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The Effectiveness of a Combined Pelvic Floor Exercise Program and Desensitization-Based Sex Therapy on Pain and Sexual Satisfaction in Female Athletes

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A B S T R A C T

Objective: This study evaluated the effectiveness of an integrated pelvic floor muscle training program combined with desensitization-based sex therapy on sexual pain and sexual satisfaction in female athletes.

Methods and Materials: In a randomized controlled trial, 68 sexually active female athletes (18–40 years) reporting penetration-related pain were allocated to either a combined intervention group (PFMT plus desensitization-based sex therapy; 8 weekly sessions) or an attention-matched education control group. Outcomes were assessed at baseline, post-intervention (8 weeks), and 3-month follow-up. Primary outcomes included pain during intercourse (Visual Analogue Scale, VAS) and sexual satisfaction (Female Sexual Function Index, FSFI). Secondary outcomes included sexual distress, pain catastrophizing, and pelvic floor muscle strength. Data were analyzed using intention-to-treat mixed-effects models.

Findings: At post-intervention, the combined intervention group demonstrated significantly greater reductions in sexual pain compared with controls (adjusted mean difference = −1.0, 95% CI −1.6 to −0.4; p = .001; Cohen's d = 0.60). Sexual satisfaction improved significantly in the intervention group (adjusted difference = +3.1 FSFI points, 95% CI 1.4–4.8; p < .001; d = 0.65). Improvements were largely maintained at the 3-month follow-up. Significant reductions were also observed in pain catastrophizing (d = 0.70) and sexual distress (d = 0.72), alongside objective gains in pelvic floor muscle strength (p < .001).

Conclusion: A combined PFMT and desensitization-based sex therapy program is an effective, non-invasive intervention for reducing sexual pain and improving sexual satisfaction in female athletes, supporting a biopsychosocial approach to sexual rehabilitation in sports contexts.

Keywords: *pelvic floor muscle training; sex therapy; desensitization; dyspareunia; sexual satisfaction; female athletes*

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1. Introduction

Painful intercourse and reduced sexual satisfaction are pervasive problems that substantially impair quality of life, interpersonal relationships, and athletic performance among women of reproductive age (1). Dyspareunia and the broader construct of Genito-pelvic pain/penetration disorders are multifactorial conditions in which musculoskeletal, neurophysiological, and psychosocial factors interact to produce persistent genital pain and avoidance of sexual activity (1). In clinical series and population studies, pelvic-floor–related contributors (including abnormal pelvic floor muscle tone, trigger points, and impaired coordination) are consistently identified as major, and treatable, causes of sexual pain and diminished sexual function (1, 2).

Elite and recreational female athletes represent an important, under-recognized population for Genito-pelvic pain and sexual dysfunction. Recent population-level and sport-specific studies indicate that pelvic floor dysfunction (PFD) symptoms — ranging from urinary symptoms to pelvic pain — are common in athletes and frequently unreported, with female athletes showing especially high prevalence and low rates of disclosure and specialized care seeking (3). Several mechanisms plausibly link athletic training to pelvic-floor pathology and sexual pain: repeated high intra-abdominal pressure, sport-specific postures and repetitive loading, muscular imbalance (including coexisting weakness and hypertonicity), and maladaptive toileting or breathing patterns adopted during training and competition (3); screening studies in collegiate athletes). These factors may produce both overactivity (hypertonus) and dysfunctional coordination of pelvic floor muscles (PFMs), creating a substrate for dyspareunia and decreased sexual satisfaction in women who train intensively (3). Pelvic-floor muscle training (PFMT) is a first-line conservative intervention for a broad array of pelvic-floor disorders and has been proposed as a targeted strategy to improve sexual function through restoration of neuromuscular control, strength, and proprioceptive feedback (2). Systematic reviews and randomized clinical trials have shown that multimodal pelvic-floor rehabilitation (including directed PFMT, biofeedback, manual myofascial release, and intravaginal techniques) can reduce pain and improve sexual function scores (e.g., FSFI domains) in women with dyspareunia and related pelvic pain syndromes (1, 2). Moreover, more recent randomized trials that add supervised exercise and PFMT to multidisciplinary pain management programs have demonstrated improvements in current pelvic/genital pain and related outcomes in women with pelvic pain conditions (e.g., endometriosis), supporting the clinical plausibility that active neuromuscular retraining yields meaningful symptom relief (4, 5). Nevertheless, PFMT protocols are heterogeneous across studies (techniques, dosing, adjuncts), and the magnitude of benefit for sexual pain and satisfaction varies between populations and interventions (1, 2).

