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SYSTEMATIC REVIEW

Pelvic floor muscle training for urinary symptoms, vaginal prolapse, sexual function, pelvic floor muscle strength, and quality of life after hysterectomy: a systematic review with meta-analyses

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Abstract
Background: After hysterectomy, women could experience pelvic floor dysfunction and negative impact on quality of life, which could be improved by pelvic floor muscle training.
Objective: To investigate effects of pelvic floor muscle training on urinary symptoms, vaginal prolapse, sexual function, pelvic floor muscle strength, and quality of life after hysterectomy.
Methods: Systematic review with meta-analyses of randomized controlled trials. Trials with pelvic floor muscle training in women after hysterectomy were included. The outcomes measures were urinary symptoms, vaginal prolapse, sexual function, pelvic floor muscle strength, and quality of life. Quality of evidence was assessed by adopting the GRADE approach.
Results: Six trials, involving 776 participants, were included. The mean PEDro score of trials was 5.5. Moderate-quality evidence suggested that pelvic floor muscle training improves sexual function by 5 points (95% CI: 4, 6) on the Female Sexual Function Index, compared with no intervention. It might affect strength (SMD 0.5; 95% CI: −0.4, 1.3), quality of life (SMD 0.5 points out of 108, 95% CI: −0.1, 0.9), urinary symptoms (RD −0.02; 95% CI: −0.06, 0.1); however, the estimates were too imprecise. In addition, it produces no or negligible effects on vaginal prolapse (RD 0; 95% CI: −0.1, 0.1). Long-term effects remain uncertain.

The results of this study were presented on V Brazilian Congress of Physiotherapy in Women's Health Online in March 2021.
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Conclusion: This systematic review provides moderate-quality evidence that pelvic floor muscle training is effective for improving women's sexual function after hysterectomy, in comparison with no intervention. Benefits on urinary symptoms, pelvic floor muscle strength, quality of life, and vaginal prolapse remains unclear. Also, the effects beyond the intervention period remains uncertain.

Introduction

Hysterectomy is the second most common major surgical gynecological procedure, after cesarean section.[1] It is recommended for the treatment of neoplasm gynecologic conditions, but 90% of procedures are performed for benign conditions.[2,3] After hysterectomy, pelvic floor dysfunctions, such as sexual,[4] urinary symptoms,[5] and pelvic organ prolapse[6] may occur. Nearly 50% of women may suffer from feelings of premature aging, due to lower libido[4] and urinary incontinence.[7] In addition, previous studies[8-10] demonstrated that pelvic floor dysfunctions are associated with reduced quality of life and activity participation.

Impairments in the pelvic floor muscles typically affect the closure of the urethral sphincter, which is one of the causes of urinary symptoms. Furthermore, uncoordinated muscle contraction might impair sexual function.[11] It is known that pelvic surgeries may cause damage or affect the function of the pelvic floor muscles and connective tissue, that also act as a sling to support the bladder and reproductive organs, which may predispose women to organ prolapse.[12] Pelvic floor muscle training[13] is the primary recommended intervention for improving pelvic floor muscle dysfunctions in women.[14-18] The training increases pelvic floor muscle strength, endurance, and relaxation, or a combination of these parameters, which facilitates motor response in situations of overload, and may improve pelvic organs support, vascularity, and coordination for better sexual responses.[15] In addition, it is an easy-to-implement intervention that does not require full time supervision and can be delivered either in groups or individual sessions.

One previous review[19] suggested positive effects of pelvic floor muscle training on sexual function (standardized mean difference [SMD] −1; 95% CI: −1.2, −0.7) and quality of life (SMD 0.6; 95% CI: 0.4, 0.9) in women who received treatments for gynecological cancer. However, the conclusions were based on two randomized clinical trials, and did not include women who had undergone hysterectomy for benign conditions. We planned to examine the effects of pelvic floor muscle training in all women who had a hysterectomy. Furthermore, effects on urinary symptoms, vaginal prolapse, and pelvic floor muscle strength were examined. The specific research questions were:

1. Is pelvic floor muscle training effective for improving urinary symptoms, vaginal prolapse, sexual function, and pelvic floor muscle strength after hysterectomy?
2. Are any benefits carried over to improved quality of life and/or maintained beyond the intervention period?

Methods

This review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines,[20] and it was registered on PROSPERO (CRD42020198000).

Selection of trials

Searches were conducted in CINAHL, Cochrane, EMBASE, MEDLINE OVID, PEDro, and Pubmed databases, without date or language restrictions. The search was conducted between February and March 2022, and updated to include trials until October 2023. Search terms included words related to *hysterectomy* and to *pelvic floor muscle training* (see Fig. 1 for the full search strategy for each database).

