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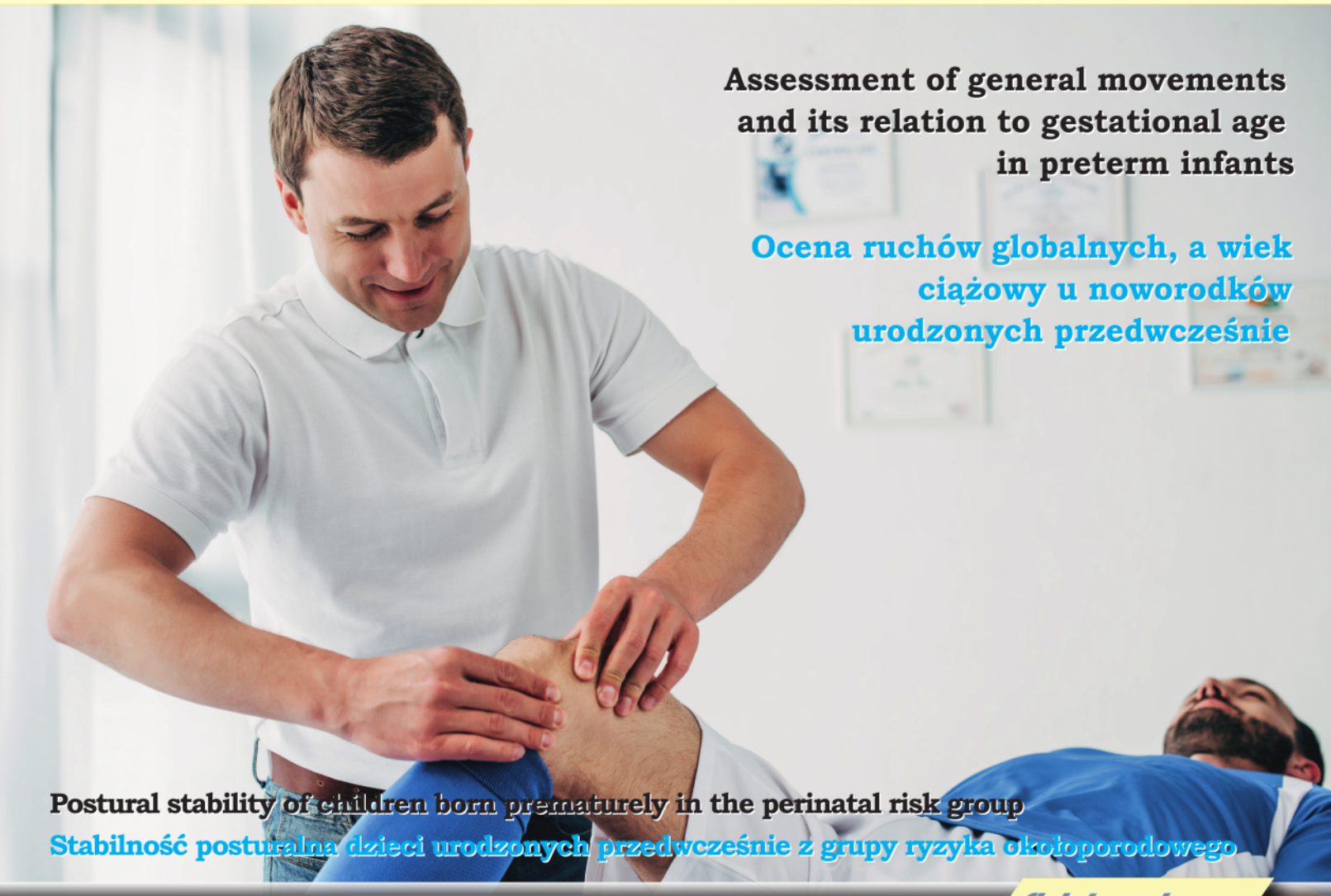

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Effect of pilates exercises on stress urinary incontinence in post-menopausal women: A randomized control trial

Wpływ ćwiczeń pilates na wysiłkowe nietrzymanie moczu u kobiet po menopauzie: randomizowane badanie kontrolne