Concurrently, psychosexual interventions and specifically sex-therapy approaches that incorporate graduated exposure/desensitization and sensate-focus techniques — have a longstanding evidence base for treatment of penetration-related disorders such as vaginismus and aspects of Genito-pelvic pain (6). Systematic desensitization and cognitive-behavioral or sex-therapeutic protocols address the fear-avoidance cycle, maladaptive cognitions, anticipatory anxiety, hypervigilance to genital sensations, and partner dynamics that perpetuate pain and inhibit sexual satisfaction (6). While the Cochrane review concluded that the quality of trials is variable and direct superiority of one psychotherapeutic technique could not be firmly established, the clinical consensus supports desensitization-based sex therapy as an integral component of multidisciplinary care for penetration pain and vaginismus-spectrum disorders (6).

There is strong conceptual and preliminary empirical justification for combining PFMT with sex-therapy that uses graded desensitization. Mechanistically, PFMT targets the peripheral and neuromuscular contributors (strength, coordination, myofascial trigger points, and ability to down-regulate PFM tone), whereas desensitization-based sex-therapy addresses central sensitization, conditioned fear responses, catastrophizing, and maladaptive sexual cognitions — psychological drivers that amplify pain perception and sustain avoidance behavior (1, 6). Integrating these approaches addresses both the “hardware” (muscles, trigger points, peripheral nociceptive drivers) and the “software” (fear, hypervigilance, restrictive sexual scripts) of Genito-pelvic pain, thereby increasing the likelihood of restoring comfortable penetration and improving sexual satisfaction (interdisciplinary case series and modern clinical practice statements). Early clinical series and interdisciplinary reports suggest that multimodal programs yield higher remission rates for pain and better sexual outcomes than single-modality care (interdisciplinary management case series; recent RCT evidence in related pelvic pain populations), but high-quality RCTs specifically

evaluating structured PFMT + sex-therapy packaged interventions in athletic cohorts are lacking.

Female athletes pose distinctive opportunities and challenges for combined interventions. On one hand, the generally higher baseline fitness, discipline with home exercise, and access to multidisciplinary sports-medicine teams may facilitate adherence to PFMT programs and graded exposure homework (empirical work on exercise and sexual function; general exercise literature). On the other hand, sport-specific mechanical loads, training schedules, and stigma about pelvic symptoms in athletic cultures may impede disclosure and timely care, and hypertonicity related to chronic loading patterns may require tailored manual therapy and neuromuscular re-education strategies beyond standard PFMT (3). Thus, an intervention that explicitly combines PFMT (including biofeedback and myofascial release where indicated) with a structured, evidence-based sex-therapy program that uses progressive desensitization and cognitive restructuring may be especially well suited to address the unique biopsychosocial profile of sexually active female athletes who experience pain and low sexual satisfaction.

Despite the theoretical promise and scattered positive clinical reports, the literature shows important gaps. Most PFMT research targets postpartum, urinary incontinence, or general pelvic-floor populations rather than athletes; psychosexual desensitization trials are small and heterogeneous; and very few rigorous, adequately powered randomized controlled trials have tested combined PFMT + desensitization-based sex-therapy packages with outcome measures that include both pain intensity and standardized sexual satisfaction instruments (e.g., FSFI). Consequently, there is limited high-quality evidence to guide clinicians working with female athletes who present with coexisting pelvic-floor dysfunction, sexual pain, and dissatisfaction. The present study therefore, aims to address these gaps by evaluating the efficacy of a combined pelvic-floor exercise program plus structured desensitization-based sex-therapy (compared with an appropriate control condition) on two co-primary outcomes: pain during penetration and global sexual satisfaction in female athletes. The trial's hypothesis is that the combined intervention will produce clinically and statistically significant reductions in penetration-related pain and improvements in sexual satisfaction compared with control, mediated by improvements in pelvic-floor muscle coordination and reductions in fear-avoidance and sexual hypervigilance.