Titles and abstracts were screened to identify relevant trials by two independent reviewers (JMVF/TVC), using Mendeley - Reference Management Software (first search) and Rayyan website (updated search).[21] Full copies of peer-reviewed relevant trials were retrieved, and their reference lists were screened to identify potentially additional relevant trials. The method section of the retrieved trials was extracted (TVC) and reviewed by two independent reviewers (JMVF/NFFO) using predetermined inclusion criteria: Design = randomized trials; Participants = women >18 years, after hysterectomy; Intervention = pelvic floor muscle training; Comparison = no intervention/placebo; Outcomes = urinary symptoms, vaginal prolapse, sexual function, pelvic floor muscle strength, or quality of life. Reviewers were blinded to authors, journals, and results. Disagreement or ambiguities were resolved by consensus after discussion with a third reviewer (LRN).

Assessment of characteristics of trials

Methodological quality: The quality of included trials was assessed by extracting PEDro scores from Physiotherapy Evidence Database (www.pedro.org.au), which is an 11-item scale designed for rating the methodological quality of randomized trials.

Participants: Trials were included when participants were adults - female sex (from now on referred to as women), according to the Sex and Gender Equity in Research (SAGER) guidelines.[22] In addition, to be included, at least 50% of the participants should have undertaken hysterectomy. Characteristics of participants were recorded to assess similarity of trials.

Intervention: Trials were included if the experimental intervention was pelvic floor muscle training, defined as exercises to improve pelvic floor muscle strength,

CINAHL, Cochrane, Embase, Medline and Pubmed Databases
S1 ('hysterectomy' OR 'abdominal hysterectomy' OR 'vaginal hysterectomy' OR 'female genital tract tumor')
S2 ('exercise therapy' OR 'resistance training'/exp OR 'pelvic floor muscle training'/exp OR 'perineometer'/exp OR 'biofeedback'/exp OR pfpt OR 'pelvic floor' OR 'physical therapy modalities')
S3 ('randomized controlled trial' OR 'controlled clinical trial' OR 'comparative study' OR 'clinical trial' OR 'trial' OR 'feasibility trial' OR 'pilot study)
S4 S1 AND S2 AND S3

PEDro Database
Search 1: pelvic floor *and* hysterect* (**Abstract and Title)**
When Searching: Match all search terms (AND)
Method: Clinical Trial

Search 2: pelvic floor *and* cancer (**Abstract and Title)**
When Searching: Match all search terms (AND)
Method: Clinical Trial

Fig. 1 Search strategy for the review.

endurance, power, or relaxation.[13] The training had to consist of rapid or sustained voluntary contractions, prescribed by a physical therapist or other healthcare professional.[23] The experimental intervention could be either home- or center-based, individualized or in groups, and participants could receive in-person or remote supervision.

Comparison: The control intervention could be no intervention/placebo. Characteristics of control were recorded to assess similarity of trials.

Measures: Five outcomes were of interest: urinary symptoms, vaginal prolapse, sexual function, pelvic floor muscle strength, and quality of life. Urinary symptoms may include urinary incontinence, bladder storage or urination symptoms, measured by direct tests (e.g., miccional diary) or questionnaires (e.g., International Consultation on Incontinence Questionnaire).[24] Vaginal prolapse had to be measured by direct tests (e.g. Pelvic Organ Prolapse Quantification) or by questionnaires of symptoms (e.g., Pelvic Organ Prolapse/ Urinary Incontinence Sexual Questionnaire).[24] Sexual function, which may include disorders of desire, arousal, pain/discomfort, and orgasm, had to be measured by questionnaires (e.g., Female Sexual Function Index, which ranges from 0 to 36 points, and values <21 are indicative of sexual dysfunction).[25,26] Pelvic floor muscle strength had to reflect the ability to generate maximum voluntary contraction, measured for example by palpation tests or vaginal manometry.[23,27] Quality of life had to be measured by generic (e.g., World Health Organization BREF) or condition-specific questionnaires related to pelvic floor dysfunction (e.g., King's Health Questionnaire).[28,29] When multiple condition-specific questionnaires were reported, the questionnaire that evaluated two or more symptoms (e.g., urinary and prolapse symptoms) was used.

Data analysis

Information about the methods and results were extracted by two reviewers (LRN and NFFO).

The post-intervention or change scores were used to obtain the pooled estimate of the effect of the intervention, using a random effects model. A visual inspection of the distribution of effect sizes in the forest plots was performed and the I^2 value was calculated to indicate the proportion of variance that was due to heterogeneity.[30] Values of I^2 greater than 50% are indicative of important heterogeneity.[31] The analysis were performed using Review Manager Version 5.3 (Copenhagen, Denmark). The pooled data for each outcome were reported as the mean difference (MD) between groups for continuous data or risk difference (RD) for dichotomous data, and their 95% confidence intervals (95% CI). Where data of trials could not be included in a pooled analysis, the between-group result was reported.

