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### Review

# Pelvic floor exercise for urinary incontinence: A systematic literature review

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#### ARTICLE INFO

**Article history:**

Received 10 July 2010  
Received in revised form 6 August 2010  
Accepted 10 August 2010  
Available online xxx

**Keywords:**

Pelvic floor exercise  
Pelvic floor muscle training  
Urinary incontinence  
Urinary stress incontinence  
Overactive bladder syndrome  
Urge incontinence

#### ABSTRACT

Urinary incontinence is a common problem among adults and conservative management is recommended as the first-line treatment. Physical therapies, particularly pelvic floor muscle exercise, are the mainstay of such conservative management. The purpose of this review is to summarise current literature and describe trends in the use of pelvic floor muscle exercise in the management of urinary incontinence in women.

Our review confirms that pelvic floor muscle exercise is particularly beneficial in the treatment of urinary stress incontinence in females. Studies have shown up to 70% improvement in symptoms of stress incontinence following appropriately performed pelvic floor exercise. This improvement is evident across all age groups. There is evidence that women perform better with exercise regimes supervised by specialist physiotherapists or continence nurses, as opposed to unsupervised or leaflet-based care.

There is evidence for the widespread recommendation that pelvic floor muscle exercise helps women with all types of urinary incontinence. However, the treatment is most beneficial in women with stress urinary incontinence alone, and who participate in a supervised pelvic floor muscle training programme for at least three months.

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Contributors..... 00  
Competing interests ..... 00  
Provenance..... 00  
References ..... 00

### 1. Introduction

Urinary incontinence (UI) is a common problem among adults living in the community. Its incidence increases with age and it is more frequent in women, being particularly common amongst elderly women in residential care. Estimates of the prevalence of urinary incontinence in women vary from 10% up to 40% [1,2]. However, these figures probably do not reflect the true scope of the problem, because of under-reporting arising from social embarrassment associated with the condition.

Pelvic floor exercise offers a possible reprieve from urinary incontinence [3]. This conservative therapy appears to have no significant side effects and enables improvement in symptoms; it can therefore be considered as a first choice of treatment for urinary incontinence in women. Moreover, if the outcome is unsatisfactory the patient can be referred for further evaluation and possible surgical intervention. The National Institute of Clinical Excellence guideline No. 40 on the management of urinary incontinence in women recommends pelvic floor muscle training for at least three months as the primary treatment for urinary stress incontinence. The guideline states that pelvic floor exercises were found to be effective in the treatment of incontinence in female patients in more than 50% of cases [4].

The purpose of this review is to summarise recently published data on the use of pelvic floor muscle training for treatment for urinary incontinence.

### 2. Methodology

#### 2.1. Data sources

In conducting this systematic review, we searched the MEDLINE (via PubMed), CINAHL and Cochrane databases for relevant articles and undertook manual searches of reference lists from systematic reviews and proceedings of the International Continence Society.

#### 2.2. Study selection

When deciding on study eligibility we followed the recommendations of the *Cochrane Handbook for Systematic Reviews of Interventions* and included original publications of randomised controlled trials (RCTs) that were published in English from 1990 to May 2010. Full texts of the RCTs that examined the effects of non-surgical clinical interventions on urinary incontinence in community-dwelling women were eligible for the review. We excluded secondary data analyses, case reports, case series and RCTs that did not report patient outcomes. We also excluded RCTs that analysed surrogate outcomes of subjective and objective measures of severity of urinary incontinence, including continuous changes in the number of incontinence episodes or pad use, and urodynamic variables (Fig. 1).

#### 2.3. Data extraction and quality assessment

We extracted the data using standardised forms that elicited information about study samples, interventions, designs, and outcomes. Study quality was analysed using the following criteria: participant selection, length and loss of follow-up, use of intention-to-treat principle, masking of the treatment status, randomisation

scheme, adequacy of randomisation and allocation concealment, and justification of sample sizes. Several strategies were used to reduce bias, including a comprehensive literature search of published and unpublished evidence in several databases, a search of reference lists of systematic reviews and proceedings of the International Continence Society, and contacts with experts for additional references. The quality of the selected studies was assessed using a standard grading system, as outlined in the PRISMA (Preferred Reporting Items for Systematic Reviews) statement. The studies were then combined quantitatively. Commercially available software was used for the analysis.