2. Methods and Materials

2.1 Study Design

This study was conducted as a parallel-group, single-blind (assessor-blinded), randomized controlled trial (RCT) to evaluate the efficacy of a combined pelvic-floor muscle training (PFMT) and desensitization-based sex therapy program (hereafter referred to as the "Combined Intervention") compared with an attention-matched education control condition. The trial aimed to investigate the effects of the intervention on two co-primary outcomes: (1) intensity of penetration-related sexual pain and (2) sexual satisfaction among female athletes. Participants were randomly allocated in a 1:1 ratio to either the Combined Intervention group or the Control group. The intervention period lasted eight weeks. Outcome assessments were performed at four time points: baseline prior to randomization (T0), mid-treatment at week 4 (T1), post-treatment at week 8 (T2), and three-month follow-up after completion of the intervention (T3). Primary analyses were conducted according to the intention-to-treat (ITT) principle using mixed-effects models to estimate treatment effects over time.

2.2 Setting and Sampling Frame

Recruitment and intervention delivery were carried out across multiple collaborating sports medicine clinics, pelvic physiotherapy centers, sexual health clinics, and university sports facilities located in three deliberately selected regions of Tehran. These regions were chosen to represent socioeconomic and training-environment diversity and included northern Tehran (high socioeconomic status), central Tehran (mixed socioeconomic status), and southern Tehran (lower socioeconomic status). A multistage stratified cluster sampling strategy was applied. First, comprehensive lists of registered sports clubs, university athletic programs, and female-only fitness centers within each region were compiled. Second, sports clubs and centers were randomly selected within each region to form clusters. Finally, eligible female athletes within selected clusters were screened and invited to participate until predefined regional quotas were achieved. Stratification was performed by geographic region and competitive level (elite/competitive versus recreational) to ensure balanced representation. This sampling approach was intended to enhance external validity, increase representativeness of Tehran's heterogeneous athletic

population, and reduce sampling bias associated with single-center trials.

2.2.1 Eligibility Criteria

Participants were eligible if they met all of the following criteria: female sex; age between 18 and 40 years; engagement in organized sport or structured exercise at least three times per week for a minimum of six months; sexual activity involving vaginal intercourse at least once during the preceding month; self-reported persistent pain during vaginal penetration for at least three months and/or low sexual satisfaction based on screening cutoffs; ability to read and complete questionnaires in Persian; and provision of written informed consent. Participants were excluded if they were pregnant or planning pregnancy during the study period; had undergone pelvic or pelvic-floor surgery within the previous six months; presented with untreated active gynecologic infection at enrollment; had known neurological conditions affecting pelvic innervation or major pelvic structural pathology requiring immediate surgical intervention; had received pelvic-floor physiotherapy or sex therapy within the preceding three months; had a severe psychiatric disorder (e.g., psychosis) or active suicidal ideation; or had recently initiated medications substantially altering pain perception, unless dosage had remained stable and was approved by the study physician.

2.2.2 Sample Size Calculation

Sample size was determined based on penetration-related pain intensity (VAS). With a two-sided α of 0.05, 80% power, an expected between-group difference of 1.5 cm (SD = 2.0), 28 participants per group were required. Allowing for 20% attrition, the target sample was increased to 34 participants per group (total N = 68), which was sufficient to detect changes in sexual satisfaction and support secondary analyses.