The GRADE system was used to summarize the quality of evidence for each outcome, which ranges from high to very low quality.[32] We rated evidence from the high-quality level and downgraded it one point if one of the following prespecified criteria was present: low methodological quality (defined as $>50\%$ of trials with PEDro score < 6); inconsistency of estimates after pooling ($I^2 > 50\%$), or when assessment was not possible (no pooling); indirectness of participants (when any trial had $<80\%$ of included women with hysterectomy or the results from those who undertook hysterectomy were not reported separately); and imprecision (pooling <300 participants for each outcome).[33] Two reviewers (NFFO and LRN) assessed the quality of the evidence using the GRADE system, with potential disagreements resolved by consensus.

Results

Flow of trials

The electronic search strategy identified 1347 records. After removing duplicates and screening titles, abstracts, and reference lists, 20 potential trials were listed for full reading. Twelve trials[34-45] failed to meet the inclusion criteria (Appendix 1) and the full-text of one trial was not obtained,[46] leaving 8 trials to be included.[47-55] Two trials[47,53] had the same sample and different outcome measures, and two trials[50,51] had the same sample and different timing for measures; these trials were, therefore, reported as single trials. Therefore, 6 comparisons from 8 trials were included in the review (Fig. 2). The corresponding authors were contacted by e-mail for additional information, but none replied.

Characteristics of included trials

The 6 trials involved 776 participants and investigated the immediate effects of pelvic floor muscle training on urinary symptoms (n = 4),[47,48,50,52] vaginal prolapse (n = 3),[47,48,50]

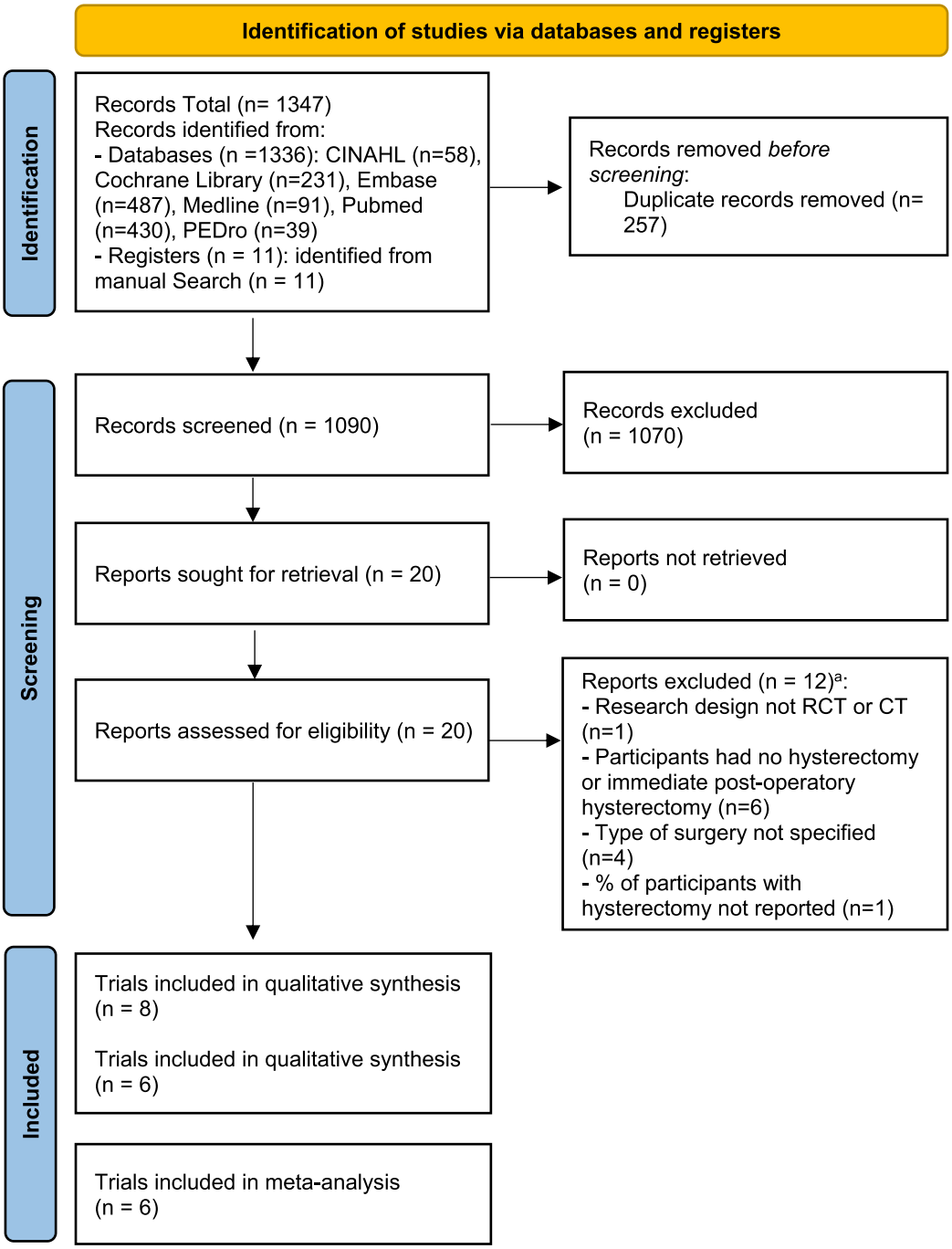

Fig. 2 PRISMA Flow diagram of included and excluded trials through the review. n = number, RCT = randomized controlled trial.
[a]Trials may have been excluded for failing to meet one or more than one inclusion criteria.

sexual function (n = 4),[49,50,53,54] pelvic floor muscle strength (n = 5),[47,48,50,52,53] and quality of life (n = 6).[48-50,52-54] Two trials[47,51] examined follow-up effects (Table 1).

