performed during unforced expiratory apnea.[13,28]

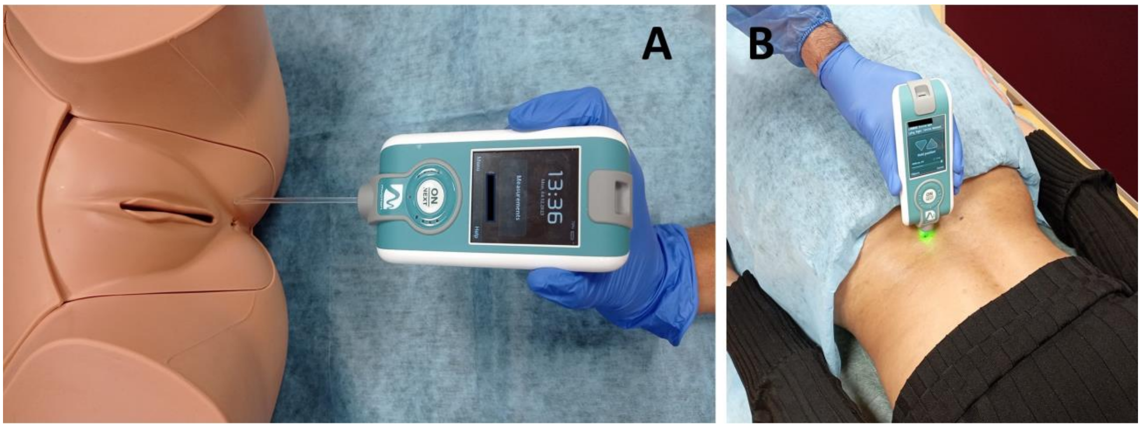

Figure 1. Assessment of the MMPs with MyotonPRO (A) on the left side at PF level (anatomical model) and (B) on the right side at LP level (in vivo).

The MMP recorded in this study included: frequency, measured in Hz, representing the muscle tone at rest (the higher frequency, the higher muscle tone); stiffness, measured in N/m, reflecting the capacity of the muscle to resist contraction or external pressure to deform (the greater stiffness, the greater resistance to deformation); logarithmic decrement of oscillation amplitude, which has no unit, and is a measure of muscle elasticity (the higher decrement, the lower elasticity); and viscoelastic properties: relaxation, measured in ms, describing the phenomenon of stress decrease with time, while the applied strain is constant, considering stress relaxation time as the recovery time for the material to return to its normal state after deformation; and creep, which represents the Deborah number, and is the material property in which progressive deformation occurs with time while applying constant stress.[27]

Statistical analysis

Frequencies and percentages, and mean, standard deviation and 95% confidence intervals (95% CI) were used to describe categorical and quantitative variables, respectively. The normality of the data distribution in the quantitative variables was evaluated using the Kolmogorov-Smirnov test ($p>0.05$, except for the PF questionnaires), and the observation of histograms.

The sociodemographic and clinical variables were compared between groups using the unpaired Student-t test, and the PFDI-20 and PFIQ-7 questionnaires, total and partial scores, were compared using the Mann-Whitney test. The PF and LP MMP were compared with 2x2 ANCOVAs, with age as the covariate, due to the statistical difference identified between groups. The hypothesis of interest was the Group (Nulliparous and Uni/Multiparous) by Incontinence (Presence and Absence) interaction. In the absence of interaction, both main factors were evaluated. The Bonferroni test was applied as a post-hoc test.

The level of significance was $p<0.05$. The data were analyzed with IBM-SPSS, version 28.

RESULTS

Demographics data

One hundred and eighty-seven women were screened for selection; however, 87 were excluded due to at least one exclusion criterion. Fifty nulliparous women and fifty uni/multiparous women were included in each group (Figure 2). Only age showed significant differences ($p<0.01$), with the nulliparous group being younger (37.56 ± 7.68 years) than the uni/multiparous group (42.36 ± 6.15 years). Both groups presented normal BMI values (20-25 Kgm^2). Forty-four percent of nulliparous women and 52% of multiparous women had UI. The stress UI subtype was the most prevalent for both groups (75.0% of all women with UI). No other differences between groups were identified, although uni/multiparous women presented higher values in the PF questionnaires, both for total and partial scores (Table 1).

