Int Urogynecol J (2008) 19:131–135
DOI 10.1007/s00192-007-0404-y

ORIGINAL ARTICLE

# Evaluation of pelvic floor muscle function in a random group of adult women in Austria

**H. Talasz · G. Himmer-Perschak · E. Marth · J. Fischer-Colbrie · E. Hoefner · M. Lechleitner**

Received: 1 March 2007 / Accepted: 10 May 2007 / Published online: 18 September 2007


**Abstract** Despite an increasing clinical interest in female pelvic floor function, there is a lack of data with respect to the knowledge of average adult women about the physiological role of the pelvic floor and their ability to contract pelvic floor muscles (PFM) voluntarily. It was the aim of our study to evaluate the percentage of PFM dysfunction in adult women and the impact of risk factors, such as age, body mass index (BMI), number of children delivered, and the influence of previous PFM training. A total of 343 Austrian adult women (mean age, 41.2±14.6 years; range, 18–79 years), selected at random, were examined to test their ability to contract the PFM. The examination was carried out by three independent gynecologists during the course of a routine gynecological visit. The ability to contract the PFM voluntarily or involuntarily was assessed by digital intravaginal palpation with the patients in a supine position. The muscle strength was graded according to the Modified Oxford Grading Scale by Laycock. A high percentage (44.9%) of the women was not able to voluntarily perform a normal PFM contraction. In only 26.5%, an involuntary contraction of the pelvic floor was present before an increase in intra-abdominal pressure. The inability to contract the PFM did not correlate with women's age but revealed a weak relationship with the number of childbirths and the patient's BMI. A significant correlation was found between the Oxford Grading Scale rating and the patient's report about previous PFM training.

**Keywords** Pelvic floor muscle (PFM) function · Voluntary and involuntary contraction of pelvic floor muscles (PFM) · Digital intravaginal palpation

H. Talasz (✉) · M. Lechleitner
Department for Internal Medicine, Hospital Hochzirl,
6170 Zirl, Austria
e-mail: helena.talasz@tilak.at

E. Hoefner
Department for Neurology, Hospital Hochzirl,
6170 Zirl, Austria

E. Marth
Specialist for Gynecology with Private Practice,
Department for Obstetrics and Gynecology,
Medical University Innsbruck, Innsbruck, Austria

J. Fischer-Colbrie
Specialist for Gynecology with Private Practice, Innsbruck,
Austria

G. Himmer-Perschak
Specialist for Gynecology with Private Practice, Klagenfurt,
Austria

## Introduction

According to the Pelvic Floor Clinical Assessment Group of the International Continence Society (ICS) 2005 [1], the term "Pelvic Floor Muscles" (PFM) refers to the muscular layer of the pelvic floor, which gives support to the pelvic organs and closes the pelvic openings when contracting. This contraction is important in preventing involuntary loss of urine or rectal contents. Normal function of the PFM is defined as the ability to perform a normal or strong voluntary contraction and the presence of an involuntary contraction, resulting in a "circular closing of the vagina, the urethra and the anus and in a cranioventral movement of the perineum and an upward movement of the pelvic organs." A voluntary contraction of the PFM can be absent, weak, normal, or strong. An involuntary contraction is defined by muscular contraction before an increase in the intra-abdominal pressure to prevent incontinence; it can be absent or present.

"Underactive" or "nonfunctioning" PFM cannot contract voluntarily or involuntarily when this is necessary [1]. Evaluation of PFM function is a difficult task because there is no general consensus on the best method to assess PFM function and to control the effect of PFM training in women. Methods to verify and quantify PFM dysfunction, accepted by the ICS, are visual inspection, digital intravaginal palpation, electromyography, pressure measurements, and different imaging methods such as ultrasound, magnetic resonance imaging, or video urodynamics [1].