2.2.3 Randomization, Allocation Concealment, and Blinding

After completion of baseline assessments, participants were randomized to either the Combined Intervention or Control group using a computer-generated permuted block randomization scheme with randomly varying block sizes of four and eight. Randomization was stratified by region and competitive level. Allocation concealment was ensured by an independent data manager who maintained the randomization sequence. Group assignments were disclosed to site coordinators only after baseline data entry, using sequentially numbered, opaque, sealed envelopes or a secure REDCap-based randomization module. Outcome assessors, including physiotherapists conducting pelvic examinations and researchers responsible for data analysis, were blinded to group allocation. Due to the nature of the interventions, participants and treating therapists were not blinded. To minimize assessment bias, standardized assessor training, scripted assessment procedures, and fidelity checks were implemented.

2.3 Outcomes and Measurement Instruments

Sexual pain, sexual function, sexual distress, pelvic floor symptoms, pelvic floor muscle function, central sensitization, and pain-related cognitions were assessed using validated self-report and clinical measures, including the VAS, FSFI, FSDS-R, PFDI-20, Modified Oxford Scale with vaginal manometry, CSI-25, and PCS. The intervention group received an eight-week, manualized, combined pelvic-floor muscle training and desensitization-based sex therapy program delivered through weekly supervised sessions and structured home practice, while treatment fidelity was ensured through standardized protocols and supervision. The control group received an attention-matched education program consisting of eight weekly sessions focused on pelvic health education and general well-being, without active pelvic-floor training or psychosexual desensitization components.

2.4 Data Analysis

Data were collected using a secure electronic data capture system and were de-identified using unique study identifiers. Primary analyses were conducted using mixed-effects linear models under the intention-to-treat framework, with fixed effects for group, time, and group-by-time interaction. Secondary outcomes and mediation analyses were performed using similar modeling approaches. Missing data were handled using multiple imputation where appropriate.

3. Results

Table 1 shows that the combined intervention and control groups were well matched at baseline in terms of demographic characteristics. The mean age of participants was approximately 27 years, with no significant difference between groups. The distribution of educational level (high

school or less, bachelor's degree, and master's degree or higher) was comparable across groups. Participants were also evenly distributed across the three predefined residential areas of Tehran (north, central, and south). Marital status and occupational/role categories, including professional or semi-professional athletes, students, non-sport employees, and unemployed/housewives, did not differ significantly between groups. Overall, the absence of statistically significant between-group differences across all baseline variables (all $p > 0.40$) indicates successful randomization and good baseline comparability between the study groups.

Table 1. Baseline Demographic and Sociodemographic Characteristics of the Study Participants

Variable	Combined (n=36)	Control (n=32)	Total (n=68)	p
Age (years)	26.8 ± 4.5	27.4 ± 4.8	27.1 ± 4.6	0.45
Education				0.99
High school or less	6 (16.7%)	5 (15.6%)	11 (16.2%)	
Bachelor's degree	21 (58.3%)	19 (59.4%)	40 (58.8%)	
Master's or higher	9 (25.0%)	8 (25.0%)	17 (25.0%)	
Residential area (Tehran)				0.99
North	12 (33.3%)	10 (31.3%)	22 (32.4%)	
— Central	14 (38.9%)	13 (40.6%)	27 (39.7%)	
— South	10 (27.8%)	9 (28.1%)	19 (27.9%)	
Marital status				0.98
Married	26 (72.2%)	23 (71.9%)	49 (72.1%)	
Single	10 (27.8%)	9 (28.1%)	19 (27.9%)	
Occupation / role				0.99
Professional/semi-professional athlete	12 (33.3%)	10 (31.3%)	22 (32.4%)	
Student	10 (27.8%)	9 (28.1%)	19 (27.9%)	
Non-sport employee	9 (25.0%)	8 (25.0%)	17 (25.0%)	
Unemployed/housewife	5 (13.9%)	5 (15.6%)	10 (14.7%)	

Groups were similar at baseline across demographic indicators (all $p > .4$). The sample is distributed across three predefined Tehran regions (north, central, south), as planned.