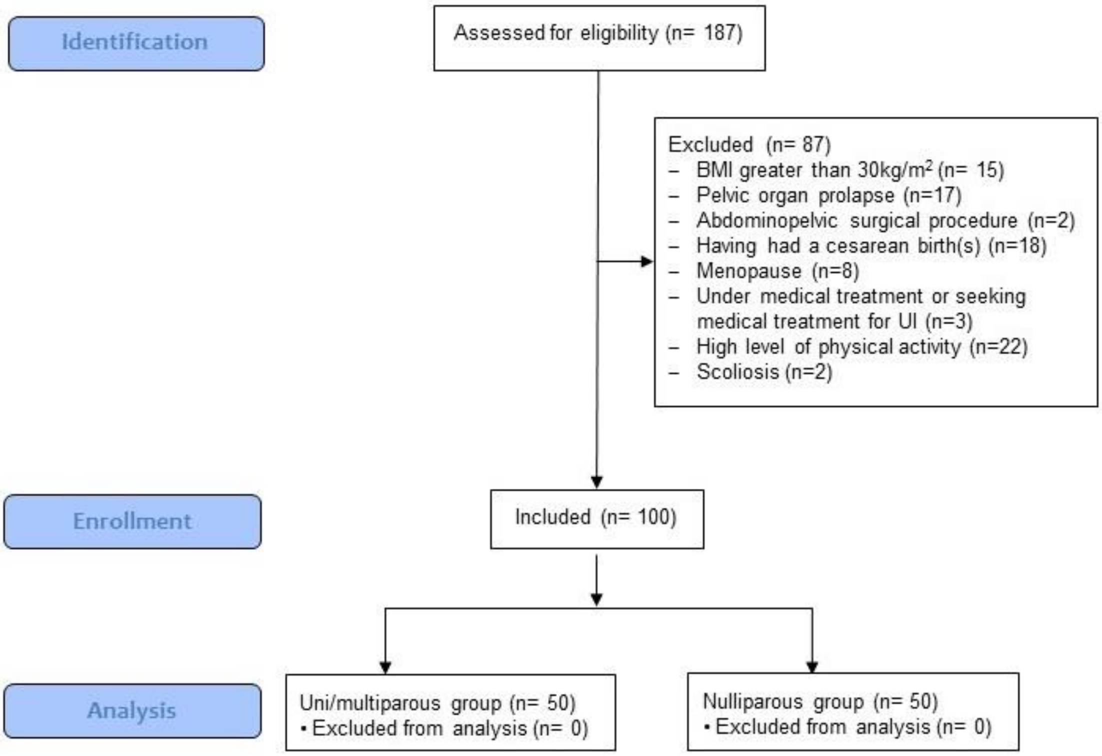

Figure 2: Flow chart of the study.

Lumbopelvic MMP comparisons between groups

All MMP showed significant differences between subgroups on at least one side of the PFM ($p<0.05$). Both frequency and stiffness of both sides showed a Group by Incontinence interaction, with the highest values being observed in the subgroup of uni/multiparous women with UI. Relaxation and creep on the left side also showed interaction ($p=0.01$). However, on the right side, no interaction was found for relaxation and creep, although there was a main factor of incontinence regardless of parity, with lower values observed in women with UI (0.97 ms, 95%CI 0.004, 1.94; 0.05 De, 95%CI

0.01, 0.09, respectively). Concerning the decrement, statistically significant differences were only found on the left side by group as the main factor. The uni/multiparous women group presented lower elasticity than the nulliparous women group (-0.09, 95%CI -0.18, -0.01) (Table 2).

