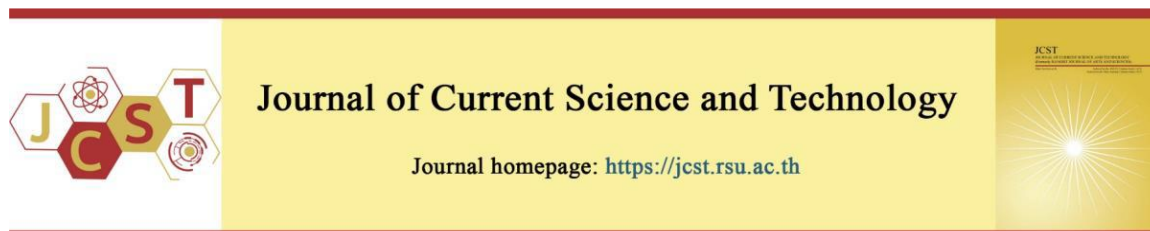


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The Effect of Kegel Exercise on Sexual Function in Menopausal Women: A Systematic Review and Meta-Analysis

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Abstract

Menopause often leads to sexual dysfunction due to hormonal and physiological changes. This research aimed to investigate the effects of pelvic floor muscle training (Kegel exercises) on sexual function in postmenopausal women by analyzing overall sexual function, specific domains, and various comorbidities. A comprehensive selection of primary studies was conducted across five databases: MEDLINE, Cochrane Library, ScienceDirect, Google Scholar, and Scopus. Inclusion criteria encompassed both randomized control trials (RCTs) and non-randomized Control Trials (non-RCTs) involving postmenopausal women participating in pelvic floor exercise programs with assessed sexual function outcomes. Eleven studies met the inclusion criteria, with 8 studies (n=643) contributing to the meta-analysis. Results from 6 RCTs (n=446) indicated that participants engaged in Kegel exercises exhibited significantly higher total sexual function scores, as assessed by the Female Sexual Function Index (FSFI), compared to control groups (mean difference = 2.58, 95% CI = 1.56, 3.59; $p < 0.00001$). Notable improvements were observed in several FSFI domains, including desire, arousal, lubrication, satisfaction, and pain; however, no significant difference was noted in the orgasm domain. Furthermore, a meta-analysis of 2 studies (n=197) involving mild pelvic organ prolapse revealed no significant difference in sexual function scores, measured by the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) (mean difference = -1.26, 95% CI = -2.75 to 0.22; $p = 0.69$). In conclusion, Kegel exercises significantly enhance sexual function in postmenopausal women, particularly regarding desire, arousal, lubrication, satisfaction, and pain, while showing no significant impact on orgasm or pelvic organ prolapse outcomes compared to the control group.

Keywords: kegel exercise; pelvic floor muscle training; sexual function; sexual dysfunction; menopause; peri-menopause; post-menopause

1. Introduction

Menopause is a natural biological transition characterized by the permanent cessation of menstruation, typically occurring in women between the ages of 45 and 55. This phase is often associated with a decline in estrogen levels, leading to various physical, emotional, and sexual health issues. Among these, sexual dysfunction is one of the most common and distressing complaints among postmenopausal women,

with symptoms including decreased libido, vaginal dryness, dyspareunia (pain during intercourse), and diminished sexual satisfaction (Nappi, & Lachowsky, 2009; Dąbrowska-Galas et al., 2019).

Sexual dysfunction is highly prevalent among postmenopausal women. A global survey conducted across 17 countries reported that the highest prevalence occurred during the perimenopausal stage (up to 78%) and continued to increase to 89% in the postmenopausal

stage (Khani et al., 2021). This dysfunction negatively affects quality of life, mental well-being, interpersonal relationships, and physical health (Dąbrowska-Galas et al., 2019). The etiology of sexual dysfunction during menopause is multifactorial, with key contributing factors including a decline in sex hormones, physiological changes, emotional factors, and pelvic floor muscle weakness (Nazarpour et al., 2016). Strengthening the pelvic floor muscles has been proposed as a potential strategy to improve sexual function (Faucher et al., 2024).

The integrity of the pelvic floor muscles plays a pivotal role in maintaining vaginal tone and function, and their deterioration may contribute significantly to sexual difficulties (Nazarpour et al., 2016; Bø, 2012). Consequently, therapeutic strategies aimed at enhancing pelvic floor muscle function have gained increasing attention.

Kegel exercises, first introduced by Dr. Arnold Kegel in the 1940s, are a non-invasive and low-cost method used to strengthen the pelvic floor muscles through voluntary contractions and relaxations. These exercises are widely recommended to treat urinary incontinence and pelvic organ prolapse, and evidence also suggests potential benefits in improving sexual function by increasing vaginal muscle tone and enhancing blood flow to the genital area (Bø et al., 2017; Lowenstein et al., 2010).

Several studies have examined the impact of pelvic floor muscle training (PFMT) on sexual function in postmenopausal women. Franco et al., (2021) found that PFMT significantly reduced sexual dysfunction, while Khosravi et al., (2022) reported that both Kegel exercises and lubricant gel improved sexual function, with Kegel exercises being more effective. However, other studies, such as those by Wiegersma et al., (2014) and Panman et al., (2017), showed limited or inconsistent benefits, especially among women with comorbidities such as pelvic organ prolapse. These mixed results suggest that while PFMT can be beneficial, its effectiveness may vary depending on individual health conditions, highlighting the need for a comprehensive synthesis of the current evidence.