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Abstract

Background and objective. Urinary incontinence (UI) is very common all over the world, especially among women, the current study conducted to investigate the effects of adding Pilates exercises to pelvic floor exercises aiming to manage postmenopausal women stress urinary incontinence. Methods. thirty postmenopausal women with mild to moderate stress urinary incontinence their age ranged from 50-60 years old, were allocated into two equal groups randomly Group A (control) group received pelvic floor muscle exercises from different positions (crock-lying, sitting, and standing) while group B (study) group received both Pilates exercises with pelvic floor exercises. All exercises were performed twice a week, for twelve weeks. Perineometer was used for measuring pelvic floor muscles strength (pneumatic pelvic muscle trainer XFT-0010) and severity of stress urinary incontinence was measured by The Revised Urinary Incontinence Scale (RUIS) before and after treatment program. Results. A significant improve of Squeeze vaginal pressure after in compared to before treatment and significant reduction of Revised urinary incontinence scale after treatments in compared to before treatment in both groups. Moreover, no significant mean values differences in "post" test in-between both groups in the two tested variables. However, a clinically valuable improve was in favour of study group. Conclusion. Pelvic Floor Muscle Exercises (PFE) is effective in improving post-menopausal stress urinary incontinence either alone or with Pilates exercises but doing both types of exercise together is more valuable from the practical point of view.

Key words:

stress urinary incontinence, revised urinary incontinence scale, squeeze vaginal pressure, pelvic floor exercises, pilates exercises

Streszczenie

Informacje wprowadzające i cel. Nietrzymanie moczu (UI) jest bardzo powszechną dolegliwością na całym świecie, zwłaszcza wśród kobiet. Niniejsze badanie przeprowadzono w celu zbadania skutków wprowadzenia ćwiczeń Pilates do ćwiczeń dna miednicy mających na celu radzenie sobie z wysiłkowym nietrzymaniem moczu u kobiet po menopauzie. Metody. Trzydzieści kobiet po menopauzie z wysiłkowym nietrzymaniem moczu o nasileniu od łagodnego do umiarkowanego, w wieku od 50 do 60 lat, zostało losowo przydzielonych do dwóch równych grup: Grupa A (kontrolna) wykonywała ćwiczenia mięśni dna miednicy w różnych pozycjach (leżąca, siedząca i stojąca), natomiast grupa B (badawcza) wykonywała ćwiczenia Pilates oraz ćwiczenia mięśni dna miednicy. Wszystkie ćwiczenia wykonywano dwa razy w tygodniu przez dwanaście tygodni. Do pomiaru siły mięśni dna miednicy wykorzystano perineometr (pneumatyczny trenażer mięśni miednicy XFT-0010), a nasilenie wysiłkowego nietrzymania moczu mierzono za pomocą skali Revised Urinary Incontinence Scale (RUIS) przed i po programie leczenia. Wyniki. Zaobserwowano znaczącą poprawę ściśnięcia pochwy po leczeniu w porównaniu do stanu przed leczeniem oraz znaczne zmniejszenie wyniku na skali RUIS po leczeniu w porównaniu do stanu przed leczeniem w obu grupach. Co więcej, nie zaobserwowano znaczących różnic w wartościach średnich po zastosowaniu programu ćwiczeń pomiędzy obiema grupami w dwóch testowanych zmiennych. Jednak klinicznie wartościową poprawę zaobserwowano na korzyść grupy badanej. Wniosek. Ćwiczenia mięśni dna miednicy (PFE) są skuteczne w łagodzeniu wysiłkowego nietrzymania moczu po menopauzie samodzielnie lub w połączeniu z ćwiczeniami Pilates, jednak wykonywanie obu rodzajów ćwiczeń jest z praktycznego punktu widzenia bardziej wartościowe.

Słowa kluczowe

wysiłkowe nietrzymanie moczu, skala RUIS, ściśnięcie pochwy, ćwiczenia dna miednicy, ćwiczenia pilates

Introduction

Urinary incontinence (UI) is the most prevalent urinary problem among menopausal women. It is considered a public health issue worldwide. According to the International Continence Society (ICS), any involuntary loss of urine, with hygienic or social distress diagnosed as urinary incontinence [1]. Such incontinence correlated to pressure rise intra-abdominally, whatever the cause; like coughing, physical exertion, sneezing, or getting up. Commonly, UI occurs in women elder than thirty by around 25 up to 45 percent, and the underlying etiology is pelvic floor musculatures atrophy and/or damage of its ligaments or enveloped fascia. Generally, UI related to labor trauma and menopause [2].

