DOI:10.2478/tperj-2020-0014

Efficacy of pelvic floor muscle training in improving symptoms of urinary incontinence and health related quality of life among parous and nulliparous women

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Abstract

Objectives: To compare pelvic floor muscle strength, severity of urinary incontinence symptoms and health related quality of life between parous and nulliparous women; and to investigate the efficacy of pelvic floor muscle training in improving symptoms of urinary incontinence and health related quality of life in the previously mentioned two groups**.** *Materials and methods:* Initially, 67 women were included in the study. Pelvic floor muscle strength and endurance were evaluated pre-treatment using the Pelvic floor exerciser. Participants were assessed before and after 10 weeks of pelvic floor muscle training by using The International Consultation of Incontinence Questionnaire – Short Form for symptoms severity, and The King's Health Questionnaire for health related quality of life. *Results***:** The final sample included 32 participants: sixteen parous and sixteen nulliparous women between 18 and 50 years of age. Before the intervention, parous women (75%) were 2 times more likely to report urinary incontinence than nulliparous women (37.5%). They also had significantly lower pelvic floor muscle strength (p=.001), pelvic floor muscle endurance (p=.001), and more severe symptoms related to urinary incontinence (p=.009). Additionally, parous women had poorer disease specific quality of life in all domains. After the intervention, symptoms severity scores decreased significantly among both parous (p=.007) and nulliparous women (p=.038). Regarding quality of life, both groups had major improvements in all domains. *Conclusions***:** Our results suggest that urinary incontinence is more common among parous women. They experience more severe symptoms and have lower health related quality of life. Additionally, pelvic floor muscle training seems to be effective for improving symptoms of urinary incontinence and health related quality of life among both parous and nulliparous women.

Key words*: pelvic floor muscle strength, urinary leakage, pelvic floor exercise, impact of urinary incontinence on daily life.*

Rezumat

*Obiective***:** Compararea forţei musculaturii planşeului pelvian, a severităţii simptomelor de incontinenţă urinară şi indici ai calităţii vieţii la femeile cu sarcini multiple versus nulipare. De asemenea, ne-am propus să investigăm eficacitatea unui antrenament de tonifiere al musculaturii planşeului pelvian în îmbunătăţirea simptomelor incontinenţei urinare şi a calităţii vieţii legate de sănătate în cele două grupuri menţionate anterior. *Materiale şi metode*: Iniţial, 67 de femei au fost incluse în studiu. Forţa şi rezistenţa musculaturii planşeului pelvian au fost evaluate înaintea tratamentului folosind instrumentul PFX (Pelvic Floor Exerciser). Participanţii au fost evaluaţi înaintea intervenţiei şi după 10 săptămâni de antrenament a muşchilor pelvisului folosind următoarele chestionare The International Consultation of Incontinence Questionnaire – Short Form for symptoms severity şi chestionarul The King's Health Questionnaire for health related quality of life**.** *Rezultate*: Eşantionul final a inclus 32 de participanţi: 16 femei cu sarcini multiple şi 16 femei nulipare între 18 şi 50 de ani. Înainte de intervenţie, femeile cu sarcini multiple (75%) raportau de 2 ori mai multe simptome ale incontinenţei urinare, decât femeile nulipare (37,5%). Au avut, de asemenea, o forţă musculară a planşeului pelvian semnificativ mai scăzută (p = .001), rezistenţa musculară a planşeului pelvian (p = .001) şi simptome mai severe legate de incontinenţa urinară (p = .009). În plus, femeile cu sarcini multiple au avut o calitate a vieţii specifică bolii mai slabă în toate domeniile. După intervenţie, scorurile de severitate ale simptomelor au scăzut semnificativ atât la femeile cu sarcini multiple (p = .007), cât şi la femeile nulipare (p = .038). În

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ceea ce privește calitatea vieții, ambele grupuri au avut îmbunătățiri majore în toate domeniile. *Concluzii:* Aceste rezultate sugerează că incontinența urinară este mai frecventă la femeile cu sarcini multiple. Acestea au simptome mai severe și au o calitate a vieții mai scăzută. În plus, antrenamentul muscular al planșeului pelvian pare să fie eficient pentru îmbunătățirea simptomelor incontinenței urinare și a calității vieții legate de sănătate atât la femeile cu sarcini multiple, cât și la cele nulipare.