In a recently published study, we could demonstrate that more than 87% of our geriatric female patients with symptoms of urinary incontinence were not aware of the location of the pelvic floor and were unable to perform any voluntary or involuntary contraction of the PFM [2]. We suspected that they had never learned to activate their PFM when they were younger, leading to PFM dysfunction and urinary incontinence when they became older. Despite the high prevalence of symptoms of PFM dysfunction [1, 3] and the widespread recommendations for PFM training as a therapeutic option for urinary incontinence and pelvic organ prolapse in women [4, 5], there is a lack of data about the general knowledge of average adult women regarding the physiological role of the pelvic floor and the ability to contract PFM voluntarily and involuntarily.

To define the percentage of average adult women with normal or impaired PFM function, we performed a prospective case–control study, evaluating the influence of age, childbirth, body mass index (BMI), and previous PFM training on the PFM function.

We were looking for answers to the following questions: Is the age of a woman really an independent risk factor for the incidence of PFM dysfunction? Are women capable of performing proper PFM training when they are unaware how PFM works? Would a routine functional examination of PFM function at the gynecologist's office make sense, and is it difficult to perform?

## Patients and methods

Between June 2005 and June 2006, a total of 343 Austrian adult women were examined to test their ability to contract the PFM. The examination was carried out by three independent gynecologists at three different outpatient departments during the course of a routine gynecological visit. The presence of voluntary and involuntary PFM contraction was registered, and the muscle strength was graded according to the Modified Oxford Grading Scale by Laycock. The women were selected at random, without regard of the ethnical background and previous or actual gynecological problems. Only patients whose incontinence was the main reason for the current gynecological visit were excluded. Because digital vaginal palpation is part of the routine to examine PFM function, the women were not informed in detail about the procedure. All three physicians are highly experienced women, each of them taking care of approximately 200 to 300 patients per month in their offices. Before the study, all three of them participated in a lecture about pelvic floor re-education guidelines according to Schuessler et al. [6].

*Age*. The mean age of the 343 women was 41.2± 14.6 years (range, 18–79 years).

*Childbirth.* Thirty-five percent of the women ($n$=120) were nulliparous at the time of the examination; 21.3% ($n$=73) had given birth once, 29.7% ($n$=102) twice, and 14% ($n$=48) three times or more.

*BMI.* Of the women studied, 9.3% ($n$=32) were underweight (BMI<19), 47.2% ($n$=162) were in normal weight (BMI=19–24.9), 33.5% ($n$=115) were overweight (BMI=25–29.9), and 9.9% ($n$=34) were obese (BMI>30).

*PFM training*. Two hundred and seventy-two participants reported that they had never undergone any PFM training, 71 have had PFM training in the past for various reasons, either in a group with a therapist's verbal and visual instruction or by studying instructions. The patients' characteristics and the demographic data for the group of PFM trainees and PFM nontrainees are displayed in Table 1.

## Method

The digital vaginal palpation was performed with the patient in a supine position on a gynecological chair—with a lightly elevated body and bent legs with 30° of knee flexion. After positioning the investigator's index finger into the distal part of the vagina, subjects were asked through individually formulated instructions to contract the PFM, to lift inward, and to squeeze around the finger. If necessary, the instruc-

**Table 1** Patients' characteristics

| | All patients ($n$=343) | PFM not trained ($n$=272) | PFM trained ($n$=71) |
|---|---|---|---|
| Mean age (±SD) | 41.2 (±14.6) | 40 (±14.7) | 45.4 (±13.6) |
| Nulliparous | 120 (35.0%) | 108 (39.7%) | 12 (16.9%) |
| 1 birth | 73 (21.3%) | 53 (19.5%) | 20 (28.2%) |
| 2 births | 102 (29.7%) | 75 (27.6%) | 27 (38.0%) |
| 3–6 births | 48 (14.0%) | 36 (13.2%) | 12 (16.9%) |
| Mean parity (±SD) | 1.3 (±1.2) | 1.2 (±1.2) | 1.6 (±1.0) |
| BMI<19 | 32 (9.3%) | 29 (10.7%) | 3 (4.2%) |
| BMI=19–24.9 | 162 (47.2%) | 127 (46.7%) | 35 (49.3%) |
| BMI=25–29.9 | 115 (33.5%) | 87 (32.0%) | 28 (39.4%) |
| BMI>30 | 34 (9.9%) | 29 (10.7%) | 5 (7.0%) |
| Mean BMI (±SD) | 23.7 (±4.2) | 23.7 (±4.3) | 23.6 (±3.7) |

tions were repeated up to two times, and the women were also asked to squeeze the PFM as they would do when feeling an acute urinary urge symptom. Between every attempt, the examiner gave a description of the location of the PFM and of the desired muscle movement [7, 8].

