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# The Effectiveness of Pelvic Floor Muscle Training on Decreasing Urinary Incontinence in Pregnant or Postnatal Women: A Systematic Review

# La eficacia del entrenamiento de los músculos del suelo pélvico para disminuir la incontinencia urinaria en mujeres embarazadas o posnatales: una revisión sistemática

*Novadri Ayubi, *Dyah Fitria Padmasari, **Anton Komaini, ***Dhea Regita Sastika Putri, ***Atika Syafawi, **Deby Tri Mario, **Andri Gemaini, *Mochamad Ridwan, *Dio Alif Airlangga Daulay, ****Jiang Wen Ming, *Junaidi Budi Prihanto
*Universitas Negeri Surabaya (Indonesia), **Universitas Negeri Padang (Indonesia), ***Universitas Airlangga (Indonesia), ****Sultan Idris Education University (Malaysia)

**Abstract.** This study aims to analyze the effectiveness of pelvic floor muscle training in preventing urinary incontinence in pregnant and postpartum women. The study employed a systematic review method by searching data from journal databases such as Pubmed, Science Direct, and Web of Science. The inclusion criteria in this study were articles published in the last five years (2019-2024) that discussed pregnant and postnatal women, pelvic floor muscle training, and urinary incontinence. Those articles must come from journals that used the official languages of the United Nations, such as Arabic, Chinese, English, Russian, French, and Spanish. Meanwhile, the exclusion criteria in this study were those not indexed by Scopus and Web of Science. This study then identified 2387 articles from the Pubmed, Science Direct, and Web of Science databases. Among them, eight articles met the inclusion criteria and were selected and analyzed for this systematic observation. For standard operations, the study followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) assessment. The results indicated that pelvic floor muscle training or Kegel exercise can help weak pelvic muscles due to uterine growth and hormonal changes during pregnancy become stronger. This is so, especially if it is carried out regularly during pregnancy to reduce postnatal urinary incontinence. This training or exercise is recommended for six weeks during pregnancy to increase the strength of the muscle tone of the blood vessel walls and pelvic floor muscles. Additionally, it can support ligament muscles in the pelvis so that it can prevent urinary incontinence. We highly recommend further research to analyze PMFT during the postpartum period which can prevent urinary incontinence even more.
**Keywords:** Pelvic Floor Muscle Training; Kegel Exercise; Pregnant; Postnatal; Urinary Incontinence

**Resumen.** Este estudio tiene como objetivo analizar la eficacia del entrenamiento de los músculos del suelo pélvico en la prevención de la incontinencia urinaria en mujeres embarazadas y posparto. El estudio empleó un método de revisión sistemática mediante la búsqueda de datos en bases de datos de revistas como Pubmed, Science Direct y Web of Science. Los criterios de inclusión en este estudio fueron artículos publicados en los últimos cinco años (2019-2024) que discutieron sobre mujeres embarazadas y posnatales, entrenamiento de los músculos del piso pélvico e incontinencia urinaria. Esos artículos deben provenir de revistas que utilicen los idiomas oficiales de las Naciones Unidas, como árabe, chino, inglés, ruso, francés y español. Mientras tanto, los criterios de exclusión en este estudio fueron aquellos no indexados por Scopus y Web of Science. Luego, este estudio identificó 2387 artículos de las bases de datos Pubmed, Science Direct y Web of Science. Entre ellos, ocho artículos cumplieron con los criterios de inclusión y fueron seleccionados y analizados para esta observación sistemática. Para las operaciones estándar, el estudio siguió la evaluación de Elementos de informes preferidos para revisiones sistemáticas y metanálisis (PRISMA). Los resultados indicaron que el entrenamiento de los músculos del suelo pélvico o el ejercicio de Kegel pueden ayudar a que los músculos pélvicos débiles debido al crecimiento uterino y los cambios hormonales durante el embarazo se vuelvan más fuertes. Esto es así, sobre todo si se realiza de forma regular durante el embarazo para reducir la incontinencia urinaria postnatal. Este entrenamiento o ejercicio se recomienda durante seis semanas durante el embarazo para aumentar la fuerza del tono muscular de las paredes de los vasos sanguíneos y los músculos del suelo pélvico. Además, puede sostener los músculos de los ligamentos de la pelvis para prevenir la incontinencia urinaria. Recomendamos encarecidamente realizar más investigaciones para analizar el PMFT durante el período posparto, lo que puede prevenir aún más la incontinencia urinaria.
**Palabras clave:** Entrenamiento de los músculos del suelo pélvico; Ejercicio de Kegel; Embarazada; Postnatal; Incontinencia urinaria