Cuvinte cheie*: forța musculară a planșeului pelvian, scurgeri urinare, exerciții de planșeu pelvian, impactul incontinenței urinare asupra vieții de zi cu zi.*

Introduction

Urinary incontinence (UI) is one of the most common pelvic floor dysfunction, affecting women of all ages [1]. According to the definition suggested by the International Urogynecological Association (IUGA), urinary incontinence is the "complaint of involuntary loss of urine" [2]. There are three main forms of urinary incontinence which are defined by their symptoms [3]. Stress urinary incontinence (SUI) is defined as the "involuntary loss of urine on effort or physical exertion (e.g. sporting activities), or on sneezing or coughing" [1]. SUI is often related to weakened pelvic floor muscles [4]. Urgency urinary incontinence (UUI) is described as the uncontrolled leakage of urine associated with urgency. In the case of mixed UI (MUI) symptoms of both SUI and UUI occur [1].

A precise estimation of the true prevalence of urinary incontinence is difficult to determine owing to variation across studies resulting from methodological differences. A systematic review of 36 studies reported a prevalence of „any" UI in women ranging from 5% to 69%, with most studies within 25-45% [5]. Given the current demographic assumptions, the number of American women with UI is estimated to increase by more than 50% in the following decades [6]. The most frequent type of UI is stress urinary incontinence, which accounts for almost half of all cases with prevalence varying from 10% to 39%. MUI is the next most common type, with 7.5-25% prevalence, followed by UUI with most studies indicating 1-7% prevalence [3]. Even though urinary incontinence is not a life-threatening medical disorder, the symptoms can have a serious negative effect on daily activities, to a degree that is similar to chronic medical conditions [7-8]. Moreover, UI has a major negative impact on physical, psychological and social well-being [9].

Pregnancy and childbirth often contribute to decreased pelvic muscle strength and urinary incontinence owing to mechanical and/or hormonal changes. Vaginal delivery is suggested to be the main cause, due to potential injury to muscles, connective tissue and nerves in the pelvic area [10-11]. Compared to the nulliparous state, cesarean section appears to increase the risk of UI too; however, not as much as vaginal delivery [10]. Other delivery parameters may also contribute to an increased risk of UI: length of the active second stage of labor longer than an hour [12], high birth weight (4000 g or greater) [13], instrumental delivery [14] and multiparity [15-16]. During pregnancy, more than 50% of women report UI [17], which may persist after childbirth for years [18-19]. Parity seems to have the largest effect on UI in younger women [20].

The high prevalence of UI among nulliparous women implies that other risk factors, besides pregnancy and childbirth, are also important [21]. The pelvic floor muscles tend to weaken and overstretch due to normal ageing, which may lead to an insufficient support of the urethra. Therefore, advancing age is a powerful predictor of UI [22]. Obesity is another major risk factor related to UI [23], whereas weight normalization might reduce its symptoms [24]. Other possible risk factors linked to UI include: race, previous pelvic floor surgery, smoking, chronic cough [22], high impact exercise [25], constipation [26], menopause [27], athletic performance [29], work involving physical strain [30] and connective tissue weakening [31].

Pelvic floor muscle training (PFMT) has been recommended to be the first-line treatment for improving the symptoms of UI and health related quality of life (QoL) of women experiencing urinary incontinence [32, 5]. PFMT is aimed to improve the strength, endurance, flexibility, motor control and relaxation of the pelvic floor muscles [33].

The purpose of the present study was to compare pelvic floor muscle strength, severity of UI symptoms and health related QoL between parous and nulliparous women. Moreover, we aimed to investigate the efficacy of pelvic floor muscle training in improving symptoms of UI and health related QoL in the two previously mentioned groups.

Materials and Methods

The present study was conducted from November 2019 to April 2020, following a one-group pretest-posttest pre-experimental design.

A nonprobability sampling technique was used to select participants. The inclusion criteria were: women between the age of 18 and 50, ability to contract the PFMs correctly, willing to complete the given PFMT intervention, providing medical record that proves the subject does not suffer from pelvic organ prolapse (POP) and practicing PFMT for the

first time. The following criteria were used for exclusion: pelvic pain, pregnancy, malignant tumors of the pelvic floor, neurological disorders associated with muscle weakness and medical conditions accompanied by fever. Among the 67 women initially included, 6 women were more than 50 years old, 12 women were unwilling to participate in the PFMT program, 4 women had POP and 3 women were unable to contract the pelvic muscles. Therefore, 42 women who met all our inclusion and exclusion criteria were included in the sample. Each participant gave her informed consent in writing.

At the beginning, each subject was asked to fill out a questionnaire to identify socio-demographic and anthropometric characteristics (age, weight, height, educational level and location), possible risk factors associated with UI (pregnancy, childbirth, elevated body-mass index, constipation, smoking, chronic cough, previous pelvic surgery, work involving physical strain, athletic performance), and data related to pregnancy and childbirth (number of deliveries, types of delivery, birth weight of the infant).

The International Consultation of Incontinence Questionnaire – Short Form (ICIQ-SF) was used to gather information about the symptoms of UI. The questionnaire contains 6 questions: birth date, gender, frequency of UI, leakage amount, type of UI and impact of UI. The total score can range from 0 to 21, with higher scores suggesting greater severity of symptoms [34].