The established constriction and elevation of the vaginal wall and the strength of PFM were graded by the Oxford Grading Scale, an internationally accepted muscle grading system, modified by Laycock in 1994 [9–11]. Grade 0 describes the complete lack of any discernible response in the perivaginal muscles, and Grade 1 corresponds to a minor fluttering of the muscles ("nonfunctioning" PFM according to the definition of the ICS) [1]. Grade 2 means a weak muscle activity without a circular contraction, squeeze, or inward movement of the vagina ("underactive" PFM according to the definition of the ICS). Grade 3 describes a reproducible muscle contraction with moderate circular squeeze pressure around the examiner's finger and with an elevation and cranioventral displacement of the vagina ("normal" PFM contraction according to the definition of the ICS). Grades 4 and 5 describe a good or a strong muscle contraction even against a resistance by the examining finger and a significant inward movement of the vagina ("strong" PFM contraction according to the definition of the ICS; Table 2). To find out whether an involuntary PFM contraction was absent or present, women were asked to cough without changing their position. During the intra-abdominal increase in pressure, performance and direction of the pelvic floor movement were evaluated by means of the palpating finger. Each circular constriction of PFM before or during the coughing was defined as involuntary PFM contraction, regardless whether there was an additional cranial movement of the vagina or not. The results were documented by the examiner in an anonymized form, including age, number of childbirths, BMI, and previous PFM training and added to an informal documentation sheet.

### Statistical analysis

Statistical analyses were performed using the statistical program SPSS (12.0). A primary analysis was performed on the whole group of patients followed by a group analysis determined by PFM training history. Group comparisons were conducted by Mann–Whitney $U$ testing. For the calculation of the correlation coefficient, Spearman's rank correlation was used. A $p$ value less than 0.05 was considered statistically significant. Gynecologist-dependent Oxford Scale ratings were compared by using one-way analysis of variance.

Table 2 Graduation of the PFM activity according to the Oxford Grading Scale modified by Laycock

| Oxford Grading Scale by Laycock | |
|---|---|
| 0 | No muscle activity |
| 1 | Minor muscle "flicker" |
| 2 | Weak muscle activity without a circular contraction |
| 3 | Moderate muscle contraction |
| 4 | Good muscle contraction |
| 6 | Strong muscle contraction |

### Terminology

Terminology relating to pelvic floor muscle function and dysfunction used in this article conforms to the definitions recommended by the ICS, except when specified otherwise [1].

The study was approved by the local ethics committee.

## Results

Among the 343 participating women, 15.2% ($n$=52) could not contract their PFM voluntarily (Oxford Grade 0 to 1, nonfunctioning PFM), 29.7% ($n$=102) achieved only a weak PFM activity without any constriction and elevation of the vaginal wall (Oxford Grade 2, underactive PFM), and 55.1% ($n$=189) were able to induce a reproducible PFM contraction with variable strength but well-notable elevation and anteversion of the vagina (Oxford Grade 3, 4, and 5, normal and strong PFM contraction; Fig. 1).

Intertester reliability was not checked; however, the three examining gynecologists achieved comparable results in the Oxford Scale rating ($F$=1.333, $p$=0.265). The achieved rating did not correlate with the women's age but revealed a negative relationship with the number of childbirths ($R$=−0.154, $p\leq0.01$) and BMI ($R$=−0.228, $p<0.01$). A positive correlation could be found between the strength of