While previous reviews have examined the effects of exercise on menopausal symptoms and general well-being, few have systematically assessed the specific impact of Kegel exercises on the full spectrum of sexual function domains in postmenopausal women. Moreover, prior meta-analyses have often included heterogeneous populations or lacked domain-specific analyses, limiting their relevance to

clinical practice (Nguyen et al., 2024; Carcelén-Fraile et al., 2020).

Therefore, the objective of this systematic review and meta-analysis is to evaluate the efficacy of Kegel exercises in improving sexual function in postmenopausal women, both overall and within specific FSFI domains. This study aims to provide updated and clinically relevant insights by synthesizing data from recent randomized controlled trials and observational studies, thereby informing a deeper understanding of this important health issue and guiding future interventions and clinical guidelines.

2. Objectives

To investigate the efficacy of pelvic floor muscle exercises on sexual function in postmenopausal women, both overall and in specific domains, as well as to analyze the effects in postmenopausal women with various comorbidities.

3. Materials and Methods

The methodology utilized in this research is a systematic review and meta-analysis, conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). This protocol has been registered with PROSPERO (registration number: CRD42024585027).

3.1 Literature Search

Two independent researchers conducted the literature search, focusing on primary research articles obtained from databases including MEDLINE, Cochrane Library, ScienceDirect, Google Scholar, and Scopus. The search utilized the following keywords: “Kegel Exercise” AND “Sexual Function” AND “Menopause,” along with related terms including “Kegel Exercise,” “Pelvic Floor Muscle Exercise,” “Pelvic Floor Muscle Training” (PFMT), “Sexual Function,” “Sexual Satisfaction,” and “Menopause,” as well as its variants such as “perimenopause” and “post-menopause.”

3.2 Study Selection

Eligible studies for inclusion comprised randomized controlled trials (RCTs) and non-randomized controlled trials (non-RCTs). Inclusion criteria targeted postmenopausal women across all age groups, without restrictions on comorbidities. The intervention of interest was Kegel exercises, with a control group consisting of participants who either did not perform Kegel exercises or received other

standard care. The primary outcome was sexual function, which was assessed using standardized questionnaires.

3.3 Quality Assessment

The quality of the included studies was evaluated according to the Cochrane Handbook for Systematic Reviews of Interventions (version 6.3, 2022) (Higgins et al., 2022). RCTs were assessed using the Cochrane Risk of Bias tool for randomized trials (RoB2) (Sterne et al., 2019), while non-RCTs were evaluated using the Risk of Bias in non-Randomized Studies of Interventions (ROBINS-I) tool (Sterne et al., 2016).

3.4 Statistical Analysis

The pooled effect was calculated using continuous data with mean differences, and statistical significance was determined using a 95% confidence interval (CI) and corresponding p-value. Statistical

significance was defined as $p < 0.05$, and analyses were conducted using the random effects model. The DerSimonian and Laird method was applied for the calculations. Data entry and analysis were performed using Review Manager Version 5.4.1, and the results were presented in a Forest plot.

Statistical heterogeneity was assessed using the I^2 statistic, with a threshold set at $p < 0.1$. Subgroup analysis was conducted when an adequate number of studies met the inclusion criteria. Furthermore, publication bias was evaluated through the use of funnel plots.

4. Results

The literature search identified 11 primary research studies that met the inclusion criteria, comprising 9 RCTs and 2 non-RCTs. The findings are reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, as shown in Figure 1.

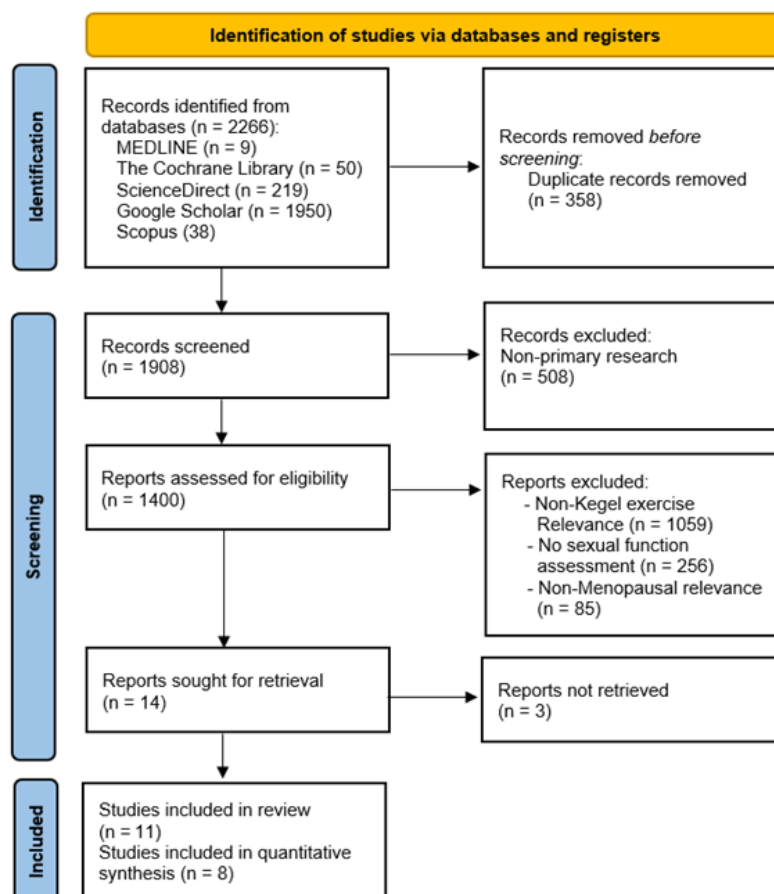


Figure 1 PRISMA flow diagram illustrating the study selection process for the systematic review and meta-analysis