Methodological quality: The mean PEDro score of the trials was 5.5 (range 5−6) (Table 2). All trials had randomly allocated participants. Most trials reported between-group differences (83%), point estimate and variability data (83%), had similar groups at baseline (67%), <15% dropouts (67%), and reported concealed allocation (50%) and whether an intention-to-treat analysis was undertaken (50%). On the other hand, most trials did not have blinded assessors (67%). No trials blinded participants or therapists, which is difficult or impossible due to the nature of the interventions.

Participants: The mean age of the participants ranged from 46 to 58 years old, and the mean body mass index ranged from 26 to 33 kg/m^2. Half of the trials (50%)[47,50,53] reported the participants' level of pelvic floor muscle weakness, and one trial[50] included participants with moderate to severe weakness (i.e., Modified Oxford Scale = 0−2). All trials included participants in the postoperative phase after hysterectomy, and three trials[48,50,52] reported the percentage of women who had hysterectomy (65−90%).

Intervention: In all trials, the experimental intervention was pelvic floor muscle training in combination with educational exercises or emotional-release management by yoga exercise. Pelvic floor muscle training was delivered either in rehabilitation center/hospital[47,48,50,52-54] and/or at home.[47,48,49,52] There was some clinical heterogeneity among trials. Only two trials[52,54] reported treatment session duration, which varied between 15 and 75 min. All trials reported session frequency: five trials[47,48,50,51,53,54] had supervised sessions once per week, and two trials[49,52] had seven unsupervised sessions per week. All trials reported program duration, which varied between 4 and 24 wk.

In most trials, the pelvic floor muscle training consisted of 3−6 series and 8−20 repetitions of sustained contractions, supervised by physical therapists.[47-50,52,53] Training progression was accomplished by increasing training intensity and/or session duration, or by modifying training positioning. All trials delivered no intervention to the control groups. Three trials[48,49,53] provided education to both experimental and control groups.

Outcome measures: Four trials[47,48,50,52] examined urinary symptoms: three[47,48,52] measured the number of women with urinary symptoms using questionnaires (i.e., *Urogenital Distress Inventory* and *Patient Global Impression of Improvement*), and one[50] measured number of voids/day using an urinary diary. Three trials[47,48,50] examined vaginal prolapse: one[50] measured prolapse stage using the *Pelvic Organ Prolapse Quantification*, and two[47,48] measured number of women with prolapse. Four trials[49,50,53,54] examined sexual function using questionnaires: two[49,50] used the *Female Sexual Function Index*, one[53] used the sexual function domain of the *Pelvic Floor Questionnaire*, and one trial[54] used the *Pelvic Organ Prolapse Incontinence Sexual Questionnaire/PISQ-12*. Five trials[47,48,50,52,53] examined pelvic floor muscle strength: two[48,53] used manometry (cmH_2O), and three[47,50,52] used validated graded scale (i.e., *Modified Oxford Scale* and *Brinks Scale*). All trials[47-50,52,53] examined quality of life using a condition-specific or a generic questionnaire.

Effects of intervention

***Urinary symptoms*:** The effects of pelvic floor muscle training on urinary symptoms were examined by pooling post-intervention data from three trials involving 429 participants,[47,48,52] which reported number of women with urinary symptoms. The mean risk difference was −0.1, which suggests 10% reduction in the probability of experiencing urinary symptoms after pelvic floor muscle training; however, there was substantial heterogeneity among trials and this estimate was imprecise (95% CI: −0.3, 0.1; I^2 = 73%) (Fig. 3). The quality of the evidence was rated as low (downgraded due to inconsistency of estimates and indirectness of participants). One additional trial[50] reported that pelvic floor muscle training might reduce the number of voids/day (MD −1; 95% CI: −2.7, 0.6; n = 49).

***Vaginal prolapse*:** The effects of pelvic floor muscle training on vaginal prolapse were examined by two trials,[47,48] involving 387 participants. The mean risk difference was 0 (95% CI: −0.1, 0.1; I^2 = 37%), which suggests no or negligible benefits on prolapse after pelvic floor muscle training (Fig. 3). The quality of the evidence was rated as moderate (downgraded due to indirectness of participants). One trial[50] did not provide usable data for pooling/calculating estimates.