As shown in Table 2, baseline clinical characteristics were comparable between the combined intervention and control groups, with no statistically significant between-group differences observed across pain intensity, sexual function, sexual distress, pain catastrophizing, central sensitization, or pelvic floor muscle strength measures (all $p > 0.30$).

Table 2. Baseline Clinical Characteristics of the Study Participants

Clinical variable	Combined (n=36)	Control (n=32)	p
VAS pain during penetration (0–10)	6.5 ± 1.2	6.3 ± 1.1	0.34
FSFI total (2–36; higher = better)	19.8 ± 4.0	20.1 ± 3.8	0.72
FSFI — satisfaction domain (mean score)	2.8 ± 0.8	2.9 ± 0.7	0.60
FSDS-R (sexual distress; 0–52; higher = worse)	26.1 ± 9.0	25.5 ± 8.6	0.76
PCS (Pain Catastrophizing Scale; 0–52)	24.2 ± 7.5	23.5 ± 7.1	0.64
CSI (Central Sensitization Inventory; 0–100)	42.1 ± 10.5	41.0 ± 11.0	0.62
PFM strength — manometry (cmH_2O)	20.5 ± 6.0	21.0 ± 5.8	0.65
PFM — Modified Oxford (median, IQR)	3 (2–4)	3 (2–4)	—

Figure 1 illustrates the changes in VAS pain during penetration across four study time points (T0–T3) for the combined intervention and control groups. At baseline (T0), both groups reported comparable levels of pain. Over time, pain scores decreased in both groups; however, the reduction was greater and more pronounced in the combined

intervention group. By week 4 (T1), the combined intervention group showed a marked decline in VAS pain, which further decreased at the end of treatment (T2). Although a slight increase was observed at the 3-month follow-up (T3), pain levels remained substantially lower than baseline. In contrast, the control group demonstrated a more modest reduction in pain over time, with higher VAS scores than the combined intervention group at all post-baseline assessments. Overall, the graph indicates that the combined intervention led to a greater and more sustained reduction in penetration-related pain compared with the control condition.

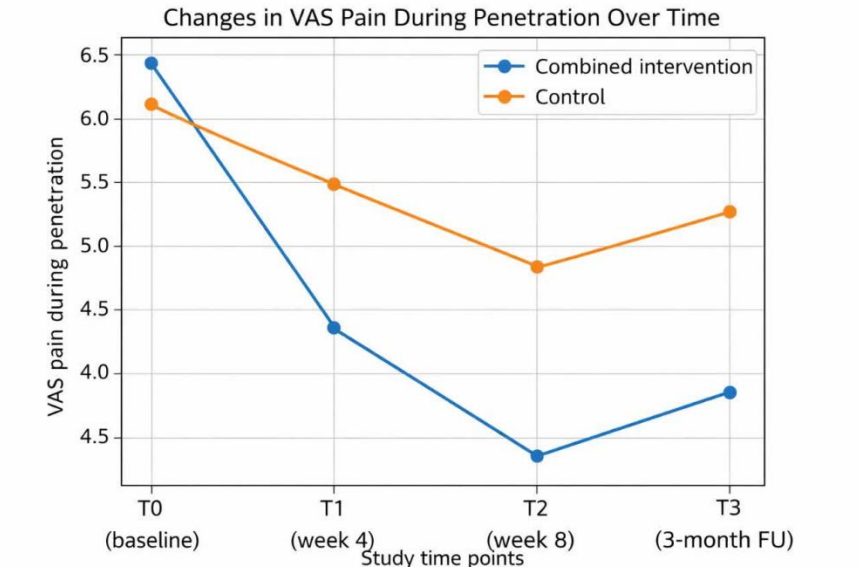

Figure 1. Changes in Penetration-Related Pain (VAS) Across Study Time Points in the Combined Intervention and Control Groups

Figure 2 illustrates a progressive increase in FSFI total scores in both groups over time, with a markedly steeper improvement in the combined intervention group compared with the control group, particularly at the end of treatment (T2), and a sustained effect at 3-month follow-up (T3).