No interaction was found in any of the MMP of the LP muscles. However, all MMP presented group main factor on both sides, independently of the presence or absence of UI, except for the decrement, which showed no differences. Thus, women who had experienced a vaginal birth had higher values, both in the right and left sides, of frequency (-2.57 Hz, 95% CI -4.42, -0.72; -2.20 Hz, 95% CI -3.82, -0.58, respectively) and stiffness (-79.74 N/m, 95% CI -143.52, -15.97; -81.30 N/m, 95% CI -140.66, -21.95, respectively), although with more variability (Table 3). The group of nulliparous women showed higher values for MMP compared to the uni/multiparous group, both on the right and left side, for the variables Relaxation (2.88 ms, 95%CI 0.31, 5.44; 2.69 ms 95%CI 0.13, 5.25, respectively) and creep (0.15 SD, 95%CI 0.01, 0.30; 0.14 SD, 95%CI 0, 0.28, respectively).

DISCUSSION

The results of the present study showed that the MMP of women's PF are different depending on whether they have experienced at least one vaginal birth and the presence of UI. Uni/multiparous women with UI had higher tone and stiffness on both sides of the PF as well as lower viscoelastic properties on the left side compared to uni/multiparous women without UI. In addition, nulliparous women showed more elasticity on the left side of the PF than uniparous/multiparous women. In contrast, the right side of the perineum was more viscoelastic in continent women compared to those with UI. In LP muscles, uniparous/multiparous women had higher tone and stiffness and lower viscoelasticity than nulliparous women, regardless of UI presence. In all cases, the differences found for tone, stiffness and relaxation were greater than the minimum detectable differences established for these regions.[20,29] No participant experienced pain or discomfort during the tests, reinforcing that the protocol is harmless and clinically applicable.

In line with our results, Verelst et al [30] observed an increase in active PF stiffness in women with UI, more pronounced with increasing parity, thus reinforcing the possible influence of vaginal birth and UI on the MMP of the PF. The increased tone and stiffness found in the uni/multiparous women with UI in our study could be explained by a possible altered motor control of the musculature[31,32] and the changes of PF connective tissue secondary to the combination of vaginal birth and UI,[33] which may prevent the generation of sufficient force to maintain continence under stress.[30] It is known that hypertonia (increased muscle tension at rest) can prevent proper sliding of actin and myosin myofilaments, responsible for muscle contraction and relaxation, and hinder the generation of muscle strength and endurance.[31] This could also explain the decrease in relaxation time that usually accompanies other PF dysfunctions with increased tone,[34] a pattern that is also observed in the present study. Therefore, the current data can help to determine what would be considered normal and altered tone at PF level and to support the current evidence regarding the increased tone found in different pelvic health conditions.[14,35]

The decrease in the elasticity of the left side of the perineum found in uni/multiparous women compared to nulliparous women, and in the viscoelastic properties in women with UI, could be due to changes in the mechanical behavior of the PF tissues.[36] Along these lines, the decrease in type III collagen fibers related to the reduction of tissue elasticity [33,37] has been observed in women with stress UI and prolapse, conditions influenced by vaginal birth.[38] In addition, other factors such as episiotomies, instrumental births, obstetric injuries, or the type of birth could explain the asymmetric involvement of the perineal musculature, already observed in healthy uni/multiparous women.[28]

Regarding the MMP of the LP muscles, previous research showed that impaired motor control of the lumbopelvic musculature may be related to the pathophysiology of stress UI. Along these lines, Smith et al. [17] observed that women with stress UI show more significant postural alterations and activity in the trunk and PFM. However, our study only showed increased tone and stiffness, and reduced viscoelasticity, in the LP muscles of women who had experienced at least one vaginal birth, but not in those with UI, thus suggesting that, in the LP muscles, the influence of vaginal birth predominates over the influence of UI, which could be explained by the impairment of the stabilizing mechanisms of the lumbopelvic region during pregnancy and postpartum.[39]

Nonetheless, some limitations should be noted, such as the external validity of the results, which is limited to populations similar to those studied. Also, the tonometric evaluation was always performed in a lying position, and different positions could lead to different results and interpretations.[40] Finally, assessors were not blinded to the individual condition; however, manual tonometry has shown low assessor dependence, which reduces its influence on the results.[41] Longitudinal studies that can determine causal relationships, as well as the study of other factors that may influence lumbopelvic MMP, such as the practice of high-impact exercise or different BMI levels, are required.