***Sexual function*:** The effects of pelvic floor muscle training on sexual function were examined by pooling post-intervention data from two trials,[49,50] involving 272 participants. Pelvic floor muscle training improved sexual function by 5 points (95% CI: 4, 6; I^2 = 0) on the Female Sexual Function Index (2 to 36 points) (Fig. 3). The quality of the evidence was rated as moderate (downgraded due to imprecision). One trial,[53] which provided change score data on the domain of sexual function of the Pelvic Floor Questionnaire, also reported benefits in favor of pelvic floor muscle training (MD −3 points out of 10; 95% CI: − 6, −1; n = 24). One trial,[54] which did not provide usable data for pooling or calculating estimates, reported no between group-differences after intervention.

***Pelvic floor muscle strength*:** The effects of pelvic floor muscle training on strength were examined by pooling change score data from three trials,[47,48,54] involving 382 participants. The best estimate suggested that pelvic floor muscle training improves strength by SMD 0.5; however, there was substantial heterogeneity among trials and this estimate was very imprecise (95% CI: −0.4, 1.3; I^2 = 81 %) (Fig. 3). The quality of the evidence was rated as low (downgraded due to inconsistency of estimates and indirectness of participants). One trial,[50] which provided post-intervention scores on the Modified Oxford Scale, reported no benefits on strength after pelvic floor muscle training (MD 0.1; 95% CI: −0.7, 0.8; n = 47). One trial[52] did not provide usable data for pooling/calculating estimates.

***Quality of life*:** The effects of pelvic floor muscle training on quality of life were examined by pooling post-intervention data from three trials,[49,50,54] involving 297 participants. The standardized mean difference was 0.5 (95% CI: −0.1, 0.9; I^2 = 70%) (Figure 3), which provides no clear evidence in favor of pelvic floor muscle training. The quality of the evidence was rated as very low (downgraded due to low methodological quality, inconsistency of estimates, and imprecision). Three additional trials[47,48,52] also

Table 1 Characteristics of the included trials (n = 6).

Trial	Participants	Intervention		Outcome measures
		Frequency and duration	Parameters	
Barber et al.[47] Weidner et al.[53]	n = 374 Age (years) = 57 (11) BMI = 29 (5) Hysterectomy = 100% Pelvic floor muscle weakness = mild to moderate Pre (2 to 4 wk before) and postoperative (2 wk after)	Exp = pelvic floor muscle training + education (behavioral therapy) 5 sessions x 1/week x 12 wk Con = no intervention	Setting = hospital and home Number of contractions = 3 × 1–15 reps Type of contraction = sustained Progression = increased number, intensity and duration Supervision = health professionals - not specified Remote supervision = no	Urinary symptoms = UDI score of PFDI[41] Vaginal prolapse = POP-Q anterior Prolapse beyond the hymen (n women)[41] Sexual Function = PISQ-12 (2–48)[48] Strength = Brink's scale (3–12)[41] Quality of life = SF-36 (0–100)[48] Measurements = 0, 6, 12, 24 months
Frawley et al.[48]	n = 51 Age (years) = 56 (10) BMI = 26 (4) Hysterectomy = 65% Pelvic floor muscle weakness = not reported Pre (not reported) and postoperative (3 days after)	Exp = pelvic floor muscle training (combined or not with electrical stimulation) 8 sessions x 1/wk x 12 wk Con = no intervention Both = education and home-based exercises recommendation	Setting = hospital and home Number of contractions = 3 × 8–12 reps Type of contraction = sustained Progression = increased intensity and different positions Supervision = physical therapist Remote supervision = telephone	Urinary symptoms = UDI-19 - stress symptoms (n women) Vaginal prolapse = UDI-19 - obstructive symptoms (n women) Strength = manometry (cmH_2O) Quality of life = AQoL (0–40) Measurements = 0, 12 months
Li et al.[49]	n = 226 Age (years) = 46 (9) BMI = not reported Hysterectomy = 100% Pelvic floor muscle weakness = not reported Postoperative (7 days after)	Exp = home-based pelvic floor muscle training + emotional-release management by yoga exercise and social support 3–5x/day x 7/wk x 24 wk Con = no intervention Both = nursing care (drug, nutrition, and health education)	Setting = home Number of contractions = 10 reps Type of contraction = sustained Progression = not reported Supervision = physical therapist (every 2 to 3 months) Remote supervision = telephone	Sexual Function = FSFI (2–36) Quality of life = FACT-G (0–108) Measurements = 0, 6 months
Pauls et al.[50], Pauls et al.[51]	n = 57 Age (years) = 58 (10) BMI = 28 (5) Hysterectomy = 88% Pelvic floor muscle weakness = moderate to severe Pre (2 wk before) and postoperative (2 wk after)	Exp = pelvic floor muscle training, biofeedback, education, and relaxation 5 sessions x 1/wk x 12 wk Con = no intervention	Setting = rehabilitation center Number of contractions = not reported Type of contraction = not reported Progression = not reported Supervision = physical therapist Remote supervision = phone calls	Urinary symptoms = urinary diary (n voids/24 h) Vaginal prolapse = POP-Q (1–4) Sexual Function = FSFI (2–36) Strength = Modified Oxford Scale (0–5) Quality of life = WHOQOL-BREF (0–100) Measurements = 0, 12 wk,[44] 6 months[45]