The studies, published between 2012 and 2023, focused on postmenopausal women aged 40 to 60 with varying comorbidities. Participants engaged in Kegel exercise programs of varying designs, and sexual function was assessed using standardized questionnaires. The most commonly used tools for assessing sexual function were the FSFI (Female Sexual Function

Index) and PISQ-12 (Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12).

The implementation of Kegel exercises varied in terms of instruction methods, frequency, and duration. Most studies included education and expert guidance on how to perform the exercises. Study durations ranged from 8 to 96 weeks. Details are presented in Table 1.

Table 1 Characteristics of included studies evaluating the effect of Kegel exercises on sexual function in postmenopausal women (Part 1)

Authors, Year, Location	Study Design	Study Period	Studied Population (Sample size, Characteristics)	Intervention (Intervention, size, mean age)	Control (Control, size, mean age)	Sexual Function Measurement	Conclusion
Brækken et al., 2015, Norway	RCT	6 months	109 women with stage I, II, and III POP, regardless of POP symptoms, Mean age 48.90	Kegel exercise with lifestyle advice, n = 59, mean age 49.40	lifestyle advice n = 50, mean age 48.30	A validated POP-specific questionnaire developed by Mouritsen et al., (2003).	Kegel exercise can improve sexual function in some women. The women who reported improvement in sexual function demonstrated a good increase in PFM strength and endurance
Franco et al., 2021, Brazil	RCT	12 weeks	70 postmenopausal women	Intensive supervised PFMT protocol, n = 37, mean age 52.68	No intervention, n = 33 mean age 53.42	FSFI	Pelvic floor muscle training decreases sexual dysfunction in postmenopausal women
Khosravi et al., 2022, Iran	RCT	12 weeks	150 menopausal women	G1: Kegel exercise n = 50, mean age 54.20 G2: Lubricant gel n = 50, mean age 54.22	No intervention, n = 50, mean age 55.28	FSFI	Kegel exercise and lubricant gel effectively improved sexual function in menopausal women. However, sexual function was more likely to be improved after using Kegel exercise than using lubricant gel

Table 1 Cont.

Authors, Year, Location	Study Design	Study Period	Studied Population (Sample size, Characteristics)	Intervention (Intervention, size, mean age)	Control (Control, size, mean age)	Sexual Function Measurement	Conclusion
Kurt et al., 2023, Turkey	RCT	8 weeks	46 primary Sjögren syndrome women, Mean age 47.78	Kegel exercise with received information about Pelvic floor anatomy and function, n = 23, mean age 46.08	Received information about Pelvic floor anatomy and function, n = 23, mean age 49.47	FSFI	Kegel exercise has a positive effect on the sexual dysfunction and discomfort caused by pelvic symptoms in patients with primary Sjögren syndrome
Lara et al., 2012, Brazil	Prospective, longitudinal exploratory study	12 weeks	32 postmenopausal women	Kegel exercise n = 32, mean age 52.10	No control group	SQ-F	Kegel exercise improved pelvic floor muscular strength in postmenopausal women. However, there was no improvement in sexual function
Mercier et al., 2019, Canada	a single-arm feasibility study	12 weeks	32 postmenopausal women with genitourinary syndrome and stress or mixed urinary incontinence, aged > 55 years	Pelvic floor muscle training program, n = 32, mean age 68.00	No control group	ICIQ-VS, ICIQ- FLUTSsex	The PFMT program reduced GSM symptoms and signs as well as the impact on ADL, QoL, and sexual function
Nazarpour et al., 2017, Iran	RCT	12 weeks	145 postmenopausal women	G1: Sex education n = 48 mean age 51.50 G2: Kegel exercise n = 47 mean age 53.10	Routine postmenopaus al care, n = 50 mean age 52.90	FSFI	Sex education programs and Kegel exercises improved some domains of sexual functions, specifically arousal, orgasm, and satisfaction
Nazarpour et al., 2018, Iran	RCT	12 weeks	97 postmenopausal women, aged 40 to 60 years.	Specific instructions on PFM exercises, n = 47, mean age 53.13	General information on menopause n = 50, mean age 52.84	FSFI	Pelvic floor muscle exercises have the potential to improve the sexual function of postmenopausal women

Table 1 Cont.