Due to poor urethral support, menopausal women will experience stress urinary incontinence. The supporting structure of the urethra and bladder neck includes the pelvic floor muscles and their complete innervation and fascia, which is mainly composed of collagen. Stress urinary incontinence occurs due to changes in collagen content, including a decrease in total collagen concentration. Collagen cross-linking is reduced which may reduce urethral resistance to urine flow [1].

Up to date, UI first recommended treatment line is pelvic floor musculature training based on its good curative effect, low cost, no side effects, and no effect on subsequent treatment [3].

Pilates is a type of exercise based on the principle of movement, including full-body movement, centering, concentration, precision, breathing and rhythm. It concentrates on core body exercise and breathing control, and promotes the activation of the transverse abdominis, diaphragm, multifidus, and pelvic floor muscles. It has been hypothesized that Pilates exercise can significantly improve the strength of pelvic floor muscle because most exercises are performed in conjunction with muscle group contractions [4].

As far as we know now no previous studies has been done to evaluate effects of Pilates exercises on postmenopausal Egyptian women suffering from stress urinary incontinence. So, the current study conducted to assess effect of adding Pilates exercising to pelvic floor musculatures training on improving stress urinary incontinence in postmenopausal women.

Materials and methods

Study Design

The present study is a randomized controlled trial conducted at Shebin El Qanater Central Hospital out-patient clinics and Family Medicine Center in Arab Juhayna, Al-Qilyubia from December 2020 to March 2021. Thirty participants (randomly allocated in equal subgroups) which advised based on a sample size calculator at 90.7% estimated power.

Participants

Thirty postmenopausal women aged between 50 and 60 years were enrolled at the outpatient clinic of the Shibin Al Qanater Central Hospital and Family Medicine Center in Arab Juhayna, Al-Qilyubia. Each participant signed an informed consent form and was given information regarding the study's nature, aim, and advantages, as well as their freedom to decline or withdraw at any time and the confidentiality of any information acquired. The Institutional Review Board at Faculty of Physical Therapy, Cairo University has approved the study, which follows the Declaration of Helsinki on the conduct of Human Research guidelines. The participants were recruited under the following inclusion criteria: they had mild to moderate degree of stress urinary incontinence with body mass index within 30 Kg/m2 and willingness to participate in the study procedure. The participants were excluded if they had body mass index more than 30 Kg/m2 or if participants had grade III or IV pelvic prolapse according to ICS classification. As well, they were excluded in case of any metabolic and/or neurological disorders correlated to bladder or sphincter impairments or had medical history of pelvic cancer or severe endometriosis.

Randomization

Using a computer-based randomization tool, the postmenopausal women were randomized to two equal groups (A and B). After randomization, there were no reports of individuals dropping out of the research. The subjects were unaware of their assignment before being divided into two equal groups. Figure 1 illustrates the flow of participants through the study's stages.

Interventions

Group A (Control group N = 15) received pelvic floor exercises from different positions; crock lying, sitting, and standing, twice weekly for 12 weeks, totaling 24 sessions. Group B (Study group N = 15) received both pelvic floor exercises and Pilates exercises, twice weekly for 12 weeks, totaling 24 sessions.

Pelvic floor exercises for both groups (A and B)

Pubovaginalis muscle

Every patient in group (A and B) was instructed to relax in crock lying position with slightly abducted thighs, and contract as if she controls urine flow, hold, or concentrate, while counting to ten, and release for another 10 counts.

Puborectalis muscle

Every patient was advised to relax in crock lying position. The researcher stood at the level of the patient waistline and both hands under the gluteal region till the tip of the fingers surround the anus to feel the contraction of puborectalis muscle. Each participant was instructed to contract trying to control bowel action, hold and concentrate for 10 counts, then relax for another 10 counts.