### 3. A short history of pelvic floor exercise

Pelvic floor muscle training (PFMT) for the management of urinary incontinence has been described in several ancient texts. So-called “Deer Exercises” were part of the exercise routine in Chinese Taoism for over 6000 years. Ancient Indian texts report similar exercises as part of the Ashwini Mudra (“horse gesture”), practiced by the Yogis. Hippocrates and Galen also described pelvic floor exercise regimens in the baths and gymnasiums of ancient Greece and Rome [5]. It was thought that strengthening this group of muscles would promote health, longevity, spiritual development and sexual health.

Pelvic floor muscle training first entered modern medicine in 1936, when a paper by Margaret Morris, describing tensing and relaxing of the pelvic floor muscle as a preventative and treatment option for urinary and faecal incontinence, introduced PFMT to the British physiotherapy profession. However, the use of PFMT as a treatment for stress urinary incontinence did not become widespread until after 1948, when Arthur Kegel, a professor of obstetrics and gynaecology in the USA, established its regular practice. In his paper ‘*Progressive resistance exercise in the functional restoration of the perineal muscles*’ he reported the successful treatment of 64 patients with urinary stress incontinence [6], hence the term Kegel Exercise, a common misnomer for pelvic floor exercises as described by Kegel.

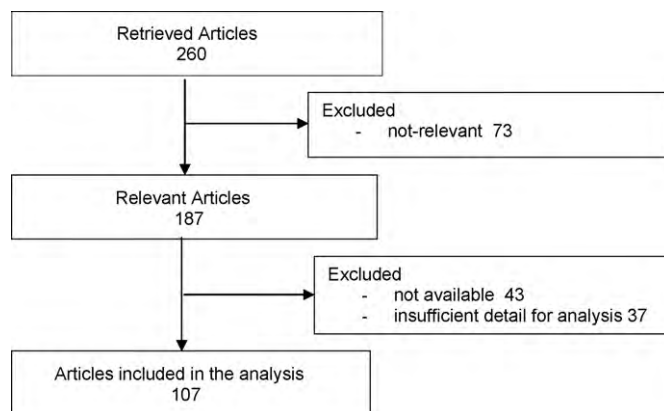


Fig. 1. Selection of studies for analysis.

#### 4. Definition, prevalence and aetiology of urinary incontinence

Urinary incontinence, as defined by The International Continence Society, is the complaint of any involuntary leakage of urine [7]. It can result from a variety of different conditions and it is useful to classify them accordingly. The most common types of urinary incontinence in women are stress and urge incontinence.

Urinary stress incontinence is the complaint of involuntary leakage of urine on effort or exertion, such as sneezing or coughing [7]. When urodynamic studies demonstrate the involuntary loss of urine during increased intra-abdominal pressure not caused by a contraction of the detrusor muscle, this is defined as urodynamic stress incontinence. The involuntary leakage of urine, accompanied by or immediately preceded by a strong desire to pass urine (void), is described as urge incontinence. Urgency, with or without urge urinary incontinence and usually with frequency and nocturia, is also defined as overactive bladder syndrome (OAB) [7]. Mixed urinary incontinence is when women have symptoms of both types of incontinence. Usually, one of these is predominant; that is, either the symptoms of urge incontinence, or those of stress incontinence, are most bothersome.

Estimates of the prevalence of urinary incontinence in women vary between 10% and 40% of the female population [1]. Factors commonly found to affect the prevalence of urinary incontinence are: age, gender, race and residing in a nursing home. The prevalence of urinary incontinence has been reported to increase with age. Data from a large epidemiological study (27,936 Norwegian women) suggest a gradual increase in prevalence with age to an early peak at around mid life (mid 50s), followed by a slight decline or stabilisation until about 70 years of age, when the prevalence begins to rise steadily [8]. The relationship of urinary incontinence to age was investigated by both Rud et al. and Enhorning et al., who found that maximum urethral closure pressures tend to decrease with age. This decrease was found to be significant after the age of 36 years and they reported a 2–4% decrease in the functioning of the urethra after the age of 40 years [9,10]. The second peak in the incidence of urinary incontinence after 70 years of age can be explained by an increase in urgency and urge incontinence, possibly due to low levels of oestrogen.