To summarize, this study showed that different factors are involved in the status of lumbopelvic MMP. Thus, vaginal birth and the presence of UI influence the MMP of the PF and LP muscles. Whereas the PF of uni/multiparous women with UI exhibits higher tone and stiffness than continent women, with no relevant differences compared to nulliparous women with or without UI, the LP muscles of uni/multiparous women show more tone and stiffness and lower viscoelastic properties than nulliparous women, regardless of whether they suffer from UI. Therefore, determining the MMP by externally applied hand-held tonometry is a valid and harmless method for determining MMP,[22] that improves the knowledge of the lumbopelvic status after vaginal birth in women with and without UI, with applicability in clinical and research fields.

CLINICAL MESSAGES

- Vaginal birth and urinary incontinence are related to changes in lumbopelvic muscle mechanical properties.

- The pelvic floor muscles of uni/multiparous women with urinary incontinence present more rigidity than in continent women.

- The lumbar paravertebral muscles of uni/multiparous women show lower viscoelastic properties compared to nulliparous ones.

- Assessing the muscle mechanical properties of the lumbopelvic region is relevant to improving the management of pelvic floor disorders in clinical settings.

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Conflict of Interest Statement

The Authors declare that there is no conflict of interest.

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Author Contributions

MTG-A participated in data collection and drafting and editing of the paper. IC-M participated in data collection and drafting and editing of the paper. SA-C in analysis and interpretation of data, and revision of the paper. LG-L in analysis and interpretation of data, and revision of the paper. MCC-P in analysis and interpretation of data, and revision of the paper. JLG-C participated in data analysis and revision of the paper. FA-S participated in conception and design of the study, data analysis and drafting and editing of the paper. DPR-S participated in conception and design of the study, data collection and analysis, and drafting and editing of the paper. All authors saw and approved the final version, and no other person made a substantial contribution to the paper.

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TABLES

Table 1. Sociodemographic and clinical data of the study groups.

	Nulliparous Group (n = 50)	Uni/Multiparous Group (n = 50)	p-value
Age (years)	37.56 ± 7.68	42.36 ± 6.15	0.001 †
BMI (Kg/m^2)	22.25 ± 3.00	23.61 ± 4.42	0.075
Types of UI (frequency)	**No UI:** 28; **SUI:** 18; **UUI:** 4; **MUI:** 0	**No UI:** 24; **SUI:** 18; **UUI:** 6; **MUI:** 2	
PFDI-20	24.68 ± 22.28	31.0 ± 37.1	0.290
UDI-6	9.49 ± 10.34	13.16 ± 17.56	0.207
CRADI-8	8.49 ± 12.06	8.37 ± 12.00	0.959
POPDI-6	6.66 ± 8.90	9.66 ± 16.94	0.272
PFIQ-7	11.47 ± 16.45	16.18 ± 29.63	0.331
UIQ-7	8.11 ± 15.77	8.56 ± 15.14	0.884
CRAIQ-7	2.57 ± 5.00	2.09 ± 3.86	0.595
POPIQ-7	0.78 ± 2.25	5.51 ± 19.69	0.097

Values expressed as frequencies, means ± SD. † Significant difference ($p < 0.05$) between the two groups. Abbreviations: BMI: body mass index; CRADI-8: Colorectal–Anal Distress Inventory; CRAIQ-7: Colorectal–Anal Impact Questionnaire; MUI: Mixed urinary incontinence; PFDI-20: Pelvic Floor Distress Inventory; PFIQ-7: Pelvic Floor Impact Questionnaire; POPDI-6: Pelvic Organ Prolapse Distress Inventory; POPIQ-7: Pelvic Organ Prolapse Impact Questionnaire; SUI: Stress urinary incontinence; UDI-6: Urinary Distress Inventory; UIQ-7: Urinary Impact Questionnaire; UI: Urinary incontinence; UUI: urge urinary incontinence.