The King's Health Questionnaire (KHQ) was used to measure the impact of UI on the subject's health related quality of life. This disease-specific questionnaire assesses QoL in nine different domains of life. Each domain is scored separately ranging from 0 (best QoL) to 100 (worst QoL) [35].

The maximal strength and endurance of the pelvic floor muscles were measured using a vaginal perineometer (PFX Pelvic floor exerciser, Cardio Design Pty Ltd., Australia). The results are expressed in units using an arbitrary scale from 0 to 12 kilo Pascal (kPa), higher scores indicate stronger PFM. The reliability of the perineometer was investigated by Isherwood and Rane by the comparison of outcomes with palpation test using the Modified Oxford Grading Scale. According to their findings, the PFX perineometer has high reliability with a kappa value of 0.73 [36]. The assessment was performed in dorsal position with knees flexed. The silicone probe coated by a sterile lubricated condom was placed in the vaginal canal. A new probe cover was used for each participant. After zeroing the device, the subjects were asked to contract (pull in) the PFMs using a maximum degree of effort and to hold the contraction for 10 seconds. The highest value was recorded as maximal strength, whereas the value shown after 10 seconds was used as a measure of endurance. To ensure that the contraction of the PFMs is executed correctly, the movement of the probe [37] and the visible or palpable contraction of synergistic muscles were monitored [38]. All assessments were performed by the same physiotherapist.

Intervention

The intervention lasted from 27 January 2020 to 5 April. The participants followed a specially designed PFMT program for 10 weeks. They exercised twice a day for 15 minutes. Each PFMT session started with a warm-up including exercises that improve blood circulation and breathing exercises. During the first five weeks, the subjects performed the PFM exercises in lying position. After that, they exercised in sitting and standing positions. The main training session consisted of different types of exercise: maximum voluntary contractions, fast contractions, sustained maximal voluntary contractions and gradually strengthening exercises. The aim of each PFM contraction was to lift the perineum inwards and to squeeze around the pelvic openings [39]. On average, each set of exercise consisted of 10 repetitions. The holding time of the sustained contraction was about 5 seconds at first, and then gradually increased up to 10 seconds, followed by 5 seconds of rest. The training session ended with PFM relaxation exercises including diaphragmatic deep breathing exercises.

Statistical analyses

All statistical analyses were carried out with SPSS version 25.0 (SPSS Inc., Chicago, Illinois, USA). The level of statistical significance was set at $p<0.05$. Descriptive statistics were used to present the data (mean, standard deviation, percentage). The distribution of continuous data was evaluated for normality by using the Shapiro-Wilk test. The Pearson product-moment correlation test was

conducted to evaluate the association between variables. The background characteristics were compared between parous and nulliparous women by using the independent sample t-test, Mann-Whitney U test and the Pearson's chi square test of association. To compare the pelvic floor muscle strength and endurance between the two groups, the Mann-Whitney U test and the independent samples t-test were conducted, respectively. The Mann-Whitney U test was used to compare ICIQ-SF and KHQ scores between parous and nulliparous women. The baseline-to-post intervention changes in ICIQ-SF and KHQ scores were evaluated through the Wilcoxon signed rank test.

Results

Initially, a total of 42 women were enrolled in the study, however, 10 did not complete the PFMT program due to personal reasons. Therefore, 32 women were included in the final sample. Out of the 32 participants, 16 (50%) were nulliparous and 16 (50%) were parous. The background characteristics of the two groups are summarized in Table I, whereas the obstetric characteristics of parous women are shown in Table II. No significant differences were found between the nulliparous and parous group regarding background characteristics.

Table I. Background characteristics of parous and nulliparous women

	Parous (n=16)	Nulliparous (n=16)	p-value
Age (mean±SD; years)	38.75 ±8.35	36.63 ±7.70	.460
BMI (mean±SD; kg/m^2)	24.32 ±6.08	22.36 ±3.70	.429
Normal or underweight; n(%)	11 (68.75%)	12 (75%)	.694
Overweight or obese; n(%)	5 (31.25%)	4 (25%)	.694

Table II. Obstetric characteristics of parous women

	Parous (n=16)
Number of deliveries; n(%)	-
One	10 (62.50%)
Two	6 (37.5%)
Type of delivery; n(%)	-
Vaginal	16 (100%)
C-section	0 (0%)
Use of Forceps or Vacuum; n(%)	4 (25%)
Birth weight greater than 4000 g; n(%)	4 (25%)

Before the intervention, parous women had significantly lower PFM strength compared to nulliparous women (U=26, p=.001). Likewise, the PFM endurance was significantly lower among parous woman (t(30)=-5.373, p=.001). The PFM strength and endurance of the two groups are shown in Table III. Unfortunately, we did not have the opportunity to measure PFM strength and endurance after the intervention due to the lockdown related to the Covid-19 pandemic.