There is a racial difference in the prevalence of urinary stress incontinence, which may be explained by differences in the bulk of urethral muscle in different races. Afro-Caribbeans, who are thought to have a low prevalence of urinary stress incontinence, were found to have greater urethral sphincter capacity, as evidenced by higher density of urethral striated muscle fibres and higher urethral closure pressures both during pelvic contraction and at rest. Women of Afro-Caribbean descent also have a larger levator ani cross-sectional area and muscle strength. This anatomical difference may explain the reduced prevalence of urinary incontinence in this population [11].

Life events having major implications for urinary incontinence are pregnancy, child birth and menopause. Pregnancy and vaginal delivery are considered to be the main risk factors for the development of urinary incontinence. It seems that the prevalence of urinary incontinence increases during pregnancy and decreases following delivery, although postpartum prevalence still remains higher than before pregnancy. Estimates of the prevalence of stress urinary incontinence during pregnancy vary between 6% and 67%, and from 3% to 38% two to three months after delivery. Urinary incontinence increases with parity and, in primiparas who deliver vaginally, it has been associated with decreases in pelvic muscle strength of 22–35% between pregnancy and the postpartum period [12].

Pregnancy and vaginal delivery are known to be associated with damage to the pelvic floor innervation, direct trauma to the levator

**Table 1**  
Modified Oxford Pelvic Tone Scoring System.

| Oxford Score | Signs   |
|--------------|---|
| 0            | No contraction                                      |
| 1            | A flicker   |
| 2            | Weak  |
| 3            | Moderate with some lift                             |
| 4            | Good contraction with lift, against some resistance |
| 5            | Normal muscle contraction, strong squeeze and lift  |

ani muscles and the endopelvic fascia by way of stretching or tearing. It has been observed that bladder neck mobility is worsened following vaginal births and this is postulated to be the cause of urinary stress incontinence secondary to parturition. A study by van Brummen et al. showed that the antenatal development of stress incontinence lead to an 18-times higher risk of developing stress incontinence during the year following child birth, and that this was most prevalent in the group that delivered vaginally [13].

Other risk factors associated with urinary stress incontinence are obesity (body mass index of over 30), high impact sports (e.g. trampolining, pole vaulting), chronic respiratory disorders causing a chronic cough, and intra-abdominal masses causing an increase in the intra-abdominal pressure. Medication such as diuretics, endocrine disorders (diabetes), central or peripheral neuropathies, dementia and smoking are also well known culprits of urinary incontinence.

A substantial proportion of patients with urinary incontinence are postmenopausal. Evidently, a hypo-oestrogenic state in a woman is associated with thinning of the urethral mucosa, reduction in urethral closure pressure from loss of sphincter tone, and alteration of the urethro-vesical angle. Fantl et al. performed a meta-analysis on the use of topical oestrogen for urinary incontinence, which supported the use of topical oestrogen therapy for the management of urinary incontinence in women [14,15]. Also, the latest Cochrane review on the use of oestrogen therapy for urinary incontinence in postmenopausal women concluded that topical oestrogen treatment for incontinence may improve or cure it; however, there was little evidence from the trials on the period after oestrogen treatment had finished and none about long-term effects [16].

#### 5. Pelvic floor exercise

##### 5.1. Muscle groups used in pelvic floor exercise

The pelvic floor consists of a group of 12 striated muscles arranged in 3 layers. This muscular plate expands from the pubic symphysis to the side walls of the ileum towards the coccyx. The striated muscle fibres of each muscle run in the same direction in each muscle but in a different direction to the other muscles of the pelvic floor group. However, when the pelvic floor contracts, it is always en masse, moving the pelvic girdle in one direction [17]. The only known voluntary function of the pelvic floor muscle group is a mass contraction, best described as an inward lift and squeeze around the urethra, vagina and rectum [18]. The function of the pelvic floor muscles is to lend structural support to the pelvic structures, the urethra, vagina and rectum. The Oxford Pelvic Tone Scoring System is a commonly used method for assessing pelvic floor muscle tone (Table 1) [19].