Authors, Year, Location	Study Design	Study Period	Studied Population (Sample size, Characteristics)	Intervention (Intervention, size, mean age)	Control (Control, size, mean age)	Sexual Function Measurement	Conclusion
Panman et al., 2017, Netherlands	RCT	24 months	287 women with symptomatic mild pelvic organ prolapse, aged > 55 years	Kegel exercise n = 145 mean age 64.50	No intervention n = 142 mean age 64.00	PISQ-12	Kegel exercise resulted in greater pelvic floor symptom improvement compared with the control group. However, there were no differences between groups in a change of sexual function
Schvartzman et al., 2019, Brazil	RCT	Results were measured after 5 sessions of the intervention	42 Peri and postmenopausal women complaint of dyspareunia at least 6 months, aged 40 to 60 years	PMNT with received heat in the lower back with myofascial release of the abdominal diaphragm, piriformis, and iliopsoas muscles (1 hour) n = 21, mean age 51.90	Received heat in the lower back with myofascial release of the abdominal diaphragm, piriformis, and iliopsoas muscles (1 hour), n = 21, mean age 50.60	FSFI	PMNT effectively improved pain, QoL, sexual function, and PFM function in climacteric women with dyspareunia.
Wiegiersma et al., 2014, Netherlands	RCT	12 weeks	287 Women aged 55 years or over with symptomatic mild pelvic organ prolapse	Kegel exercise n = 145 mean age 64.50	No intervention n = 142 mean age 64.00	PISQ-12	Kegel exercise led to a significantly greater improvement in pelvic floor symptoms. However, there were no differences between groups in the change of sexual function

Quality Assessment of Included RCT Studies

The quality assessment of nine RCTs revealed that 33.3% of the studies raised concerns regarding the randomization process due to insufficient details on allocation concealment. Bias arising from deviations from the intended interventions, missing outcome data, and outcome measurement was categorized as low risk. However, 33.3% of the studies showed a

high risk of bias in the selection of reported results, as multiple outcome measurements were conducted at various time points. Overall, 33.3% of the studies demonstrated high overall bias, 22.2% showed concerns related to randomization bias, and 44.4% showed a low risk of bias across the studies. Further details are provided in Figures 2 and 3.

Quality Assessment of Included non-RCT Studies

The quality assessment of two non-RCTs revealed that both studies exhibited a low risk of bias in confounding, participant selection, and classification of interventions. However, 50% of the studies demonstrated a serious risk of bias due to deviations from the intended interventions, as only half of the participants adhered to the prescribed activities. Furthermore, 50% of the studies showed a

moderate risk of bias due to missing data, as some participants withdrew from the study. All studies displayed a moderate risk of bias in outcome measurement, as there was no comparison group and the evaluators were aware of the intervention. Overall, 50% of the studies showed serious bias, while the remaining 50% exhibited moderate bias. Further details are presented in Figures 4 and 5.

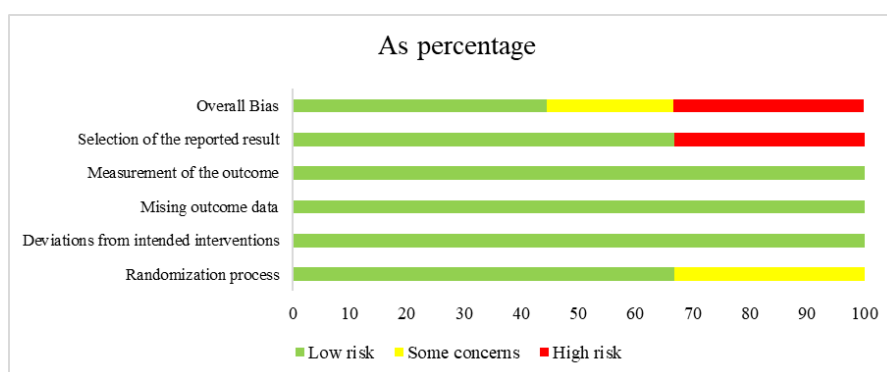


Figure 2 Risk of bias graph summarizing the authors' judgments on the nine included RCTs across bias domains, using the Cochrane RoB 2 tool

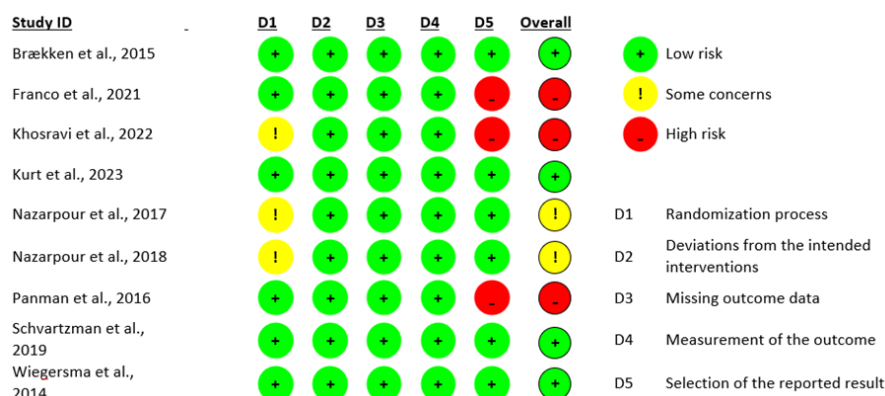


Figure 3 Risk of bias summary for each included RCT, indicating risk levels for individual domains across studies