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Novadri Ayubi
novadriayubi@unesa.ac.id

## Introduction

Decreased bladder function and muscle tone around the urinary tract are the main causes of urinary incontinence, which causes the body to experience uncontrolled urine output (Tunn et al. 2023). Major symptoms and signs that appear in this diagnosis include the leakage of urine without distension, nocturia, and residual urine of 100 ml. In addition, several conditions have been associated with urinary incontinence, such as asthma, allergies, neurological diseases, and nerve-demyelinating multiple sclerosis (Johannessen et al. 2021).

Research suggests that patients with a history of urinary incontinence during pregnancy or postpartum will likely have bigger risk factors for suffering urinary incontinence in the future. Therefore, urinary incontinence is a condition that is closely related to pregnancy (Nygaard et al. 2017). The overall prevalence of urinary incontinence ranges from 8.2% to 26.8%, where women have a higher prevalence of 13-38.7% than men, 2.9- 9.9% (Sacomori et al. 2020). About 10% of all adult women experience urinary incontinence at least weekly. A higher incidence rate was found in research with pregnant women, where it was 10.4-71.11% (Chen et al. 2023). In particular, the highest prevalence of urinary incontinence occurred in the third trimester of pregnancy until after delivery (Chen et al. 2023). This incident has been basically mentioned by earlier studies that claimed pregnant and postnatal women were

more prone to urinary incontinence because they had a shorter anatomy of the urethra and a weaker bladder than men (Szumilewicz et al. 2019). Other scholars supported this idea as they found two mechanisms of urinary incontinence in women, namely urethral hypermobility and intrinsic sphincter deficiency (Schreiner et al. 2018). These two mechanisms are believed to be interrelated as the causes of urinary incontinence in women. However, in some societies, there is a stigma that considers this dysfunction normal. As a result, patients rarely seek help for their urinary incontinence complaints (Molina-Torres et al. 2023).

Several actions can be done to prevent urinary incontinence, such as avoiding constipation, doing light physical activity, and performing a main exercise choice called Pelvic floor muscle training (PFMT). Such training is beneficial since it can improve the ability of muscle contractions, increase intraurethral pressure, maintain the position of urethra, and mechanically presses the urethra against the symphysis (Stafne et al. 2022). In addition, PMFT can strengthen the pelvic floor muscles and is the most cost-effective non-invasive therapy. Unlike other exercise, patients who perform PMFT can do it themselves, anytime, anywhere, without the need for regular visits at home.

Given the fact that PMFT can be very beneficial, this study aims to analyze the effectiveness of such training in preventing urinary incontinence in pregnant and postpartum women. The analysis is based on trusted literature that is published in reliable academic databases. Therefore, the study can recommend appropriate solutions to prevent urinary incontinence.

## Materials and methods

### *Studi Design*

This study employed a systematic review method by searching data from journal databases such as Pubmed, Science Direct, and Web of Science. These websites are considered premier platforms as they compile publications worldwide that have scientific impact and relevance.