##### 5.2. Pelvic floor exercise regimens

Pelvic floor muscle training involves the repetitive contraction of the pelvic floor muscle, which builds strength and perineal support, and improves muscle tone. As the pelvic floor is entirely composed of striated muscle, the principles of strength training for

striated muscle should be followed when attempting to tone and strengthen the pelvic floor. The movement is a voluntary inward and upward contraction or squeeze of the pelvic floor. The number of contractions recommended across studies ranges from 8 to 12 contractions three times a day, to 20 contractions four times a day, to as many as 200 contractions per day. However, Arthur Kegel, the founder of contemporary pelvic floor exercises, in his 1948 paper recommended up to 500 contractions a day. The duration of 'squeeze and hold', or contraction, varies in published studies from 4 s to 30–40 s [20,21]. The recommended posture to be adopted during the prescribed exercise regimen also varies and includes sitting, kneeling, standing, lying down and standing with legs astride. The recommended duration of the prescribed regimen varies widely, from one week to six months, with three months being most frequently recommended. The National Institute for Clinical Excellence recommends a trial of supervised pelvic floor exercises, consisting of at least eight contractions three times a day for a minimum of three months, as a first-line treatment for urinary incontinence [4]. The International Consultation on Incontinence Committee recommends that supervised pelvic floor muscle training for women with stress incontinence is maintained for 8–12 weeks before reassessment and possible referral for further management if the patient has not improved sufficiently [22].

The 'Quick Flick' is a technique for use by women with urge incontinence or mixed urinary incontinence. This exercise involves taking slow deep breaths, while contracting the pelvic floor muscles rapidly 3–5 times, when the urge to void is felt. This has been found to suppress the urge to void.

There is evidence suggesting that it may not be necessary to maintain a lifelong regime of pelvic floor exercise, although this may be desired. An optimal pelvic floor exercise regime would change the morphology and position of the muscles to enable subconscious contraction, a mechanism thought to occur in continent women. In addition, as with strength training of skeletal muscle, less effort would be needed to maintain muscle tone than to build muscle mass initially [17].

## 6. How pelvic floor exercise works in treating stress urinary continence

The objective of pelvic floor muscle exercise is to improve the timing of contractions, the strength of the pelvic floor muscles and the stiffness of the pelvic floor muscles. The mechanisms of action of pelvic floor exercises are threefold: strength training, counterbalancing, and indirect training of the pelvic floor muscle by contracting the transverse abdominal muscle.

### 6.1. Strength training

The bladder neck is supported by the pelvic floor muscles, which limit the downward movement of the urethra during exertion and thereby prevent leakage of urine (Bo 2004, Peschers 2001) [17,21]. Intensive training of any striated muscle will build muscle bulk; similarly strength training of the pelvic floor muscles will build muscle bulk and thereby provide structural support to the pelvic floor by permanently elevating the levator muscle plate to a higher position in the pelvis. The support is further enhanced hypertrophy and stiffness of the endopelvic fascia. Balmforth et al. reported increased urethral stability at rest and during effort following 14 weeks of supervised pelvic floor muscle training. Pelvic floor muscle training will, in addition, facilitate more effective automatic motor unit firing of the pelvic floor musculature, preventing pelvic floor descent during increased intra-abdominal pressure, and hence prevent leakage of urine [17,23,24].

### 6.2. 'The Knack' manoeuvre

The term 'The Knack' was coined by Ashton-Miller in the original study, because the simple English word 'knack' implies an adroit way of doing something. This manoeuvre is performed by consciously contracting the pelvic floor muscle prior to a physical stress and then maintaining the contraction during the stress. This prevents the urethra and bladder base descending and enhances continence. An intentional, effective pelvic floor muscle contraction (lifting the pelvic floor muscle in a cranial and forward direction) prior to and during effort or exertion clamps the urethra and increases the urethral pressure, thereby preventing urine leakage (DeLancey et al.) [25]. Ultrasonography and magnetic resonance imaging studies have demonstrated the cranial and forward movement of the pelvic floor muscle during active contraction and the resulting impact on the urethral position, which supports this rationale.