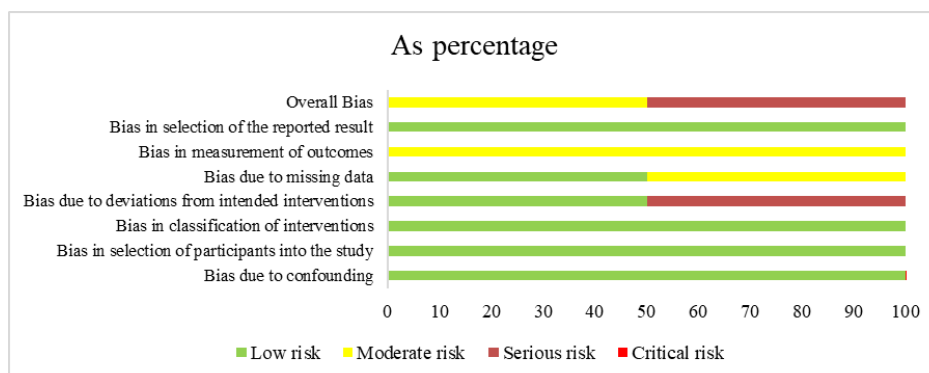


Figure 4 Risk of bias graph for the two included non-RCTs, assessed using the ROBINS-I tool

Meta-analysis of the Effect of Kegel Exercise on Sexual Function in Menopausal Women

A meta-analysis was conducted based on RCTs that met the inclusion criteria. Six studies, with a combined sample size of 446 participants, were included in the analysis. The FSFI questionnaire was used to assess sexual function. The results of the meta-analysis, as shown in Figure 6, showed a significant improvement in the overall sexual function score in the Kegel exercise group compared to the control group (mean difference = 2.58, 95% CI = 1.56 to 3.59; $p < 0.00001$; $I^2 = 96\%$).

Subgroup analysis by domain revealed that the scores in various domains, including desire (mean difference = 0.07, 95% CI = -0.07 to 0.21; $p < 0.00001$; $I^2 = 88\%$), arousal (mean difference = 0.42, 95% CI = 0.34 to 0.50; $p = 0.03$; $I^2 = 61\%$), lubrication domain (mean difference = 0.36, 95% CI = -0.08 to 0.80; $p < 0.00001$; $I^2 = 99\%$), satisfaction (mean difference = 0.55, 95% CI = 0.45, 0.66; $p < 0.001$; $I^2 = 75\%$), and pain (mean difference = 0.54, 95% CI = 0.04 to 1.04; $p < 0.00001$; $I^2 = 99\%$) significantly increased compared to the control group, as shown in Figures 7-11.

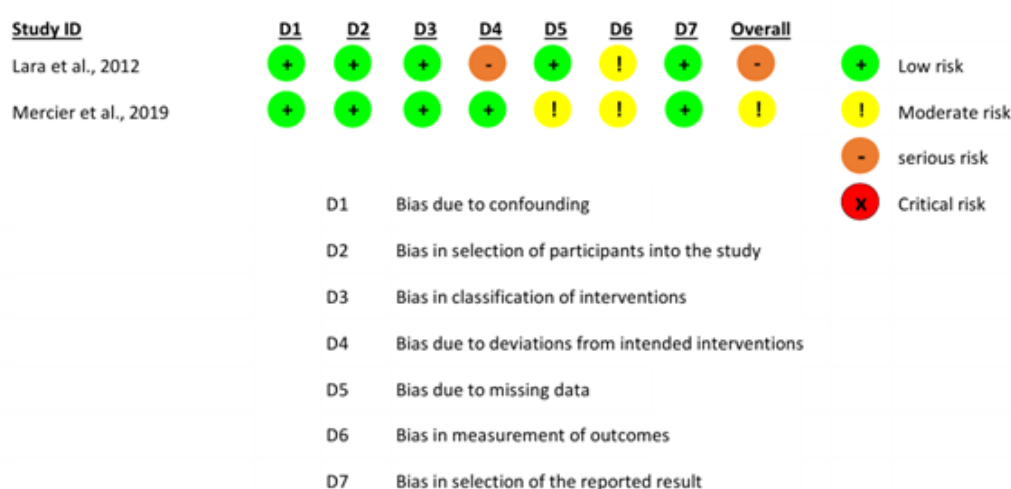


Figure 5 Risk of bias summary for non-RCTs, showing individual judgments for each domain

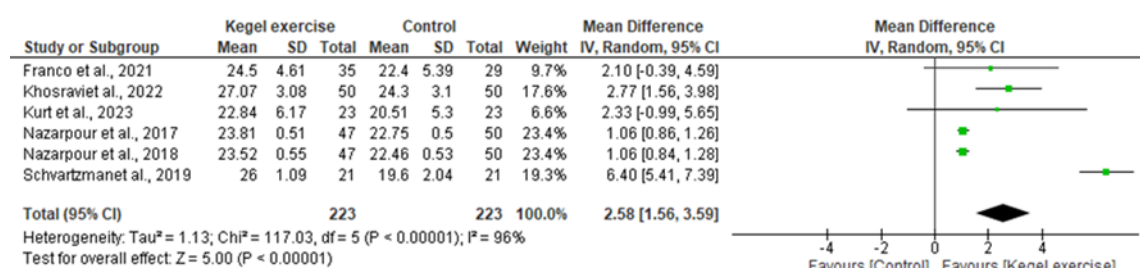


Figure 6 Forest plot of meta-analysis comparing overall FSFI scores between the Kegel exercise group and control group