### *Eligibility criteria*

Prior to data analysis, the study must ensure that it only analyzed relevant articles. Thus, it determined a set of inclusion criteria, such as articles published in the last five years (2019-2024) and discussing pregnant and postnatal women, pelvic floor muscle training, and urinary incontinence. Furthermore, the articles must come from journals that used the official languages of the United Nations, such as Arabic, Chinese, English, Russian, French, and Spanish. On the other, the exclusion criteria in this study were those not indexed by Scopus and Web of Science.

### *Procedure*

The review process began by screening articles' titles, abstracts, and full texts. These data were then verified and stored in Mendeley software. This process generated a total of 2387 articles from the Pubmed, Science Direct, and Web of Science databases. Next, in the second stage, 88 articles were screened based on the suitability of the title and abstract. In the third stage, 41 articles were advanced to the next stage. At this stage, the articles were filtered based on their overall suitability and suitability. Then, in the final stage, eight articles that met the inclusion criteria were selected and analyzed for this systematic observation. For standard operations, this study followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) assessment. Figure 1 below illustrates how the articles in this study were selected using the PRISMA guidelines.

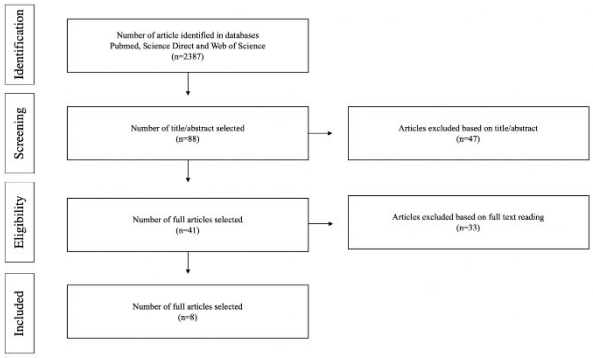


Figure 1. PRISMA flowchart of the article selection process

## Results

This study identified 2387 articles at the first stage of the search. Among them, eight articles met the inclusion criteria. The summary of these articles is presented in Table 1.

Table 1.
Summary of the design and intervention of the studies

| Author | Design | Sample Characteristics | Intervention | Outcome |
|---|---|---|---|---|
| (Hagen et al. 2020) | Parallel-group Randomized controlled trial | Women aged ≥ 18 years old with new stress urinary incontinence or mixed urinary incontinence. | Both groups were offered six appointments over 16 weeks to receive biofeedback pelvic floor muscle training or basic pelvic floor muscle training. Home biofeedback units were provided to the biofeedback pelvic floor muscle training group. Behavior change techniques were built into both interventions. | The primary outcome was urinary incontinence severity at 24 months (measured using the International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form score, range 0-21. A higher score in the instrument indicates greater severity). The secondary outcomes were urinary incontinence cure/improvement, other urinary and pelvic floor symptoms, urinary incontinence-specific quality of life, |