It would seem to be common sense that, if one contracts the urethral and levator ani striated muscles just before and during the moment of a stressor event, one can prevent urine loss. Unfortunately, many women seem unable to discover this 'hidden' self-care mechanism on their own and need to be taught 'The Knack'. Thus it is plausible that part of the mechanism by which pelvic floor exercises become effective in treating stress urinary incontinence could be an increased awareness and skill in learning to time the contraction with the event that causes the leakage. Miller et al. showed that this simple manoeuvre can reduce urinary leakage by 98.2% with a medium cough, and 73.3% with a deep cough, after only one week of training [26].

### 6.3. Indirect training of pelvic floor muscles by contracting the abdominal muscles

Pelvic floor muscle may be activated together with the abdominal muscle. An increasing body of evidence suggests that active contraction of the *transversus abdominus* muscle is associated with co-activation of the pelvic floor muscle. This has been demonstrated by ultrasound, electromyography and magnetic resonance imaging studies. However, contraction of the *transversus abdominus* muscle does not appear to elevate the pelvic floor muscle all women and, when it does, it does not appear to be as effective as a direct contraction of the pelvic floor muscle itself. Recent studies suggest that the relationship between pelvic floor muscle and *transversus abdominus* muscle differs between continent and incontinent women, with the pelvic floor muscle being displaced less during a *transversus abdominus* muscle contraction in women with stress urinary incontinence as compared to continent women. More research is needed to understand the effect of incontinence on rehabilitation of the interaction between the *transversus abdominus* and pelvic floor musculature in the treatment of urinary incontinence [16].

## 7. Biofeedback and other physical therapies

Other physical therapies recommended for treatment of stress urinary incontinence include biofeedback, the use of vaginal cones, electrical stimulation, transcutaneous electrical nerve stimulation and posterior tibial nerve stimulation, and magnetic therapy.

### 7.1. Biofeedback therapy

Biofeedback therapy provides awareness of the physiological action of the pelvic floor muscles by visual, tactile or auditory means. Vaginal cones attached to electrodes, manometry and electromyography are examples of such means.

## 7.2. Vaginal cones

Weighted cones in the vagina can be used for strength training of the pelvic floor muscles. They are of varying weight and are used typically for around 20 min a day, starting with the lower weight and progressing according to the individual's ability to hold the cones. The cones can weigh from 20 to 150 g. For example, Mabella cones (Vitacon AS), weighing 20, 40 and 70 g each, were used in the randomised controlled trial by Bo et al. [27].

## 7.3. Sacral nerve stimulation

Electrical stimulation of the sacral reflex pathway can be used to inhibit the reflex behaviour of the bladder. Nerve stimulation can be achieved using surface electrodes, or transcutaneous needles, or electrodes implanted close to nerves. Initially an electrode is placed via the sacral foramen alongside a sacral nerve (usually S3). In an alternative procedure, the electrode is connected by wires under the skin to an implanted programmable pulse generator that provides stimulation within set parameters [28]. This technology has been used for patients with overactive bladders, urgency incontinence, and voiding (retention of urine) difficulties, and for some patients with defecation problems. It has also been used in the management of chronic pelvic pain, although this is outside the scope of this review. In randomised trials about 50% of patients in the stimulation group achieved complete continence or an improvement greater than 90% in the main incontinence symptoms, while a 50% improvement in the main incontinence symptoms was observed in about 87% [28].

Sacral nerve stimulation (SNS) is recommended for the treatment of urinary incontinence due to detrusor overactivity in women who have not responded to conservative treatments. Women should be offered sacral nerve stimulation on the basis of their response to preliminary percutaneous nerve evaluation. Lifelong follow-up is recommended [4].

## 7.4. Posterior tibial nerve stimulation

Stimulation of the posterior tibial nerve (PTNS) delivers retrograde stimulation to the sacral nerve plexus. The posterior tibial nerve contains mixed sensory motor nerve fibres that originate from the same spinal segments as the innervations to the bladder and pelvic floor. The exact mechanism of action of neuromodulation is unclear. The potential benefit of percutaneous posterior tibial nerve stimulation is that it may achieve the same neuromodulatory effect as sacral nerve stimulation through a less invasive route.

In a randomised controlled trial of 100 patients comparing PTNS with medication, 80% (35/44) of patients in the PTNS group and 55% (23/42) of patients in the medication group considered themselves to be cured or improved ( $p=0.01$ ). Both groups showed a similar statistically significant decrease in the number of voids per day, nocturia, urge incontinence and the number of moderate to severe urgency episodes per day. Quality of life was also significantly improved in both groups immediately after treatment [29,30].