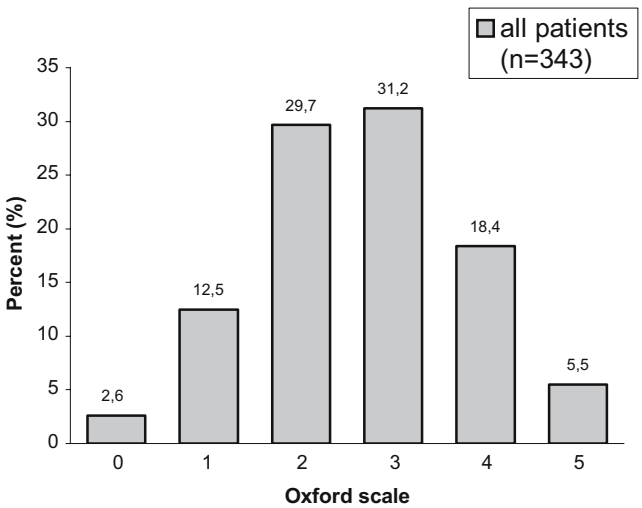


**Fig. 1** Pelvic floor muscle function in all patients ($n$=343) graded by the Oxford Scale

a voluntary PFM contraction and previous PFM training ($R$=0.291, $p$<0.001). An involuntary contraction was present in 26.5% ($n$=91) of the women and was positively correlated with the strength of the voluntary PFM contraction ($R$=0.571, $p$<0.001).

A positive history of PFM training determined a significantly higher Oxford Scale rating at the time of examination ($p$<0.001). Comparing the results obtained in women with a reported previous PFM training ($n$=71) with those who had none ($n$=272) revealed that nonfunctioning PFM (Oxford Grade 0 to 1) were 12.7% ($n$=9) in the trained group and 15.8% ($n$=43) in those without PFM training. With respect to the performance of a nondirectional weak muscle contraction (Oxford Grade 2, underactive PFM), this difference was more pronounced with 12.7% ($n$=9) in the trained group and 34.2% ($n$=93) in the group without muscle training. The percentage of women with a normal or strong pelvic muscle contraction (Oxford Grade 3, 4 and 5) was 74.6% ($n$=53) in women with previous muscle training and 50.0% ($n$=136) in those without it (Fig. 2). The number of women who showed an involuntary contraction was 38% ($n$=27) in the trained and 23.5% ($n$=64) in the untrained group.

## Discussion

In the past, several authors [12–17] noted that many women are unable to contract PFM on demand, but the data were mostly collected in selected patients with symptoms of PFM dysfunction. Up to now, there are no epidemiological data focusing on the situation in average women. The results of our study indicate that a high percentage (44.9%) of average adult women in Austria is unable to perform a normal voluntary contraction of the PFM when asked during a routine gynecological visit. Apparently, this inability does not correlate with women's age, and only some women seem to benefit from PFM training. We do know that the women in our study were selected at random, without regard of ethnical background and previous or actual gynecological problems, and the number of participants was rather low. However, we consider it a rather representative selection of the female population in Austria. The design and performance of the study were simple, comprehensive, and correctly executed by experienced gynecologists, who cover a wide range of gynecological patients and healthy women in their offices without any special focus. The results are impressive and should increase the awareness of this important part of female life, and they have to change the understanding and the way of dealing with the widespread problems of pelvic floor dysfunction. Because we previously have noted normal PFM function in many elderly women (a fact that we did not register academically), we suppose that the high prevalence of PFM dysfunction and urinary incontinence in women's older lives are not only caused by age and age-related physical changes but the lack of activity and control of the PFM during their whole lives. Assuming that identification of PFM dysfunction in early life promises a successful possibility to prevent urinary incontinence in the elderly, further studies and investigations are necessary to assure these presumptions.

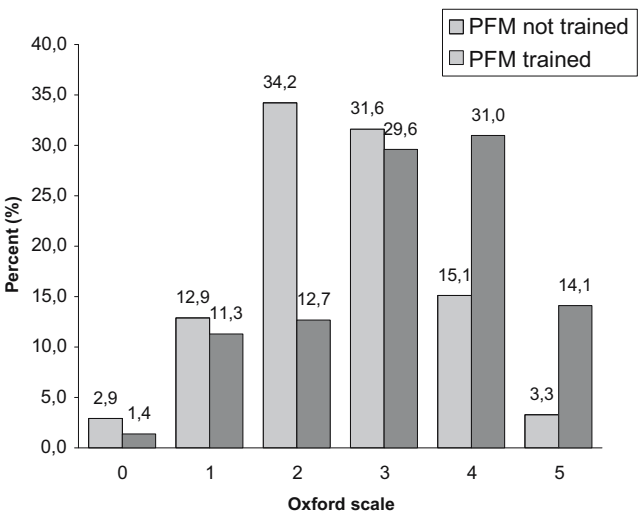


**Fig. 2** PFM function graded according to the Oxford Scale in the untrained group ($n$=272) and in the trained group ($n$=71)