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| | | | | self-efficacy for pelvic floor muscle training, global impression of improvement in urinary incontinence, adherence to the exercise, uptake of other urinary incontinence treatment and pelvic floor muscle function. Women were positive about both interventions, and adherence to both groups of interventions was similar. Besides, both interventions were facilitated by a desire to improve their urinary incontinence. |
| (Johannessen et al. 2021) | Short-term follow-up and secondary analysis of a randomized controlled trial | Pregnant women aged >18 years old with a singleton live fetus. | The intervention group received a 12-week standardized exercise program, with weekly group exercise classes led by a physiotherapist and twice-a-week home exercise sessions. The group exercise sessions included 30-35 minutes of aerobics with moderate intensity (no running or jumping), 20-25 minutes of strength exercises of the lower and upper limbs, back extensors, deep abdominal muscles, and PFM, and 5-10 minutes of light stretching, breathing exercises, and relaxation. In addition, the women were advised to follow a home exercise program at least twice a week, which included 30 minutes of endurance training and 15 minutes of strength training, including PFMT. | Antenatal exercise programs, including PFMT, had a protective effect on UI at three months postpartum. The prevalence of UI at three months postpartum was significantly lower among women in the exercise group (29%) compared with the control group (38%, P= .010). |
| (Szumilewicz et al. 2020) | Quasi-experimental trial | Postpartum Caucasian women (29±4 years old; mean ± standard deviation). The training group (n=133) attended a high-low impact exercise and educational program from the second trimester of pregnancy until birth, three times a week. | At the beginning of the intervention, this study assessed the pelvic floor muscle function in the training women by surface electromyography. The assessment was done using the TeleMyo 2400T Direct Transmission System, In the 2nd stage of the study, this study enrolled all women from the training group who, after childbirth, had uncomplicated puerperium and no contraindications to exercise. This study gave participants written exercise programs for the whole-body workout, containing examples of pelvic muscle floor training/kegel exercises, six sets of 3 to 5 resistance and stretching exercises planned to be performed over 10 to 15 minutes. | The training group started regular pelvic floor muscle exercises substantially earlier postpartum than controls (P<0.001). Significantly, fewer training women reported the life impact of urinary incontinence in both two months (P=0.03) and one year postpartum (P=0.005). Two months after birth, the IIQ scores of the symptomatic women were significantly lower in the training than in the control women. The number of women affected by incontinence symptoms decreased by 38% in the intervention group and by 20% in the controls. |
| (Bick et al. 2022) | Randomized controlled trial | 10–12 weeks postpartum women, prevalence of UI and other health outcomes, and feasibility of implementing the trial intervention by midwives at routine antenatal care contacts. | Two research midwives led and facilitated initial training sessions lasting approximately two hours. Each intervention cluster included a midwife 'champion' from the team who would receive additional training on supporting and managing women whose UI symptoms may be more severe or giving cause for concern, including appropriate referral pathways. Champions also provide reminders and advice for midwives in their teams. Midwives were given 2 to 3 months (depending on the date of their training) to practice implementing the PFME intervention into their routine care. | High exercise adherence PFME in pregnancy can prevent Urinary incontinence. |
| (Pires et al. 2020) | Experimental study | Pregnant women with symptoms of SUI (but not in all pregnant women) | - All pregnant women received training with explanations regarding the general concepts of the PFM.<br>- All participants started their childbirth preparation classes at 28 weeks of gestation. Both groups attended the classes regularly, having their respective topics addressed by their family nurse. The only exception was that only the EG performed the PFMT protocol. At the end of class, both were supervised by a physiotherapist. Meanwhile, at home, they were left unsupervised. | This PFMT protocol reduced urinary incontinence in pregnant women. The program significantly improved the quantity of urinary leakage and increased the strength of the pelvic floor muscle. |
| (Weber-Rajek et al. 2019) | Experimental study | Age < 60, BMI under 25, diagnosed urge and mixed urinary incontinence, lack of | The experimental group underwent 12 therapy sessions of PFMT (45 minutes each, three times a week for four weeks). | The measured variables were reported to have no statistically significant differences between the control group at the initial and |

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| | | regular physical activity, no therapeutic interventions in UI in the last three months (PFMT, Extracorporeal Magnetic Innervation (ExMI), electrostimulation, biofeedback), and the presence of contraindications to the treatment. | | final assessments. |
| (Nipa et al. 2022) | Randomized controlled trial study | Married women aged 18–60 years old, with mild-to-moderate severity on the visual analog scale (i.e., VAS 1/10–7/10) of CLBP (> three months), who had been free from any intervention program for CLBP for at least one month. Had to undergo the one-hour pad test with a weight of 2–20 grams and at least have primary education (i.e., can understand and answer the questionnaires). Study included married women who had been pregnant, as pregnancy and childbirth act as significant causal factors for UI. | The intervention was provided by a well-trained physical therapist. Participants in both groups performed one set of exercises during each week's intervention. Besides this, telephone calls, feasible appointments, and counseling of family members were conducted each week to encourage compliance with the intervention. | They found that RCT-illustrated improvement of SUI in women with nonspecific chronic low back pain, reduction of frequency, and improvement of the QoL. The improvement was greater from PFME with core stability exercise than from PFME alone. |
| (Wu et al. 2021) | Prospective cohort study | Primiparous women who had vaginal deliveries and experienced non-extending second-degree perineal lacerations were invited to participate in this study. | The PFMT started at one week postpartum, and one-on-one EMG-BF assisted pelvic floor muscle training was carried out by a qualified physiotherapist at the first and fourth week postpartum. All the participants (PFMT þ control groups) were assessed for pelvic floor muscle strength, including baseline strength and maximum voluntary contraction at six weeks postpartum. | Our study showed that supervised biofeedback-assisted pelvic floor muscle training started routinely at one week postpartum did not provide additional improvement in lower urinary tract symptoms. |