Table 2. Differences in the MMP of the PFM between groups according to continence status.

			Nulliparous Group (n = 50)	Uni/Multiparous Group (n = 50)	Mean difference (95%CI)
Frequency (Hz)	Right side	UI	15.03 ± 0.74	16.11 ± 2.64	-0.71 (-1.86, 0.34)
		No UI	15.52 ± 2.06	14.77 ± 1.79	0.96 (-0.19, 2.11)
		Mean difference (95%CI)	-0.33 (-1.46, 0.80)	**-1.34 (-2.45, -0.23) †**	
	Left side	UI	15.10 ± 1.00	16.37 ± 2.90	**-1.27 (-2.41, -0.14) †**
		No UI	15.56 ± 1.94	14.51 ± 1.09	1.02 (-0.11, 2.16)
		Mean Difference (95%CI)	0.44 (-0.67, 1.56)	**-1.86 (-2.95, -0.76) †**	
Stiffness (N/m)	Right side	UI	231.91 ± 38.31	255.69 ± 91.69	-19.27 (-55.51, 16,96)
		No UI	233.00 ± 54.45	212.42 ± 51.53	31.06 (-5.33, 67.46)
		Mean difference (95%CI)	6.88 (-29.00, 42,76)	**-43.45 (-78,52, -8.38) †**	
	Left side	UI	225.18 ± 39.80	252.15 ± 95.83	-25.89 (-62.56, 10.77)
		No UI	232.36 ± 55.94	202.33 ± 37.34	32.51 (-4.31, 69.35)
		Mean difference (95%CI)	8.55 (-27.75, 44,86)	**-49.86 (-85.34, -14.37) †**	
Decrement (Ø)	Right side	UI	1.06 ± 0.22	1.13 ± 0.17	-0.06 (-0.18, 0.05)
		No UI	1.07 ± 0.24	1.04 ± 0.11	0.02 (-0.09, 0.14)
		Mean difference (95%CI)	0.004 (-0.11, 012)	-0.08 (-0.20, 0.02)	
	Left side	UI	1.00 ± 0.15	1.14 ± 0.23	**-0.15, (-0.27, -0.04) †**
		No UI	1.10 ± 0.25	1.10 ± 0.13	-0.03 (-0.15, 0.08)
		Mean difference (95%CI)	0.08 (-0.03, 0.19)	-0.04 (-0.15, 0.07)	
Relaxation (ms)	Right side	UI	17.48 ± 0.96	17.23 ± 3.15	0.16 (-1.24, 1.57)
		No UI	18.14 ± 2.62	18.61 ± 2.19	-0.66 (-2.08, 0.75)
		Mean difference (95%CI)	0.55 (-0.84, 1.95)	**1.38 (0.02, 2.75) †**	
	Left side	UI	17.50 ± 1.20	16.69 ± 2.82	0.82 (-0.44, 2.09)
		No UI	17.40 ± 2.34	18.73 ± 1.83	**-1.30 (-2.58, -0.02) †**
		Mean difference (95%CI)	-0.09 (-1.35, 1,17)	**2.04 (0.80, 3.27) †**	
Creep (De)	Right side	UI	0.96 ± 0.05	0.95 ± 0.13	0.02 (-0.04, 0.08)
		No UI	1.01 ± 0.11	1.00 ± 0.09	0.01 (-0.04, 0.07)
		Mean difference (95%CI)	0.05(-0.01, 0.11)	0.05 (-0.005, 0.11)	
	Left side	UI	0.95 ± 0.06	0.89 ± 0.08	**0.06 (0.01, 0.12) †**
		No UI	0.94 ± 0.11	1.00 ± 0.11	-0.03 (-0.09, 0.02)
		Mean difference (95%CI)	0.00 (-0.05,0.05)	**0.10 (0.04, 0.15) †**	

Values expressed as means ±SD. † Significant difference ($p<0.05$) between measurements. Abbreviations: 95%CI, 95% confidence interval; UI: urinary incontinence.