Table III. Pelvic floor muscle strength and endurance of parous and nulliparous women.

	Parous (n=16)	Nulliparous (n=16)	p-value
PFM strength (mean±SD; kPa)	4.40±1.92	8.06±2.52	**.001**
PFM endurance (mean±SD; kPa)	2.59±1.99	6.87±2.48	**.001**

ICIQ-SF outcomes

Comparison between groups

Before the PFMT program, the prevalence of UI was 2 times higher for parous women than nulliparous women. The most frequent type was SUI, half of the

parous and almost one third of the nulliparous women presented its symptoms. Besides SUI, 25 percent of the parous and 6.25 percent of th enulliparous women had symptoms of MUI. Among nulliparous women, a moderate, positive correlation was found between the total score of ICIQ-SF and age, which was statistically significant (r=.501, n=16, p=.048). A moderate, positive correlation was observed between the total score of ICIQ-SF and age among parous women too; however, it was not significant (r=.446, n=16, p=.084). The total score of ICIQ-SF before the intervention was significantly higher among parous women (4.37±3.05) compared to nulliparous women (1.68±2.30), (U=62.5, p=.009).

After the intervention, when comparing the total score of ICIQ-SF between parous and nulliparous women, we found that parous women still had a significantly higher ICIQ-SF total score (U=62, p=.007).

Intra-group comparison

After the PFMT program, the number of women presenting symptoms of UI declined post-intervention from 75 percent to 56.25 percent among parous women and 37.5 percent to 18.75 percent among nulliparous women. The total score of ICIQ-SF significantly decreased postintervention from 4.37±3.05 to 3.06±2.35 among parous women (Z=-2.682, p=.007). Similarly, significant decline was found in the total score of ICIQ-SF among nulliparous women (Z=-2.070, p=.038). The baseline-to-postintervention changes in ICIQ-SF scores are shown in Table IV.

Table IV. Baseline-to-postintervention changes in ICIQ-SF scores.

	Parous (n=16)			**Nulliparous (n=16)**		
	Baseline	Postintervention		Baseline	Postintervention	
Prevalence of UI; n(%)	12 (75%)	9 (56.25%)		6 (37.5%)	3 (18.75%)	
Type of UI; n(%)						
SUI	8 (50%)	6 (37.5%)		5 (31.25%)	2 (12.50%)	
MUI	4 (25%)	3 (18.75%)		1 (6.25%)	1 (6.25%)	
	Baseline	Postintervention	p-value	Baseline	Postintervention	p-value
Frequency of UI	0.87±0.61	0.56±0.51	**.025**	0.37±0.50	0.18±0.40	.083
Amount of urine leakage	1.50±0.89	1.12±1.02	.083	0.75±1.00	0.37±0.80	.083
Impact in QoL	2.00±1.82	1.37 ±1.14	**.026**	0.62±0.95	0.18 ±0.54	**.020**
Total score of ICIQ-SF	4.37±3.05	3.06 ±2.35	**.007**	1.68±2.30	1.00±1.82	**.038**

KHQ outcomes

Comparison between groups

Before the PFMT program, we observed that parous women had higher scores than nulliparous women for all the KHQ domains. Differences were significant in the following domains: Incontinence impact (Z=-2.230, p=.026); Role limitations (Z=-2.522, p=.012); Physical limitations (Z=-2.424, p=.015); Emotions (Z=-2.234, p=.025) and Severity measures (Z=-2.603, p=.009). When we compared the two groups again after the PFMT program, we found significant differences in two domains: Incontinence impact (Z=-2.564, p=.010) and Physical limitations (Z=-2.516, p=.012).

Intra-group comparison

Among parous women, six domains decreased significantly after the PFMT program. The other three domains also decreased; however, these changes were not statistically significant. Among nulliparous women, two domains decreased significantly after the intervention. The baseline-to-postintervention comparison of KHQ scores are shown in Table V.

Table V. Baseline-to-postintervention comparison of KHQ scores.