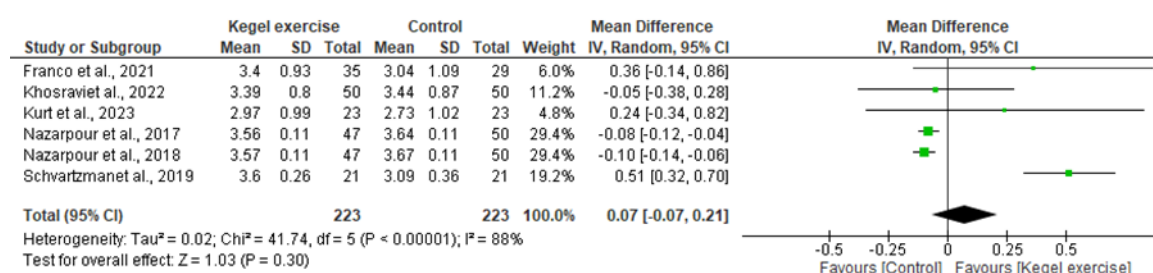


Figure 7 Forest plot of the effect of Kegel exercises on the desire domain of the FSFI

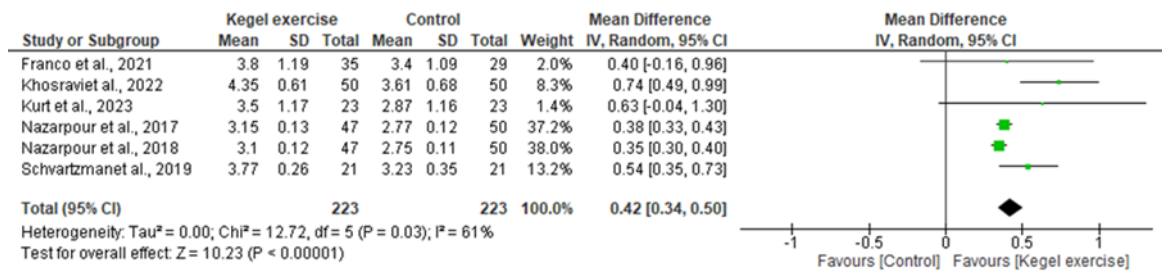


Figure 8 Forest plot of the effect of Kegel exercises on the arousal domain of the FSFI

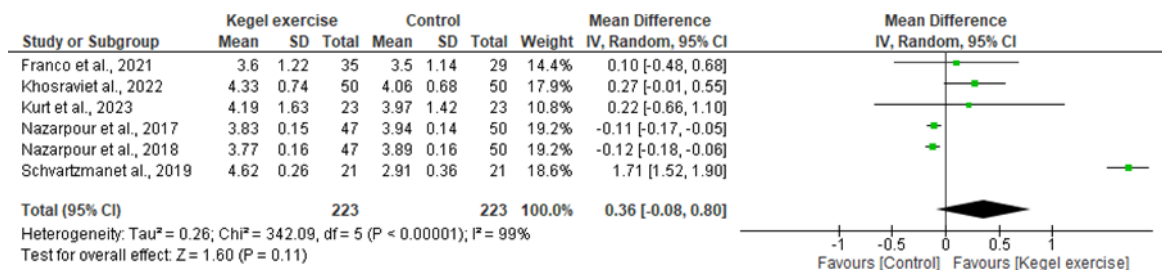


Figure 9 Forest plot of the effect of Kegel exercises on the lubrication domain of the FSFI

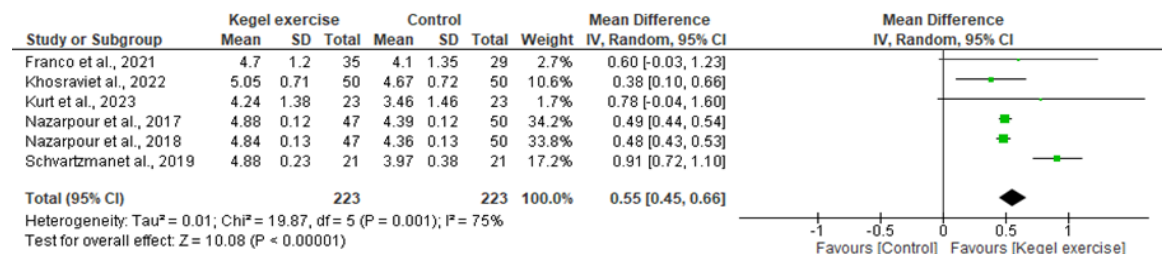


Figure 10 Forest plot of the effect of Kegel exercises on the satisfaction domain of the FSFI