Until this day, the mechanisms of success or failure of PFM training in women with urinary incontinence or pelvic organ prolapse are unknown, making it difficult to select patients that may respond to this therapy [16]. It should be the main aim of every type of PFM training to achieve a correct PFM contraction with a resultant cranioventral displacement of the vagina and the bladder neck [14]. We suggest that only women with normal or at least underactive PFM are able to carry out the instructions during PFM training and to train the right muscles. Women with nonfunctioning PFM may contract auxiliary muscles when they undergo conventional PFM training methods without any direct control, and therefore they will not improve their PFM function. Unfortunately, the functional assessment of the pelvic floor often remains a neglected part during a gynecological visit [3]. In a review of 43 randomized controlled trials focusing on the effect of PFM training, Hay-Smith et al. [5] found that only 16 trials stated that a correct voluntary PFM contraction was checked by vaginal palpation before PFM training started. We demand that functional assessment of the PFM has to precede every type of PFM training. Positive effects as well as failure of PFM training methods should be controlled routinely.

Generally speaking, it is important to give more attention to the female pelvic floor in young women. Because almost

every woman undergoes gynecological routine controls at a young age and during pregnancy, birth, and climacteric period, these visits could be an ideal opportunity to assess pelvic floor function and to initiate an adequate therapy if PFM dysfunction is noted.

Using the simple method of intravaginal palpation and the gradation of the PFM function by the Oxford Grading Scale or by the definitions of the ICS could increase the gynecologists' disposition to a routine assessment. It is an easy and reliable method to evaluate PFM function without additional cost and time effort and without negative effects for the evaluated women. Using this method, an insight can be gained into the multimuscular activity and coordination of the pelvic floor, and correct PFM contraction can be evaluated [18]. Furthermore, both inward and forward lift and squeeze can be registered [19], and co-contractions of the auxiliary muscles are easy to identify [20, 21]. Additionally, the digital intravaginal palpation combined with verbal instructions may be an effective biofeedback method, if deficiencies are detected. In physiotherapeutic literature, digital intravaginal palpation shows a high acceptance. Bo and Sherburn [20] consider digital intravaginal palpation as a standard when assessing the ability to contract the PFM in the clinical practice. Therefore, using this method could also improve the communication between gynecologists, physiotherapists, and other professionals employed in PFM training.

Some studies doubt the intertester reliability and reproducibility of this method [7, 8, 19], but we do not suggest it for scientific research! It seems to be a sufficient method to routinely judge PFM function in the office, to identify women with impaired PFM function in their early lives, and to initiate PFM re-education programs or further investigations. It is obvious that diagnostic and therapeutic measures need to be enhanced in the case of PFM malfunction.

It is necessary to start a widespread educational program. We recommend some "examinational and educational minutes" during every gynecological visit—we are sure that this effort would pay itself in the future.