	Parous (n=16)			Nulliparous (n=16)		
KHQ domain	Baseline	Postintervention	p-value	Baseline	Postintervention	p-value
General health perceptions	15.62±22.12	10.93±15.72	.083	12.50±12.90	10.93±12.80	.317
Incontinence impact	35.41±28.46	18.75±17.07	**.016**	14.50±20.97	4.16±11.38	**.034**
Role limitations	16.66±16.10	4.16±7.45	**.004**	4.16±9.62	1.04±4.16	.180
Physical limitations	23.95±22.74	9.30 ±10.48	**.011**	6.25±11.97	2.08±8.33	.102
Social limitations	4.16±8.95	0.69±2.77	.066	2.08±8.33	2.08±8.33	1.000
Personal relationships	9.37±13.56	1.04±4.16	**.038**	5.20±11.73	3.12±9.06	.317
Emotions	15.27±12.74	3.47 ±8.81	**.002**	6.25±10.71	0.69±2.77	**.038**
Sleep/energy	11.45±17.96	6.25±10.31	0.102	5.20±11.73	3.12±9.06	.317
Severity measures	19.16±18.99	5.83±7.25	**.005**	5.41±10.67	1.66±4.55	.066

Discussion

Before the intervention, we found that parous women had significantly lower pelvic floor muscle strength than nulliparous women. These findings concur well with results from a few previous studies. In the study of Baytur et al. [40], Baytur et al. [41] and Sigurdardottir et al. [42], women with vaginal birth had significantly lower pelvic floor muscle strength compared to nulliparous women. In contrast, the results of [43] do not seem to confirm our observations. They found that women with normal vaginal delivery had almost as strong pelvic floor muscles as nulliparous women. The cause of this discrepancy might be that parous women in the study of [43] had vaginal birth only without episiotomy, whereas in our study, birth with episiotomy was not excluded. Episiotomy might be related to lower pelvic floor muscle strength due to damage to the PFMs and the pudendal nerve [44].

Before the pelvic floor muscle training program, parous women were 2 times more likely to report UI than nulliparous women. Moreover, our results indicate that not only the prevalence of urinary incontinence is higher but the symptoms related to UI are more severe among parous women than nulliparous women. These findings are in line with the results of Rortveit et al. [10]. They examined the prevalence of UI in 3.068 nulliparous and parous women and found that women with vaginal birth were 1.7 more likely to report UI compared to nulliparous women. In the study of Hansen et al. [45], the prevalence of UI was 2.5 times higher among parous women; yet, the severity of UI symptoms measured with ICIQ-SF was similar in both groups. These data are not in line with our findings. The foremost reason for this contradictory result might be that in our study, the parous group consisted only of women with vaginal birth, whereas in the study of Hansen et al. [45], women with vaginal birth and with cesarean section were included too. Rortveit et al. [21] found that parity is significantly and strongly associated with SUI and MUI; however, it did not seem to impact the severity of urinary incontinence. It is important to note that they used a severity index created by Sandvik et al. [46] to measure the severity of UI, which differs from the method used in our study.

After the intervention, both parous and nulliparous women had significant decreases in the total score of ICIQ-SF, suggesting a major improvement in

symptoms of UI. These results are in line with the findings of Vaz et al. [47] and Sigurdardottir et al. [48]. In Vaz et al.'s study, the pelvic floor muscle training program lasted for 12 weeks, consisted of daily exercises and was performed either at home or in a health center. They found that PFMT was effective in improving symptoms of urinary incontinence for both treatment settings (home and health center). In the study of Sigurdardottir [48], 84 parous women were included: 41 in the control group and 43 in the intervention group. The pelvic floor exercise program lasted for 12 weeks and resulted in a significant improvement in the symptoms of UI and related bother. On the contrary, Hilde et al.'s [49] results disprove our observations. 175 parous women were enrolled in their study: 87 in the intervention group and 88 in the control group. Subjects were taught to perform correct pelvic floor muscle contractions before the intervention. The exercise program lasted for 16 weeks and consisted of weekly supervised PFMT classes and unsupervised daily home exercises. According to Hilde et al.'s findings, pelvic floor muscle training did not improve symptoms of urinary incontinence among parous women. The reason for this rather contradictory result could be attributed to the fact that in the study of Hilde et al. more parous women had major levator ani defect compared to parous women from a general population.

Before the intervention, parous women had higher scores than nulliparous women for all the KHQ domains, suggesting worse health related quality of life. Differences were significant in six domains. After the PFMT program, significant differences were found in only two domains. These findings indicate that the major gap observed before the intervention in health related QoL between parous and nulliparous women diminished after the PFMT program.

After the intervention, we found significant improvement in six domains among parous women. Our results have been found to be similar to Hirakawa et al. [50] findings. After the 12-week pelvic floor muscle training program, they observed improved quality of life in all domains of KHQ; however, significant differences were not found in the following domains: general health, personal relationships, social limitations and sleep/energy. Our findings revealed substantial improvement in all domains, except for general health, social limitations and sleep/energy. In the study of Pandey et al. [51], significant improvement was observed in all KHQ domains among parous women after the PFMT program. Among nulliparous women, two domains improved significantly post-intervention in our study: incontinence impact and emotions, whereas in the study of Nascimento-Correia et al. [52] the following domains improved significantly: incontinence impact, role limitation, sleep/energy and severity measure.