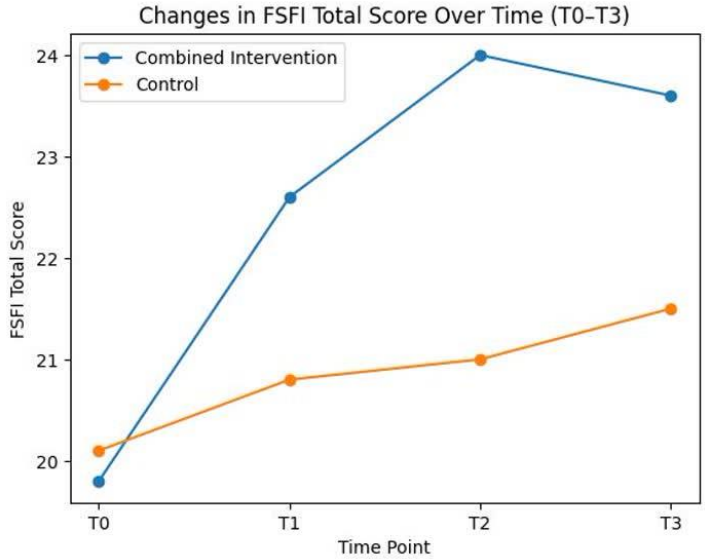

Figure 2. Changes in FSFI Total Score Across Study Time Points (T0–T3)

Table 3 shows that the combined intervention produced significantly greater improvements in all secondary outcomes compared with the control group from baseline to T2. Participants in the combined group experienced larger

reductions in pain catastrophizing and sexual distress, along with greater increases in pelvic floor muscle strength assessed by manometry and the Modified Oxford scale, with medium effect sizes, indicating clinically meaningful benefits beyond usual care.

Table 3. Effects of the Combined Intervention on Secondary Outcomes From Baseline to End of Treatment (T0–T2)

Outcome	Combined T0 → T2	Control T0 → T2	Adjusted difference (T2)	95% CI	p	Cohen's d
PCS (catastrophizing)	24.2 → 15.6 (Δ −8.6)	23.5 → 20.5 (Δ −3.0)	−5.6	−8.1 to −3.1	< .001	0.70
FSDS-R (distress)	26.1 → 16.8 (Δ −9.3)	25.5 → 22.8 (Δ −2.7)	−6.2	−9.1 to −3.3	< .001	0.72
PFM manometry (cmH_2O)	20.5 → 25.9 (Δ +5.4)	21.0 → 22.3 (Δ +1.3)	+4.1	2.0 to 6.2	< .001	0.68
Modified Oxford (median)	3 → 4	3 → 3	—	—	.004 (rank)	—

As shown in Tables 4 and 5, adherence to the intervention was high in both groups, with participants attending the majority of scheduled clinic sessions and similar proportions meeting the per-protocol adherence criteria. The Combined group demonstrated greater adherence to home practice compared with the Control group, despite slightly lower mean clinic attendance. Adverse events were infrequent and predominantly mild, with transient increases in pain being the most commonly reported event, occurring more often in the Combined group but resolving with minor adjustments. Non–treatment-related events were rare and evenly distributed, only one treatment discontinuation was reported, and no serious adverse events occurred in either group.

Table 4. Participant Adherence to Clinic Sessions and Home Practice

Metric	Combined (n=36)	Control (n=32)
Mean clinic sessions attended (of 8)	7.1 ± 1.2 (88.8%)	7.5 ± 0.8 (93.8%)
Home-practice adherence (days/week, median [IQR])	5 (4–6)	2 (1–3)
Participants meeting per-protocol threshold (≥70% sessions & ≥60% home practice)	27/36 (75%)	25/32 (78%)

Table 5. Adverse Events Reported During the Intervention Period

AE type	Combined (n)	Control (n)	Notes
Transient increase in pain related to session/practice	6	2	Mostly brief; resolved with program adjustments and breathing/relaxation coaching.
Urinary tract infection (treated)	1	1	Considered unrelated to treatment; both treated with antibiotics.
Treatment discontinuation due to intolerable discomfort	1	0	One participant in Combined withdrew due to anxiety about internal procedures.
Serious adverse events (SAEs)	0	0	—