## Discussion

This research aims to analyze the effectiveness of pelvic floor muscle training (PFMT) in preventing urinary incontinence in pregnant and postpartum women. PFMT is effective in all types of urinary incontinence (Sacomori et al. 2020). In pregnant and postpartum women, the mechanism is characterized by contractions before or during an increase in intra-abdominal pressure and the formation of structural support (Dufour et al. 2019).

The pelvic floor refers to a group of muscles that support several organs in the pelvis, consisting of the pelvic diaphragm, which extends from the pubic symphysis anteriorly to the coccyx posteriorly. The pelvic diaphragm forms a hammock-like structure that supports the pelvic organs (Sacomori et al. 2020). The pelvic floor also consists of the levator ani muscles. The levator ani muscle plays an important role in supporting the pelvic organs and is innervated by the fourth sacral nerve (Miquelutti, Cecatti, and Makuch 2013). It covers the puborectalis, pubococcygeus and iliococcygeus muscles, and the coccygeus muscle (Woldringh et al. 2007). The puborectalis muscle arises from the back of the pubis and forms a U-shaped loop behind the rectum that connects the anorectal junction to the pubic symphysis (Chen et al. 2023). Meanwhile, the pubococcygeus muscle arises from the posterior part of the superior pubic ramus and attaches to the anococcygeal and superior surfaces of the coccyx (Yan et al. 2022). Finally, the iliococcygeus muscle arises from the ischial spine and attaches to the anococcygeal raphe and coccyx. The name of each component muscle comes from its attachment (Figure 2). Previously, the coccygeus and iliococcygeus are thought to be innervated by divisions of the pudendal nerve, inferior rectal nerve, and perineal nerve (Johannessen et al. 2021).

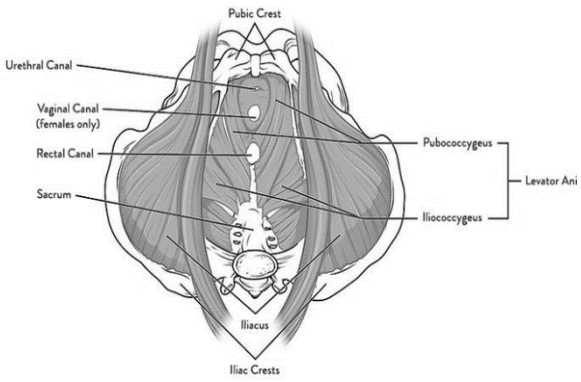


Figure 2. Pelvic floor muscle of female anatomy

In previous studies, most samples were taken from

populations living in the community. Most trials involved a 12-week intervention (Hagen et al. 2020), but some were six weeks or eight weeks long (Bick et al. 2022). Research by Szumilewicz et al. 2020 reported that the intervention group started regular pelvic floor muscle training much earlier after giving birth than the control group ($P<0.001$). Women with less training reported an impact of urinary incontinence on life at two months ($P=0.03$) and one year postpartum ($P=0.005$). Two months after birth, for symptomatic women, IIQ scores were significantly lower in training than in female controls. The number of women affected by incontinence symptoms decreased by 38% in the intervention group and 20% in the control group (Szumilewicz et al., 2020).