Table 1 (*Continued*)

Trial	Participants	Intervention		Outcome measures
		Frequency and duration	Parameters	
Rutledge et al.[52]	*n* = 40 Age (years) = 57 (7) BMI = 33 (2) Hysterectomy = 90% Pelvic floor muscle weakness = not reported Postoperative (median = 2.5 years after)	Exp = home-based pelvic floor muscle training + education (behavioral therapy) 15 min x 7/wk x 12 wk Con = no intervention	Setting = rehabilitation center and home Number of contractions = 3 × 10 reps Type of contraction = sustained Progression = not reported Supervision = physical therapist Remote supervision = phone call	Urinary symptoms = PGI-I (n women) Strength = Brink's scale (3—12) Quality of life = UDI-6 (0—100) Measurements = 0, 12 wk
Yang et al.[54]	*n* = 28 Age (years) = 52 (4) BMI = not reported Hysterectomy = 100% Pelvic floor muscle weakness = not reported Postoperative (median = 1.2 years after)	Exp = pelvic floor muscle training (combined with biofeedback and core exercise) 45 min x 1/wk x 4 wk Con = no intervention Both = education and home-based exercises recommendation	Setting = hospital Number of contractions = 40 reps Type of contraction = sustained Progression = increased number, intensity and duration Supervision = physical therapist Remote supervision = no	Sexual Function = PFQ Sexual function domain (0—10) Strength = manometry (cmH_2O) Quality of life = EORTC QLQ-C30 (0—100) Measurements = 0, 4 wk

Groups and outcome measures listed are those that were analyzed in this systematic review; there may have been other groups or measures in the trial.
AQoL, Assessment of Quality of Life; Con, control group; EORTC QLQ-C30, European Organization for Research and Treatment of Cancer global health status; Exp, experimental group; FACT-Cxm, Functional Assessment of Cancer Therapy for Cervical Cancer; FSFI, Female Sexual Function Index; min, minutes; n, number; PFDI, Pelvic Floor Distress Inventory; PFQ, Pelvic Floor Questionnaire; PGI-I, Patient Global Impression of Improvement; PISQ, Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire; POPDI, Pelvic Organ Prolapse Distress Inventory; POP-Q, Pelvic Organ Prolapse Quantification; RCT, randomized controlled trial; reps, repetitions; SF-36, 36-item Short-Form Health Survey; UDI, Urogenital Distress Inventory; WHOQOL-BREF, World Health Organization Quality of Life-BREF; wk, week.

Table 2 PEDro criteria and scores for the included trials ($n = 6$).

	Random allocation (0/1)	Concealed allocation (0/1)	Baseline comparability (0/1)	Participant blinding (0/1)	Therapist blinding (0/1)	Assessor blinding (0/1)	< 15 % dropouts (0/1)	Intention-to-treat analysis (0/1)	Between - group difference reported (0/1)	Point estimates and variability	Total PEDro Score
Barber et al.[47]	Y	Y	Y	N	N	N	Y	N	Y	Y	**6**
Weidner et al.[53]											
Frawley et al.[48]	Y	Y	N	N	N	Y	N	Y	Y	Y	**6**
Li, et al.[49]	Y	N	Y	N	N	N	Y	Y	Y	Y	**6**
Pauls et al.[50]	Y	N	Y	N	N	N	Y	N	Y	Y	**5**
Pauls et al.[51]											
Rutledge et al.[52]	Y	Y	N	N	N	N	Y	Y	N	Y	**5**
Yang et al.[54]	Y	N	Y	N	N	Y	N	N	Y	Y	**5**

reported no benefits on quality of life after pelvic floor muscle training but only one[48] provided data for calculating estimates, based on change scores (MD 0; 95% CI: −0.1, 0.1; $n = 43$).

Effects of intervention beyond the intervention period

Two trials examined the maintenance of benefits six[51] and twenty-four[47] months after the intervention period, but the results could not be combined in meta-analyses due to different type and timing of measurements. One trial,[51] involving 49 participants, provided imprecise results for urinary symptoms (MD −0.8 voids/day; 95% CI: −2.6, 0.9), sexual function (MD 4 points out of 36; 95% CI: −4, 13), pelvic muscle strength (MD −0.3 points out 5; 95% CI: −1.0, 0.4), and quality of life (MD −0.6 points out of 100; 95% CI: −1.7, 2.8). The second trial,[47] involving 308 participants, indicated no long-term difference between-groups for urinary symptoms (RD 0; 95% CI: −0.1, 0.1), vaginal prolapse (RD 0;95% CI: −0.1, 0.1), and pelvic muscle strength (MD 0 points; 95% CI: −0.4, 0.5).