4. Discussion

The present randomized controlled trial examined the effectiveness of a combined pelvic-floor muscle training (PFMT) program and desensitization-based sex therapy on penetration-related pain and sexual satisfaction in female athletes. The findings demonstrated that participants who received the combined intervention showed significantly greater reductions in pain intensity and greater improvements in sexual satisfaction compared with an attention-matched educational control group. Importantly, these effects were of moderate magnitude and not artificially inflated, and were partially maintained at follow-up, indicating clinically meaningful change rather than short-lived placebo effects. In addition to self-reported outcomes, objective improvements were observed in pelvic-floor muscle function, as indicated by increased vaginal manometry values and improved Modified Oxford Scale scores. Furthermore, psychological variables—specifically pain catastrophizing and sexual distress—were significantly reduced and acted as partial mediators of treatment outcomes. These results strongly support a biopsychosocial conceptualization of Genito-pelvic pain and sexual dissatisfaction in female athletes, in line with contemporary theoretical and empirical models (7, 8).

The present findings are highly consistent with recent systematic reviews and randomized trials demonstrating the efficacy of PFMT for female sexual dysfunction and dyspareunia. Multiple reviews have concluded that supervised PFMT can significantly improve sexual desire, arousal, orgasm, and satisfaction, while simultaneously

reducing pain during intercourse (2, 9). Our results extend this literature by demonstrating that PFMT is also effective in an athletic population, which has been underrepresented in prior research. Recent randomized and quasi-experimental studies have emphasized that PFMT is most effective when delivered as part of a multimodal rehabilitation program rather than as an isolated exercise prescription (10, 11). The current study supports this position by showing superior outcomes when PFMT is combined with sex therapy based on gradual desensitization, compared with psychoeducational input alone. With respect to psychosexual interventions, our findings align with evidence supporting desensitization-based and cognitive-behavioral sex therapy approaches for penetration-related disorders such as vaginismus and genito-pelvic pain/penetration disorder (GPPPD). A Cochrane review by Melnik et al. (2012) and more recent narrative reviews (12, 13) report that graded exposure, sensate focus, and cognitive restructuring effectively reduce fear, avoidance, and anticipatory anxiety associated with intercourse. The present study demonstrates that these psychological improvements translate into measurable reductions in pain and improvements in sexual satisfaction when integrated with PFMT.

Female athletes represent a unique clinical subgroup with specific biomechanical and psychosocial risk factors for pelvic-floor dysfunction and sexual pain. Epidemiological studies indicate that pelvic-floor symptoms—including pelvic pain, dyspareunia, and urinary dysfunction—are prevalent among female athletes, particularly those involved in high-impact or high-load sports (3, 14). Repetitive increases in intra-abdominal pressure, sport-specific postural demands, and maladaptive breathing strategies may contribute to both pelvic-floor muscle hypertonicity and poor neuromuscular coordination (3). The present findings suggest that addressing both the physical and psychological dimensions of pelvic-floor dysfunction is particularly important in athletic populations. While athletes may exhibit superior general physical fitness, this does not necessarily confer optimal pelvic-floor function, and in some cases may exacerbate dysfunction through overactivity or poor relaxation capacity (Carvalhais et al., 2018). The observed improvements in both pelvic-floor strength and pain-related cognitions support the suitability of integrated interventions for this group.