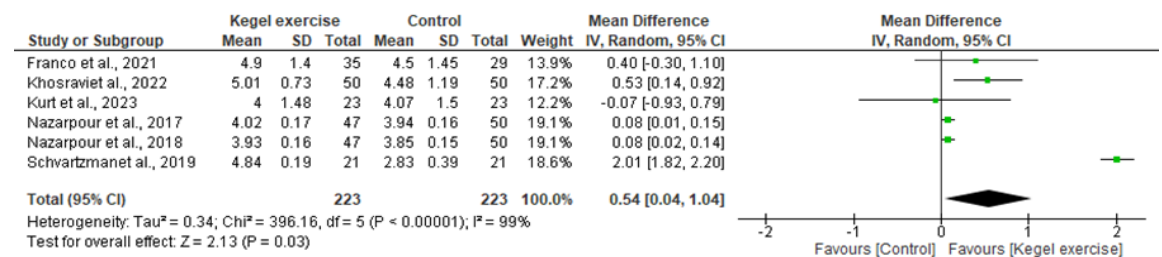


Figure 11 Forest plot of the effect of Kegel exercises on the pain domain of the FSFI

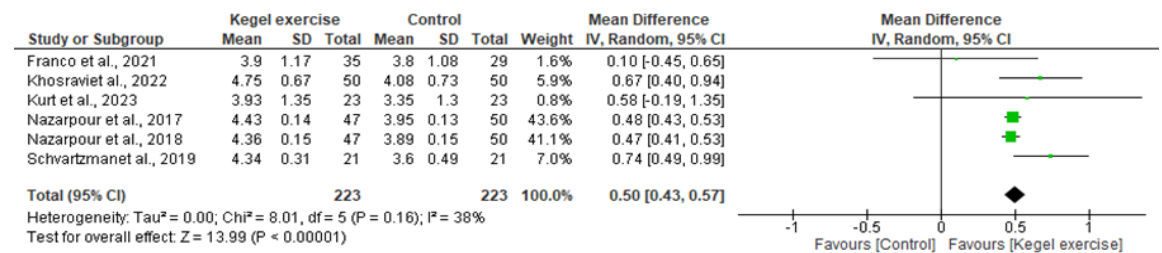


Figure 12 Forest plot of the effect of Kegel exercises on the orgasm domain of the FSFI.

However, no statistically significant difference in sexual function scores was found between the Kegel exercise group and the control group in the Orgasm domain (mean difference = 0.50, 95% CI = 0.43 to 0.57; $p = 0.16$; $I^2 = 38\%$), as shown in Figures 12.

A meta-analysis examining the effect of Kegel exercise on sexual function in postmenopausal women with mild pelvic organ prolapse, measured using the PISQ-12 questionnaire, included 2 RCTs with a total of 197 participants. The analysis found no statistically significant difference in sexual function scores between the Kegel exercise group and the control group (mean difference = -1.26, 95% CI = -2.75 to 0.22; $p = 0.69$; $I^2 = 0\%$), as shown in Figure 13.

The Assessment of Publication Bias

Due to the limited number of studies, the assessment of publication bias using funnel plots was challenging. However, visual inspection of the funnel plot symmetry indicated a relatively even distribution, suggesting a low risk of publication bias. The evaluation was performed separately for each domain of sexual function as measured by the FSFI questionnaire, including the overall score, desire, arousal, lubrication, orgasm, satisfaction, and pain domains, as well as for the PISQ-12 questionnaire. The results are presented in Figure 14

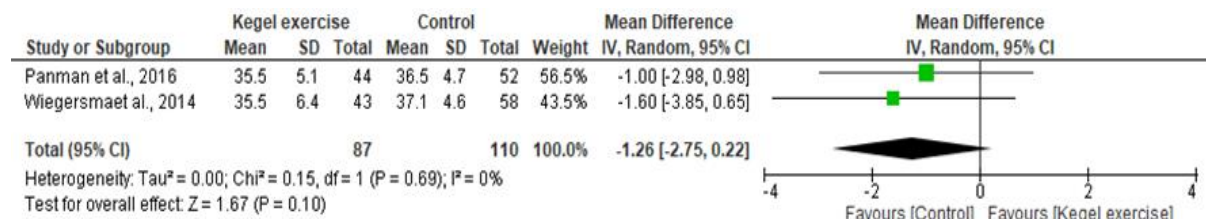


Figure 13 Forest plot of meta-analysis assessing the effect of Kegel exercises on sexual function in women with mild pelvic organ prolapse, measured using the PISQ-12