Discussion

This systematic review provided moderate-quality evidence that pelvic floor muscle training improves sexual function in women after hysterectomy. However, benefits on urinary symptoms, vaginal prolapse, pelvic floor muscle strength, and quality of life, as well as maintenance of benefits beyond the intervention period remains uncertain.

Pelvic floor muscle training is highly recommended to treat pelvic floor dysfunctions due to the potential of improving muscle function.[13,14] This review indicated that pelvic floor muscle training might increase pelvic floor maximal voluntary strength but some uncertainty regarding the magnitude of the benefit was evidenced in a wide confidence interval. Surprisingly, all included trials[47-54] had no inclusion criteria related to muscle dysfunction, which may have allowed the inclusion of women with mild impairments. When participants with mild impairments are included, there is little room for improvement, which may explain the negative lower bound in the confidence interval. In addition, although only randomized trials examining pelvic floor muscle training after hysterectomy were included, there was some clinical heterogeneity related to the participants' characteristics: some trials included women with moderate and severe pelvic floor muscle weakness, and most trials did not report the participants' weakness level. Further trials should only include women diagnosed with muscle dysfunction, such as low maximal voluntary contraction, inability to sustain contractions, or poor coordination. Also, there was some clinical heterogeneity in the interventions' characteristics. The session duration, session frequency, and program duration varied among trials or were poorly reported. The experimental interventions should be detailed according to the Template for Intervention Description and Replication (TIDIeR) checklist[55] to improve the completeness of reporting, and ultimately the replicability of interventions.

Despite the uncertainty around strength improvements, the review indicated that pelvic floor muscle training improves sexual function and might reduce the probability of