## 7.5. Magnetic therapy

Magnetic therapy aims to stimulate the pelvic floor muscles and/or sacral roots by placing them within an electromagnetic field. The women remain fully clothed throughout the procedure and may find the process more acceptable when compared with electrical stimulation [31].

At present there is no robust evidence that such additional physical therapies are any more successful when used instead of,

or together with, pelvic floor muscle training [16,27,32]. Therefore, it is recommended that pelvic floor electrical stimulation and biofeedback should not be used as a routine part of pelvic floor muscle training. While there is no evidence of effectiveness for either biofeedback or electrical stimulation, the information and support generated by biofeedback may assist motivation for some women, and electrical stimulation may be of value for those who are unable to initiate a pelvic floor muscle contraction. Therefore, electrical stimulation and biofeedback could be considered in women who cannot actively contract pelvic floor muscles, in order to aid motivation and adherence to therapy [4,20]. **Supervision of pelvic floor exercise**

The evidence suggests that women do better in exercise regimes that are supervised by specialist physiotherapists or specialist continence nurses, in contrast to unsupervised or leaflet assisted care. The reasons for this may be that, in addition to exercise, such specialists are likely to cover numerous other areas which may also impact on the pelvic floor, such as occupation, respiratory status, lifestyle issues, overall muscle fitness, diet and general health. There is also likely to be better compliance with exercise regimes in the long term, if each woman fully understands how she can help herself and if she has had adequate time to address the problem with professional support.

Slack et al. recommend a dedicated pelvic floor physiotherapy service and have found a reduction of 33% in the surgical and urodynamic work load following the use of this service [31]. In their study they used a pelvic tone of less than or equal to 3 as a criterion for recommending pelvic floor exercises for the treatment of urinary incontinence. Ishiko et al. advised a supplement of intravaginal oestriol in postmenopausal women undertaking pelvic floor exercise and found that this resulted in a higher cure rate of incontinence [33].

## 9. Effectiveness of pelvic floor exercise in treatment of urinary stress incontinence

Daily pelvic floor muscle training is an effective treatment for stress or mixed urinary incontinence, compared with no treatment, over the short term. Other than occasional cases of pain or discomfort, no other adverse effects have been noted. This evidence is derived from several large randomised controlled trials and two systematic reviews published in the Cochrane library [4,20].

A study by Cammu et al., comprising a 10-year follow-up of women after pelvic floor muscle exercise for stress incontinence, concluded that when pelvic floor muscle training is initially successful there is a 66% chance that the favourable results will persist for at least 10 years [34].

The trials suggest that the treatment effect (especially self reported cure/improvement) might be greater in women with stress urinary incontinence participating in a supervised PFMT programme for at least three months [31]. It also seems that the effectiveness of PFMT does not decrease with age: in trials with stress urinary incontinent older women it appeared that results for both primary and secondary outcome measures were comparable to those in trials with younger women.

### 9.1. Role of pelvic floor exercise in treatment of overactive bladder symptoms

Pelvic floor muscle exercise can also be used in the management of urgency and urge incontinence. The biological rationale is based on Godec's observation that a detrusor muscle contraction can be inhibited by a pelvic floor muscle contraction induced by electrical stimulation [35]. Further, de Groat demonstrated that during urine storage there is an increased pudendal nerve outflow response to

the external urethral sphincter, increasing intraurethral pressure and representing what he termed a 'guarding reflex' for continence [36]. Additionally, Morrison demonstrated that Barrington's micturition centre excitatory loop switches on when bladder pressures are between 5 and 25 mm Hg, while the inhibitory loop is predominantly active above 25 mm Hg. Inhibition involves an automatic (unconscious) increase in tone for both the pelvic floor muscle and the urethral striated muscle [37]. Thus, voluntary pelvic floor muscle contractions may be used to control urgency and urge incontinence. After inhibiting the urgency to void and the detrusor contraction, the patient can reach the toilet in time to avoid urine leakage. However, the number, duration, intensity and timing of the pelvic floor muscle contraction required to inhibit a detrusor muscle contraction are not known.