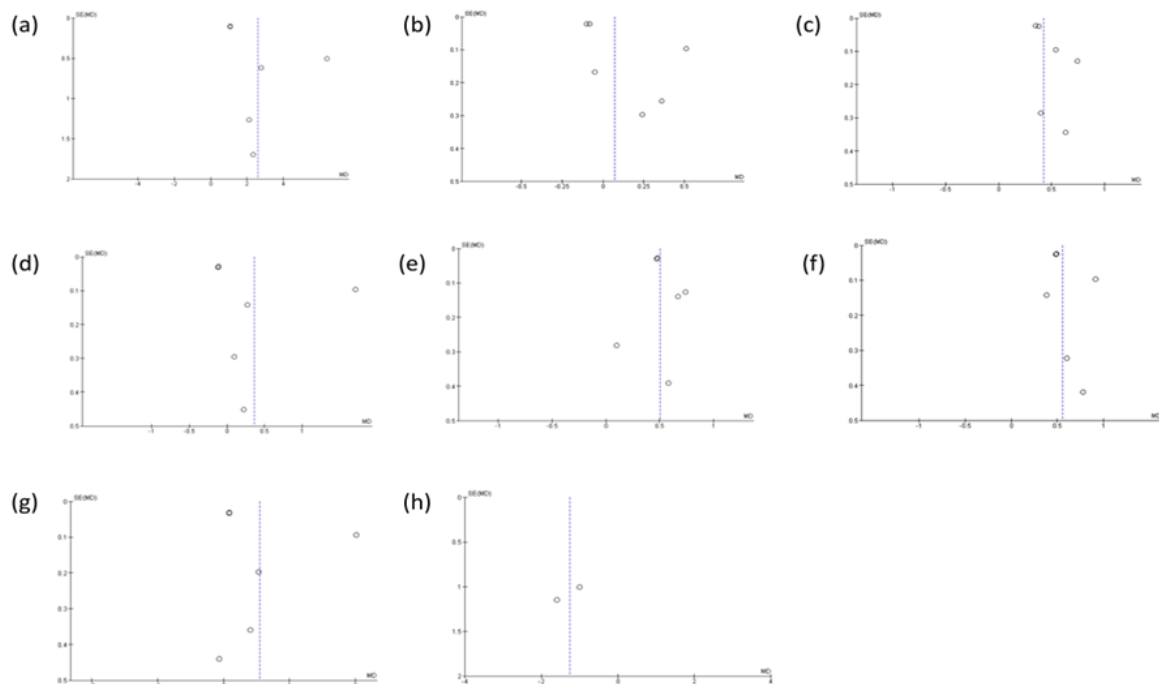


Figure 14 Funnel plots for publication bias assessment across FSFI domains and the PISQ-12: (a) FSFI overall score, (b) Desire, (c) Arousal, (d) Lubrication, (e) Orgasm, (f) Satisfaction, (g) Pain, and (h) PISQ-12.

5. Discussion

This systematic review and meta-analysis of 11 studies, including 6 RCTs with 446 participants, revealed significant improvements in overall sexual function scores among postmenopausal women performing Kegel exercises. These improvements were evident across several FSFI domains, including desire, arousal, lubrication, satisfaction, and pain, suggesting that pelvic floor muscle training is particularly effective in enhancing these aspects of sexual health. These results support the clinical use of Kegel exercises as a safe and effective intervention. Importantly, improvements were observed across studies with varying exercise frequencies, durations (8 to 96 weeks), and modes of delivery. None of the included studies reported adverse events, further supporting the safety of this approach. The consistency of benefit across diverse populations and settings highlights the generalizability of the findings.

The physiological mechanisms underlying these improvements are likely related to increased muscle tone and local blood flow in the pelvic region. Improved circulation enhances vaginal lubrication and tissue responsiveness, which contributes to reduced pain and heightened arousal during sexual activity (Sacomori et al., 2015; Ferreira et al., 2015; Lowenstein et al., 2010). Regular Kegel exercises may also improve sexual satisfaction through enhanced pelvic support and body awareness, leading to greater sexual responsiveness (Curillo-Aguirre et al., 2023).

However, our analysis found no significant improvements in the orgasm domain. Orgasmic response is complex and may be influenced more strongly by psychological, neurological, and hormonal factors than by pelvic floor muscle strength alone (Selice, & Morris, 2022; Wierman et al., 2010). Therefore, while Kegel exercises offer physical and functional benefits, additional therapeutic approaches, such as counseling, stress reduction, and hormone therapy, may be necessary to address orgasmic dysfunction (IsHak et al., 2010).

Among women with mild pelvic organ prolapse (POP), our meta-analysis of two studies using the PISQ-12 (n = 197) found no statistically significant improvement in sexual function. Although Kegel exercises are effective in improving pelvic muscle tone and reducing prolapse symptoms (Bo et al., 2017; Brækken et al., 2015), these structural benefits may not directly translate into enhanced sexual function in this subgroup. POP is associated with decreased body image, reduced sexual confidence, and altered vaginal anatomy, which may require multimodal treatment approaches including physical therapy, hormone replacement, and surgery (Giarenis, & Robinson, 2014; Fatton et al., 2020; Novi et al., 2005).

Overall, the findings of this systematic review and meta-analysis strongly support the integration of Kegel exercises into routine care for postmenopausal women experiencing sexual dysfunction, particularly in addressing symptoms related to arousal, lubrication, satisfaction, and pain. The results provide compelling evidence that Kegel exercises are a safe, accessible, and effective intervention for enhancing multiple domains of sexual function in postmenopausal women. These benefits are most pronounced in the physical and sensory aspects of sexual response. However, the intervention appears to be less effective for orgasmic dysfunction and among women with pelvic organ prolapse, suggesting the need for multimodal or adjunctive therapies in these subgroups.

6. Conclusion

This systematic review and meta-analysis demonstrated that pelvic floor muscle training (Kegel exercises) significantly improves overall sexual function in postmenopausal women, particularly in the domains of desire, arousal, lubrication, satisfaction, and pain. However, no statistically significant improvements were observed in orgasmic function or in women with mild pelvic organ prolapse. These findings support the recommendation of Kegel exercises as a first-line, non-pharmacological intervention for enhancing sexual health in postmenopausal populations. Nonetheless, targeted strategies may be necessary for addressing sexual dysfunction related to orgasm and pelvic organ prolapse, warranting further research in these subgroups.

7. Acknowledgements

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