The present research also found that PFMT can be performed with multiple modes. For example, most samples in PFMT performed exercises at home supervised by a physiotherapist or nurse/midwife. In some trials, PFMT was delivered individually (Chen et al. 2023; Johannessen et al. 2021; Weber-Rajek et al. 2019). Meanwhile, others were delivered in group classes (Hagen et al. 2019; Szumilewicz et al. 2020). Some trials were limited to PFMT with or without functional pelvic floor muscle contractions to prevent episodes of stress urinary incontinence (Wu et al. 2021).

Meanwhile, in other studies, PFMT was embedded in a multicomponent program with other behavioral or exercise components. One trial included PFMT within a broader general physical exercise program (Silva et al. 2023). Another interesting report on PFMT is that it is effective as a stand-alone therapy, as part of a multicomponent therapy that combines PFMT with behavioral strategies and lifestyle changes, and as part of a more general physical exercise program to improve physical function in pregnant and postpartum women (Stafne et al. 2022).

The results expand the evidence that promotes the implementation of PFMT via mobile technology, with the potential for broader reach, cost savings, and impact on the health of pregnant women in rural areas. Its benefits were demonstrated in various cultural contexts, using several different training programs, and assessed based on a variety of outcome measures (Woodley et al. 2023).

Another key takeaway from the articles reviewed in this study is the fact that the effects of PFMT in women with stress urinary incontinence do not appear to diminish with age. In trials involving older women, primary and secondary outcome measures were comparable to trials focusing on younger women. Therefore, age should not be a barrier to PFMT (Weber-Rajek et al., 2019; Nipa et al., 2022). Intensive pelvic floor muscle training during pregnancy can prevent urinary incontinence in about three out of six women during pregnancy and four out of eight women after giving birth. Pelvic floor muscle strength was significantly higher in the training group at 36 weeks of gestation ($P = 0.008$) and three months after delivery ($P = 0.048$) (Bø 2020). Based on the above evidence, supervised PFMT should be offered as a first-line conservative therapy for women of all ages, especially pregnant and postpartum women who experience stress, or mixed urinary incontinence.

Figure 3. One of the Movements from Pelvic Floor Muscle Training

## Conclusions

This study concludes that intensive pelvic floor muscle training (PFMT) prevents urinary incontinence during pregnancy and after delivery. It was reported that pelvic floor muscle strength increases significantly after intensive pelvic floor muscle training. From the analysis of several scientific evidence, pelvic floor muscle training is recommended for six weeks starting in the third trimester of pregnancy because it can increase the strength of the muscle tone of the blood vessel walls, pelvic floor muscles, and supporting ligament muscles in the pelvis. We highly recommend further research to analyze PMFT during the postpartum period which can prevent urinary incontinence even more.

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## Conflicts of Interest

The authors declare no conflict of interest

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**Datos de los autores:**


| | | |
|---|---|---|
| Novadri Ayubi | novadriayubi@unesa.ac.id | Autor/a |
| Dyah Fitria Padmasari | dyahfp@gmail.com | Autor/a |
| Anton Komaini | antonkomaini@fik.unp.ac.id | Autor/a |
| Dhea Regita Sastika Putri | sastikaputri@gmail.com | Autor/a |
| Atika Syafawi | atikasyafawi@gmail.com | Autor/a |
| Deby Tri Mario | debytrimario@unp.ac.id | Autor/a |
| Andri Gemaini | andrigemaini@fik.unp.ac.id | Autor/a |
| Mochamad Ridwan | mochamadridwan@unesa.ac.id | Autor/a |
| Dio Alif Airlangga Daulay | diodaulay@unesa.ac.id | Autor/a |
| Jiang Wen Ming | wenmingjiang975@gmail.com | Autor/a |
| Junaidi Budi Prihanto | junaidibudi@unesa.ac.id | Autor/a |
| Mhs proofreading | mhsproofreading@gmail.com | Traductor/a |