## 10. Pelvic floor exercise in pregnancy and postpartum

There is strong evidence to suggest that women, who do intensive supervised pelvic floor exercises during pregnancy, reduce their chances of leakage postpartum in the first year after childbirth. For women having their first baby, antenatal pelvic floor exercise appears to reduce the prevalence of urinary incontinence in late pregnancy (34 weeks or more) and early postpartum (less than 12 weeks). Fifteen studies involving 6181 women (3040 PFMT, 3141 controls) contributed to the analysis. Based on the trial reports, pregnant women without prior urinary incontinence who were randomised to intensive antenatal PFMT were less likely than women randomised to no PFMT or usual antenatal care to report urinary incontinence in late pregnancy (about 56% less; RR 0.44, 95% CI 0.30–0.65) and up to six months postpartum (about 30% less; RR 0.71, 95% CI 0.52–0.97) [38–40].

Postnatal women with persistent urinary incontinence three months after delivery and who received PFMT were less likely than women who did not receive treatment (about 20% less; RR 0.79, 95% CI 0.70–0.90) to report urinary incontinence 12 months after delivery. The greatest treatment effect was seen in the trial with the most intensive, supervised strengthening PFMT programme (with the addition of weekly electrical stimulation). Based on the trials to date, the most beneficial population approach for postnatal PFMT appears to be to offer an individually taught strengthening PFMT programme to women potentially at greater risk of postnatal incontinence, such as after a forceps delivery or vaginal delivery of a large baby. However, it seems that a PFMT programme of sufficient dose might be important both for women at potentially increased risk of postnatal incontinence and in a population-based approach to prevention of postnatal incontinence [38–40].

## 11. Conclusions

Overall, there is evidence for the widespread recommendation for use of pelvic floor muscle training as a first-line conservative management programme for women with stress, urge or mixed urinary incontinence. A trial of supervised PFMT of at least three months' duration should be offered as first-line treatment to women with stress or mixed urinary incontinence. A pelvic floor muscle training programme should comprise at least eight contractions performed three times per day. If pelvic floor muscle training is beneficial, the exercise programme should be maintained.

There have been many publications on the benefits of PFMT in urinary stress incontinence, although the evidence for its use in urge incontinence is more recent. There are no long-lasting or debilitating adverse effects of pelvic floor muscle training. For those cases where it does not succeed, there are other alternative management options. PFMT is cost effective, uses fewer resources than a

surgical procedure, and has fewer and milder side effects compared to pharmacological treatment.

The treatment effect is usually enhanced when the PFMT programme is taught and supervised by a specialist physiotherapist or specialist continence nurse. Additional physical therapies, such as electrical stimulation and biofeedback, are not recommended for routine use during pelvic floor muscle training. However, they can be considered in women who cannot actively contract their pelvic floor muscles, in order to aid motivation and adherence to therapy.

In common with its use in older women with stress incontinence, there is evidence for the widespread recommendation that PFMT is an appropriate treatment for women with persistent postpartum urinary incontinence. It is possible that the effects of PFMT might be greater with targeted rather than population-based approaches and in certain groups of women (for example: primiparous women or women who have had bladder neck hypermobility in early pregnancy, a large baby, or a forceps delivery).

The limited nature of follow-up beyond the end of treatment in the majority of the published studies means that the long-term outcomes of PFMT are less clear. Longer-term effects may be greater in women participating in supervised PFMT for at least three months. Continued adherence to training may be associated with maintained or increased treatment effect, but this hypothesis needs further testing.

There is a need for at least one large, pragmatic, well conducted, and explicitly reported randomised trial, comparing PFMT with a control, to investigate the longer-term clinical effectiveness of PFMT. Also, studies investigating different pelvic floor muscle training regimens are required to establish the optimum method of delivering and undertaking this intervention.

In conclusion, pelvic floor exercises are beneficial and have no significant adverse effects. Substantial and durable improvements in continence can be achieved, when the patient is appropriately selected and the exercises are adequately performed.

## Contributors

Natalia Price reviewed the evidence and wrote the paper, Rehana Dawood reviewed the evidence and co-wrote the paper, and Simon R. Jackson edited the paper.

## Competing interests

The authors have no competing interests to declare and were not in receipt of any funding to undertake this review.

## Provenance

Commissioned and externally peer reviewed.

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