Table 3. Differences in MMP of LP muscles between groups according to continence status.

			Nulliparous Group (*n* = 50)	Uni/Multiparous Group (*n* = 50)	Mean Difference (95%CI)
Frequency (Hz)	**Right side**	**UI**	14.59 ± 3.10	17.16 ± 4.63	-2.27 (-4.81, 0.27)
		No UI	15.13 ± 3.56	18.72 ± 5.90	**-2.87 (-5.43, -0.31) †**
		Mean difference (95%CI)	0.93 (-1.58, 3.46)	1.54 (-0.92, 4.00)	
	Left side	**UI**	15.02 ± 2.69	17.80 ± 5.58	**-2.52 (-4.76, -0.29) †**
		No UI	15.24 ± 2.75	17.69 ± 3.65	-1.87 (-4.12, 0.37)
		Mean difference (95%CI)	0.53 (-1.68, 2.74)	-0.11 (-2.28, 2.04)	
Stiffness (N/m)	**Right side**	**UI**	269.91 ± 96.89	344.69 ± 160,34	-64,27 (-152.31, 23.75)
		No UI	300,21 ± 123.14	419.83 ± 208,53	**-95,21 (-183.64, -6.79) †**
		Mean difference (95%CI)	43.78 (-43.38, 130.96)	74.72 (-10.46, 156.91)	
	Left side	**UI**	285.09 ± 104.93	384.23 ± 206.81	**-89.41 (-171.35, -7.47) †**
		No UI	294.71 ± 97.46	390.50 ± 130.42	-73.20 (-155.50, 9.10)
		Mean difference (95%CI)	22.10 (-59.03, 103.24)	5.88 (-73.40, 85.17)	
Decrement (Ø)	**Right side**	**UI**	1.24 ± 0.32	1.31 ± 0.23	-0.04 (-0.20, 0.12)
		No UI	1.35 ± 0.26	1.40 ± 0.34	0.008 (-0.15, 0.17)
		Mean difference (95%CI)	0.13 (-0.03, 0.30)	0.08 (-0.07, 0.24)	
	Left side	**UI**	1.24 ± 0.29	1.34 ± 0.23	-0.07 (-0.22, 0.08)
		No UI	1.27 ± 0.24	1.47 ± 0.30	-0.14 (-0.30, 0.01)
		Mean difference (95%CI)	0.06 (-0.09, 0.21)	0.12 (-0.02, 0.27)	
Relaxation (ms)	**Right side**	**UI**	20.13 ± 5.52	17.85 ± 6.02	1.78 (-1.75, 5.31)
		No UI	20.37 ± 6.74	15.22 ± 6.26	**3.98 (0.43, 7.54) †**
		Mean difference (95%CI)	-0.40 (-3.90, 3.10)	-2.60 (-6.03, 0.81)	
	Left side	**UI**	19.36 ± 5.05	14.97 ± 4.82	1.66 (-1.87, 5.19)
		No UI	19.90 ± 6.66	17.18 ± 7.49	**3.72 (0.17, 7.27) †**
		Mean difference (95%CI)	-0.12 (-3.62, 3.36)	-2.18 (-5.60, 1.22)	
Creep (De)	**Right side**	**UI**	1.18 ± 0.30	1.10 ± 0.33	0.06 (-0.13, 0.26)
		No UI	1.24 ± 0.38	0.95 ± 0.35	**0.24 (0.04, 0.44) †**
		Mean difference (95%CI)	0.03 (-0.16, 0.22)	-0.14 (-0.34, 0.04)	
	Left side	**UI**	1.15 ± 0.25	1.05 ± 0.42	0.07 (-0.12, 0.27)
		No UI	1.20 ±0.37	0.93 ± 0.27	**0.21 (0.01, 0.41) †**
		Mean difference (95%CI)	0.01 (-0.17, 0.21)	-0.12 (-0.31, 0.06)	

Values expressed as means±SD. † Significant difference ($p<0.05$) between measurements. Abbreviations: 95%CI, 95% confidence interval; UI: urinary incontinence.