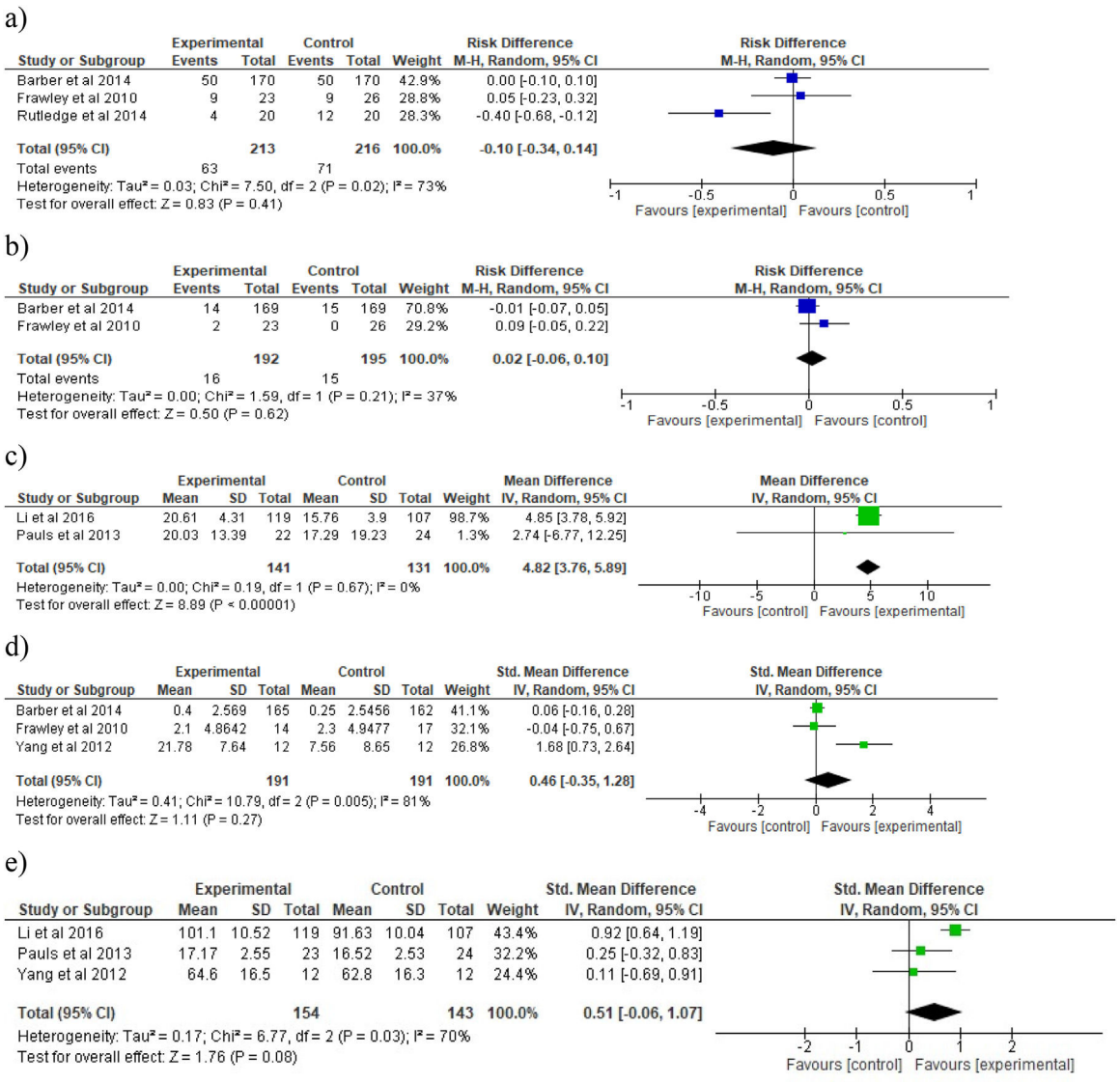

Fig. 3 (a) Risk difference (95% CI) of pelvic floor muscle training versus no intervention (n = 429) for urinary symptoms (number of women with urinary symptoms); (b) Risk difference (95% CI) of pelvic floor muscle training versus no intervention (n = 387) for vaginal prolapse (number of women with vaginal prolapse); (c) Mean difference (95% CI) of pelvic floor muscle training versus no intervention (n = 272) for sexual function (2—36 points); d) Mean difference (95% CI) of pelvic floor muscle training versus no intervention (n = 382) for pelvic floor muscle strength (cmH_2O); e) Standardized Mean difference (95% CI) of pelvic floor muscle training versus no intervention (n = 297) for quality of life (0—108).

experiencing urinary symptoms. An increase of 5 points in sexual function represents a 15% increase in the range of the *Female Sexual Function Index*, which is sufficient to be considered clinically relevant.[56] As participants scored, on average, 17 on admission to the trials, this increase overcomes the cut-off score of 21 points used to distinguish women with and without sexual dysfunction.[26] This is consistent with the results of the trial[53] that could not be included in the meta-analyses but reported an increase of 35% in the proportion of sexually active women in the experimental group, in comparison with an increase of 5% in the control group. In addition, this review also suggested potential effects on urinary symptoms. The mean risk difference suggests a 10% reduction in the probability of experiencing urinary symptoms after pelvic floor muscle training. On the other hand, those benefits were not observed on vaginal prolapse or carried over to improving quality of life. Although previous reviews[17,57] have demonstrated improvements on prolapse symptoms, our results suggested that women with moderate to severe vaginal prolapse (i.e., prolapse beyond the hymen) may require additional interventions, such as surgery. With regards to quality of life, besides the broad construct inherent to this outcome, each trial measured women's quality of life differently. Further trials should examine the measurement properties of condition-specific questionnaires and help reach consensus on the most appropriate quality of life measure to be used in clinical trials.

This systematic review is not without limitations. The search strategy did not include all the terms used as synonyms to pelvic floor muscle training; however, additional efforts were used in the manual search. The GRADE system of qualifying evidence suggested that only two of the five outcomes (i.e., sexual function and vaginal prolapse) examined in this

review was credible (i.e, provided moderate-quality evidence). The main reasons that no outcomes provided high-quality evidence were the substantial clinical and statistical heterogeneity, and the moderate methodological quality of the included trials. There were several factors that contributed to this. First, data were not always available for inclusion in the meta-analyses (eg., although all trials measured quality of life, two trials did not provide usable data). Second, some trials included a mixed sample and did not provide separate results for women after hysterectomy. Third, the included trials were not of high methodological quality; although blinding of participants and therapists is impractical during complex interventions, blinding of assessors is mandatory in further trials. Fourth, there was heterogeneity on collecting and reporting of outcome measurements, which precluded pooling of all trials (eg, although five trials measured strength, some trials reported change scores in cmH_2O, and another reported post-intervention data from an ordinal scale). Lastly, only two trials[47,51] measured outcomes beyond the intervention period. Large trials of high methodological quality are warranted to reduce the uncertainty of the effects of pelvic floor muscle training on strength and urinary symptoms, and to estimate the maintenance of benefits beyond the intervention period. Appropriate data reporting that includes both point measures and measures of variability at all timepoints, or provision of data from individual participants is encouraged to enable data usage in further conventional or individual-patient-data meta-analyses.[58] A roundtable with experts in women's health working collectively is strongly recommended to achieve consensus regarding intervention reporting as well as on outcome measures and patient characteristics that should be collected in clinical trials.[59] On the other hand, this is the first systematic review to demonstrate that pelvic floor muscle training improves women's sexual function after hysterectomy compared to no treatment, and also included analysis of the quality of the evidence.

Conclusion

This systematic review provides moderate-quality evidence that pelvic floor muscle training is effective for improving women's sexual function after hysterectomy compared to no treatment. Unfortunately, benefits on strength, urinary symptoms, vaginal prolapse, and quality of life, as well as maintenance of benefits beyond the intervention period remains uncertain.

Conflicts of interest

The authors declare no conflicts of interest.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.bjpt.2024.101122.

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