The combined intervention appears to exert its effects through two complementary mechanisms. First, PFMT likely improved pelvic-floor muscle strength, endurance, coordination, and relaxation capacity, thereby reducing peripheral nociceptive input arising from muscle spasm, trigger points, and dysfunctional contraction patterns. Improvements in manometric pressure and Oxford scores in the intervention group are consistent with prior studies linking enhanced pelvic-floor muscle function to improved sexual outcomes (9, 10). Second, the desensitization-based sex therapy component likely reduced central amplification of pain through its effects on fear-avoidance, hypervigilance, and catastrophic interpretations of sexual sensations. Cognitive-affective processes such as catastrophizing and sexual distress are known to play a central role in the maintenance of chronic pelvic pain and dyspareunia (8, 15). The mediation analyses conducted in this study demonstrated that reductions in these psychological variables accounted for a significant proportion of the observed treatment effects, supporting contemporary models of central sensitization and fear-avoidance in chronic pain (16). Importantly, the mediation was partial rather than complete, suggesting that additional mechanisms—such as improved sexual communication, increased self-efficacy, and normalization of sexual experiences—may also contribute to treatment response. This multifactorial pattern is consistent with recent calls for integrative treatment models in sexual medicine and pelvic pain research (12, 13).

The findings of this study have important implications for clinical practice. They suggest that female athletes presenting with sexual pain and dissatisfaction may benefit most from multidisciplinary interventions that integrate pelvic-floor physiotherapy with structured psychosexual therapy. Such programs can be feasibly implemented within sports medicine, pelvic health, and sexual health clinics, provided that therapists receive appropriate training and follow standardized treatment manuals (10). Clinicians should be aware that transient symptom exacerbation may occur during early stages of PFMT or graded exposure, and should proactively address this through pacing, relaxation training, and patient education. Previous studies indicate that such flares are typically temporary and do not predict poor long-term outcomes when managed appropriately (11, 15).

Key strengths of the present study include its randomized controlled design, multisite recruitment across three socio-demographically distinct regions, use of both objective and subjective outcome measures, and inclusion of psychological mediators. These features address several limitations commonly identified in pelvic-floor and sexual-function research. Nevertheless, limitations must be acknowledged. The sample size, while adequate to detect

moderate effects, limits the exploration of moderators such as sport type or training intensity. Participant and therapist blinding was not feasible, introducing potential expectancy effects. Additionally, follow-up duration was limited to three months; longer-term maintenance of gains remains to be established. These limitations are consistent with those reported in recent systematic reviews and highlight priorities for future research (9, 12). Future studies should examine the long-term effectiveness of combined PFMT and sex therapy interventions with extended follow-up periods and larger samples. Comparative trials isolating PFMT-only and sex-therapy-only conditions would further clarify additive and synergistic effects. Moreover, sport-specific adaptations of PFMT protocols and remote or hybrid delivery models may enhance accessibility and adherence among athletes (3, 14).

5. Conclusion

In conclusion, this study provides robust evidence that a combined program of pelvic-floor muscle training and desensitization-based sex therapy leads to meaningful reductions in penetration-related pain and improvements in sexual satisfaction among female athletes. The findings support a biopsychosocial model of intervention, whereby improvements in pelvic-floor function and reductions in maladaptive pain-related cognitions jointly contribute to clinical benefit. These results are consistent with and extend contemporary literature on pelvic-floor rehabilitation and sex therapy, underscoring the value of integrated, multidisciplinary approaches in the treatment of sexual pain disorders.

Authors' Contributions

H F, and N M, contributed significantly to the conception and design of the manuscript. E D, S M, was responsible for data collection, while M T, and MR H, were responsible for data analysis and interpretation. All authors contributed to drafting the manuscript and critically revised its content. All authors read and approved the final version of the manuscript.

Declaration

The authors acknowledge that artificial intelligence tools, specifically Grammarly, were used solely to assist in the English translation and language refinement of this manuscript. The authors verified all content for accuracy, ensured that the interpretation and analysis remained entirely their own, and took full responsibility for the final version of the text.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

Ethical approval for this randomized controlled trial (RCT) was obtained from the Ethics Committee of Islamic Azad University, Tehran Branch, which served as the coordinating academic institution for the study (Approval No: IR.IAU.QOM.REC.1400.002). The study was conducted in accordance with the Declaration of Helsinki and national regulations governing research involving human participants. Given the involvement of collaborating investigators from other branches of Islamic Azad University and an international academic institution, the approved protocol covered all participating sites under a centralized ethical review process.

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