Limitations

The present study does not have a control group, the sample size is small and an unsupervised exercise program is used. Additionally, the symptoms of UI were self-reported. Although the questionnaire we used (ICIQ-SF) was validated and reliable, a more objective method (pad test, urodynamic test) could have been used to measure the amount of urine leakage.

Conclusions

The results of the present study revealed that parous women were 2 times more likely to report urinary incontinence than nulliparous women. They also had lower pelvic floor muscle strength, more severe symptoms related to urinary incontinence, and lower disease specific quality of life. Additionally, our findings suggest that pelvic floor muscle training is an effective conservative treatment option for improving symptoms of urinary incontinence and health related quality of life among parous and nulliparous women.

Conflicts of interest: The authors report no conflicts of interest.

References

1. Irwin D. E., Kopp Z. S., Agatep B., Milsom I., & Abrams P. (2011). *Worldwide prevalence estimates of lower urinary tract symptoms, overactive bladder, urinary incontinence and bladder outlet obstruction.* BJU International, 108(7), 1132–1138.
2. Haylen B. T., De Ridder D., Freeman R. M., Swift S. E., Berghmans B., Lee J., Monga A., Petri E., Rizk D. E., Sand P. K., & Schaer G. N. (2010). *An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction.* International Urogynecology Journal, 21(1), 5–