## References


1. Messelink B, Benson T, Berghmans, Bo K, Corcos J, Fowler C, Laycock J, Huat-Chye Lim P, van Lunsen R, Lycklama a Nijeholt G, Pemberton J, Wang A, Watier A, Van Kerrebroeck P (2005) Standardisation of terminology of pelvic floor muscle function and dysfunction: report from the pelvic floor clinical assessment group of the international continence society. Neurourol Urodyn 24:374–380
2. Talasz H, Gosch M, Enzelsberger H, Rhomberg HP (2005) Geriatrische Patientinnen mit Harninkontinenz-Symptomen und ihre Kontrolle über den Beckenboden. Z Gerontol Geriatr 38:424–430
3. Davis K, Kumar D (2003) Pelvic floor dysfunction: a conceptual framework for collaborative patient-centred care. J Adv Nurs 43 (6):555–568
4. Hagen S, Stark D, Maher C, Adams E (2006) Conservative management of pelvic organ prolapse in women. Cochrane Database Syst Rev 4:CD003882
5. Hay-Smith EJC, Bo K, Berghmanns LCM, Hendriks HJM, de Bie RA, van Waalwijk van Doorn ESC (2004) Pelvic floor muscle training for urinary incontinence in women (Cochrane Review). In: The Cochrane Library, Issue 2, 2004. Wiley, Chichester, UK
6. Schuessler B, Laycock J, Norton P, Stanton S (2002) Pelvic floor re-education: principles and practice. Springer, London
7. Frawley HC, Galea MP, Phillips BA, Sherburn M, Bo K (2006) Reliability of pelvic floor muscle strength assessment using different test positions and tools. Neurourol Urodyn 25:236–242
8. Frawley H, Galea MP, Phillips BA, Sherburn M, Bo K (2006) Effect of test position on pelvic floor muscle assessment. Int Urogynecol J 17:365–371
9. Laycock J, Standley A, Crothers E, Naylor D, Frank M, Garside S, Kiely E, Knight S, Pearson A (2001) Clinical guidelines for the physiotherapy management of females aged 16–65 with stress urinary incontinence. Chartered Society of Physiotherapy, London
10. Laycock J (1994) Clinical evaluation of the pelvic floor. In: Schuessler B, Laycock J, Norton P, Stanton S (eds) Pelvic floor re-education: principles and practice. Springer, London, pp 42–47
11. Schuessler B (2002) (39–41) Aims of pelvic floor evaluation. In: Schuessler B, Laycock J, Norton P, Stanton S (eds) Pelvic floor re-education: principles and practice. London, Springer
12. Bo K, Larsen S, Oseid S, Kvarstein B, Hagen R, Jorgensen J (1888) Knowledge about and ability to correct pelvic floor muscle exercises in women with stress urinary incontinence. Neurourol Urodyn 7(3):261–262
13. Dietz HP, Steensma AB, Vancaillie TG (2003) Levator function in nulliparous women. Int Urogynecol J Pelvic Floor Dysfunct 14 (1):24–26
14. Dietz HP, Wilson PD, Clarke B (2001) The use of perineal ultrasound to quantify levator activity and teach pelvic floor muscle exercises. Int Urogynecol J Pelvic Floor Dysfunct 12(3):166–169
15. Kegel AH (1948) Progressive resistance exercise in the functional restoration of the perineal muscles. Am J Obstet Gynecol 56:238–249
16. Theofrastus JP, Wyman JF Bump RC, McClish DK, Elser DM, Robinson D, Fantl JA (1997) Relationship between urethral and vaginal pressure during pelvic muscle contraction. Neurourol Urodynam 16:553–558
17. Thompson J, O'Sullivan P, Briffa NK, Neumann P (2006) Assessment of voluntary pelvic floor muscle contraction in continent and incontinent women using transperineal ultrasound, manual muscle testing and vaginal pressure measurements. Int Urogynecol J Pelvic Floor Dysfunct 12(3):166–169
18. Devreese A, Staes, F, De Weerdt W, Feys H, Van Assche A, Penninckx F, Vereecken R (2004) Clinical evaluation of pelvic floor muscle function in continent and incontinent women. Neurourol Urodyn 23(3):190–197
19. Bo K, Finckenhagen B (2001) Vaginal palpation of pelvic floor muscle strength: intertester reproducibility and comparison between palpation and vaginal squeeze pressure. Acta Obstet Gynecol Scand 80:883–887
20. Bo K, Sherburn M (2005) Evaluation of female pelvic-floor muscle function and strength. Phys Ther 85(3):269–282
21. Peschers UM, Gingelmaier A, Jundt K, Leib B, Dimpfl T (2001) Evaluation of pelvic floor muscle strength using four different techniques. Int Urogynecol J 12:27–30