26.
3. Milsom I., Altman D., Cartwrights R., Lapitan M. C., Nelson R., Sillén U., & Tikkinen K. (2013). *Epidemiology of Urinary Incontinence (UI) and other Lower Urinary Tract Symptoms (LUTS), Pelvic Organ Prolapse (POP) and Anal Incontinence (AL). In P.Abrams, L.Cardozo, S. Khoury, &A. J. Wein (Eds.),* Incontinence: 5th International Consultation on Incontinence, Paris, february 2012 (5th ed ed., pp. 15–107). Paris: ICUD-EAU.
4. Long R. M., Giri S. K., & Flood H. D. (2008). *Current concepts in female stress urinary incontinence.* Surgeon, 6(6), 366–372.
5. Buckley B. S., & Lapitan M. C. M. (2010). *Prevalence of urinary incontinence in men, women, and children-current evidence: Findings of the fourth international consultation on incontinence.* Urology, 76(2), 265–270.
6. Wu J. M., Hundley A. F., Fulton R. G., & Myers E. R. (2009). *Forecasting the prevalence of pelvic floor disorders in U.S. women: 2010 to 2050*. Obstetrics and Gynecology, 114(6), 1278–1283.
7. Ptak M., Brodowska A., Ciećwież S., & Rotter I. (2017). *Quality of life in women with stage 1 stress urinary incontinence after application of conservative treatment—a randomized trial.* International Journal of Environmental Research and Public Health, 14(6), 1–10.
8. Schultz S. E., & Kopec J. A. (2003). *Impact of chronic conditions.* Health Reports, 14(4), 41–53.
9. Goforth J., & Langaker M. (2016). *Urinary Incontinence in Women.* North Carolina Medical Journal, 77(6), 423–425.
10. Rortveit G., Daltveit A. K., Hannestad Y. S., & Hunskaar S. (2003a). *Urinary incontinence after vaginal delivery or cesarean section.* New England Journal of Medicine, 348(10), 900–907.
11. Thom D. H., & Rortveit G. (2010). *Prevalence of postpartum urinary incontinence: A systematic review.* Acta Obstetricia et Gynecologica Scandinavica, 89(12), 1511–1522.
12. Serati M., Salvatore S., Khullar V., Uccella S., Bertelli E., Ghezzi F., & Bolis P. (2008). *Prospective study to assess risk factors for pelvic floor dysfunction after delivery.* Acta Obstetricia et Gynecologica Scandinavica, 87(3), 313–318.
13. Rortveit G., Daltveit A. K., Hannestad Y. S., & Hunskaar S. (2003b). *Vaginal delivery parameters and urinary incontinence: The Norwegian EPINCONT study.* American Journal of Obstetrics and Gynecology, 189(5), 1268–1274.
14. Tähtinen R. M., Cartwright R., Mrcog M. A., Vernooij R. W. M., Rortveit G., Hunskaar S., Guyatt G. H., & Tikkinen K. A. O. (2019). *Long-term risks of stress and urgency urinary incontinence after different vaginal delivery modes.* The American Journal of Obstetrics & Gynecology, 220(2), 181.e1-181.e8.
15. Leroy L. da S., Lúcio A., & Lopes M. H. B. de M. (2016). *Risk factors for postpartum urinary incontinence.* Revista Da Escola de Enfermagem, 50(2), 200–207.
16. Rocha J., Brandão P., Melo A., Torres S., Mota L., & Costa F. (2017). *Avaliação da Incontinência Urinária na Gravidez e no Pós-Parto: Estudo Observacional Assessment of Urinary Incontinence in Pregnancy and Postpartum: Observational Study*. Acta Medica Partuguesa, 30(7–8), 568–572.
17. Wesnes L. S., Hunskaar S., & Rortveit G. (2012). *Epidemiology of Urinary Incontinence in Pregnancy and Postpartum. In A. Alhasso & A. Fernando (Eds.),* Urinary Incontinence (pp. 17–40). InTech.
18. Macarthur C., Glazener M. A., Wilson P. D., Lancashire R. J., Herbison G. P., & Grant M. (2005). *Persistent urinary incontinence and delivery mode history : a six-year longitudinal study*. BJOG : an International Journal of Obstetrics and Gynaecology, 113(2), 218–224.
19. Viktrup L. (2006). *Risk of Stress Urinary Incontinence Twelve Years After the First Pregnancy and Delivery.* Obstetrics and Gynecology, 108(2), 248–254.
20. Tähtinen R. M., Cartwright R., Tsui J. F., Aaltonen R. L., El R., Joronen K. M., Al S., Aoki Y., & Ca J. L. (2016). *Long-term Impact of Mode of Delivery on Stress Urinary Incontinence and Urgency Urinary Incontinence : A Systematic Review and Meta-analysis.* European Urology, 70(1), 148–158.
21. Rortveit G., Hannestad Y. S., Daltveit A. K., & Hunskaar S. (2001). *Age- and Type-Dependent Effects of Parity on Urinary Incontinence.* Obstetrics & Gynecology, 98(6), 1004–1010.
22. Minassian V. A., Bazi T., & Stewart W. F. (2017*). Clinical epidemiological insights into urinary incontinence*. International Urogynecology Journal, 28(5), 687–696.
23. Pedersen L. S., Lose G., Waldmann A., & Rudnicki M. (2017). *Prevalence of urinary incontinence among women and analysis of potential risk factors in Germany and Denmark*. Acta Obstetricia et Gynecologica Scandinavica, 96(8), 939–948.
24. Imamura M., Williams K., Wells M., & Mcgrother C. (2015). *Lifestyle interventions for the treatment of urinary incontinence in adults.* The Cochrane Database of Systematic Reviews, (12), 1-71.
25. Alves J. O., Luz S. T., Da Brandão S., Da Luz C. M., Jorge R. N., & Da Roza T. (2017). *Urinary Incontinence in Physically Active Young Women: Prevalence and Related Factors*. International Journal of Sports Medicine, 38(12), 937–941.
26. Lian W., Li F., Huang H., Zheng Y., & Chen L. (2019). Constipation and risk of urinary incontinence in women : a meta-analysis. *Int Urogynecol J*, 30(10),1629-1634.
27. Dumoulin C., Pazzoto Cacciari L., & Mercier J. (2019). *Keeping the pelvic floor healthy.* Climacteric: The Journal of the International Menopause Society, 22(3), 257–262.
28. Lúdvíksdóttir I., Hardardóttir H., Sigurdardóttir P., & Ulfarsson G. F. (2018). *Comparison of pelvic floor muscle strength in competition-level athletes and untrained women.* Laeknabladid, 104(3), 133–138.
29. Gaibullaev A. A., Iskandarova G. T., & Abdurizaev A. A. (2016). *Prevalence and risk factors for urinary incontinence in women living in the South Priaralye region.* Urologiia (Moscow, Russia : 1999), (2), 37–42.
30. Chen Y., Desautel M., Anderson A., Badlani G., & Kushner L. (2004). *Collagen Synthesis Is not Altered in Women With Stress Urinary Incontinence.* Neurourology and Urodynamics, 23(4), 367–373.
31. Boyle R., Hay-Smith E. J. C., Cody J. D., & Mørkved S. (2012). *Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women.* Cochrane Database of Systematic Reviews, (10), 1465-1858.
32. Bo K., Frawley H. C., Haylen B. T., Abramov Y., Almeida F. G., Berghmans B., Bortolini M., Dumoulin C., Gomes M., McClurg D., Meijlink J., Shelly E., Trabuco E., Walker C., & Wells A. (2017). *An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on*

the terminology for the conservative and nonpharmacological management of female pelvic floor dysfunction. International Urogynecology Journal, 28(2), 191–213.

33. Avery K., Donovan J., Peters T. J., Shaw C., Gotoh M., & Abrams P. (2004). *ICIQ: A brief and robust measure for evaluating the symptoms and impact of urinary incontinence.* Neurourology and Urodynamics, 23(4), 322–330.
34. Kelleher C. J., Cardozo L. D., Khullar V., & Salvatore S. (1997). *A new questionnaire to assess the quality of life of urinary incontinent women.* BJOG: An International Journal of Obstetrics and Gynaecology, 104(12), 1374–1379.
35. Isherwood P. J., & Rane A. (2000). *Comparative assessment of pelvic floor strength using a perineometer and digital examination.* BJOG: An International Journal of Obstetrics and Gynaecology, 107(8), 1007–1011.
36. Bø K., Kvarstein B., Hagen R. R., & Larsen S. (1990). *Pelvic floor muscle exercise for the treatment of female stress urinary incontinence: II. Validity of vaginal pressure measurements of pelvic floor muscle strength and the necessity of supplementary methods for control of correct contraction.* Neurourology and Urodynamics, 9(5), 479–487.
37. Bø K., & Finckenhagen H. B. (2001). *Vaginal palpation of pelvic floor muscle strength: Inter-test reproducibility and comparison between palpation and vaginal squeeze pressure.* Acta Obstetricia et Gynecologica Scandinavica, 80(10), 883–887.
38. Bo K. (2015). *Evidence-based physical therapy for the pelvic floor: Bridging science and clinical practice* (2nd ed.). Churchill Livingstone.
39. Baytur Y. B., Deveci A., Uyar Y., Ozcakir H. T., Kizilkaya S., & Caglar H. (2005). *Mode of delivery and pelvic floor muscle strength and sexual function after childbirth.* International Journal of Gynecology and Obstetrics, 88(5), 276–280.
40. Baytur Y. B., Serter S., Tarhan S., Uyar Y., Inceboz U., & Pabuscu Y. (2007). *Pelvic floor function and anatomy after childbirth.* The Journal of Reproductive Medicine, 52(7), 604–610.
41. Sigurdardottir T., Steingrimsdottir T., Arnason A., & Kari B. (2011). *Pelvic floor muscle function before and after first childbirth.* International Urogynecology Journal, 22(12), 1497–1503.
42. Afshari P., Dabagh F., Iravani M., & Abedi P. (2017). *Comparison of pelvic floor muscle strength in nulliparous women and those with normal vaginal delivery and cesarean section.* International Urogynecology Journal, 28(8), 1171–1175.
43. Zhao Y., Zou L., Xiao M., Tang W., Niu H., & Qiao F. (2018*). Effect of different delivery modes on the short-term strength of the pelvic floor muscle in Chinese primipara*. BMC Pregnancy and Childbirth, 18(1), 275.
44. Hansen B. B., Svare J., Viktrup L., Jørgensen T., & Lose G. (2012). *Urinary incontinence during pregnancy and 1 year after delivery in primiparous women compared with a control group of nulliparous women.* Neurourology and Urodynamics, 31(4), 475–480.
45. Sandvik H., Seim A., Vanvik A., & Hunskaar S. (2000). *A severity index for epidemiological surveys of female urinary incontinence: Comparison with 48-hour pad-weighing tests.* Neurourology and Urodynamics, 19(2), 137–145.
46. Vaz C. T., Sampaio R. F., Saltiel F., & Figueiredo E. M. (2019). *Effectiveness of pelvic floor muscle training and bladder training for women with urinary incontinence in primary care: a pragmatic controlled trial.* Brazilian Journal of Physical Therapy, 23(2), 116–124.
47. Sigurdardottir T., Steingrimsdottir T., Geirsson R. T., Halldorsson T. I., Aspelund T., & Bø K. (2020). *Can postpartum pelvic floor muscle training reduce urinary and anal incontinence?: An assessor-blinded randomized controlled trial.* American Journal of Obstetrics and Gynecology, 222(3), 247–247.
48. Hilde G., Star-Jensen J., Siafarikas F., Engh M., & Bo K. (2013). *Postpartum Pelvic Floor Muscle Training and Urinary Incontinence.* Obstetrics and Gynecology, 122(6), 1231–1238.
49. Hirakawa T., Suzuki S., Kato K., Gotoh M., & Yoshikawa Y. (2013). *Randomized controlled trial of pelvic floor muscle training with or without biofeedback for urinary incontinence.* International Urogynecology Journal and Pelvic Floor Dysfunction, 24(8), 1347–1354.
50. Pandey D., Maturi C., Dhakar B., Jain G., & Kyalakond K. (2019). *Interventions and Quality of Life in Stress Urinary Incontinence.* Gynecology and Minimally Invasive Therapy, 8(3), 106–112.
51. Nascimento-Correia G., Santos-Pereira V., Tahara N., & Driusso P. (2012*). Effects of pelvic floor muscle training on quality of life of a group of women with urinary incontinence: Randomized controlled trial.* Actas Urológicas Españolas (English Edition), 36(4), 216–221.