The whole pubococcygeus muscle

Every patient was asked to relax in crock lying position with slightly abducted thighs, The researcher stranded at the level of the patient waistline with her eyes on the lower abdomen of the patient to observe the correct action of pubovaginalis muscle, while both hands under the gluteal region till the tip of the fingers surround the anus to feel the contraction of puborectalis muscle. Every patient was asked to contract as if she controls bowel and/ or urine action, up draw vagina, hold and concentrate counting to ten and relax then repeat for 10 counts [7]. Progression of the exercises: -By increasing repetitions: Start by 10 repetitions then gradually increase repetitions by 5 repetitions every week up to 50 repetitions maximum. -By chan-

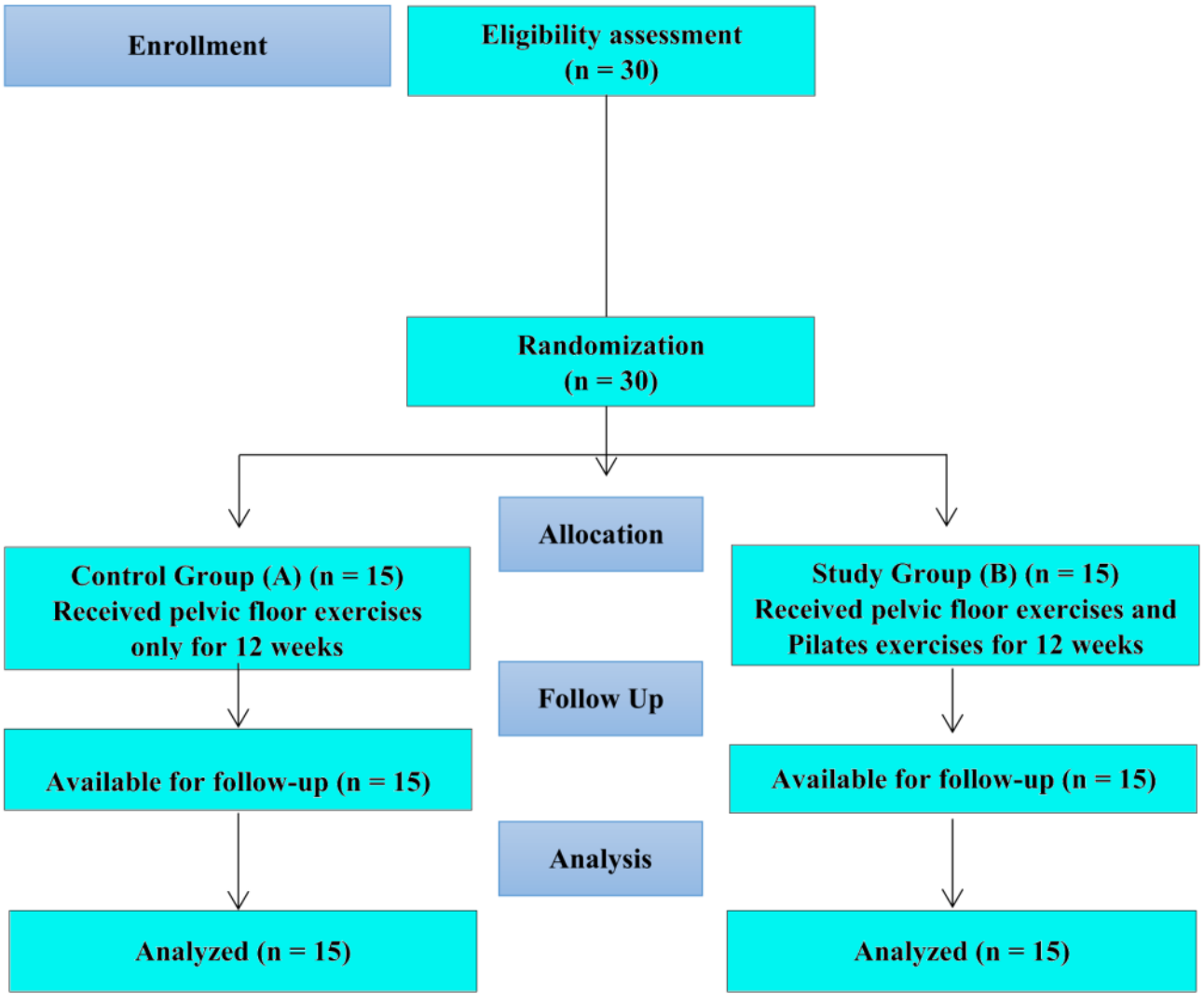

Figure 1. Flow chart of the study

ging the position: Start by doing these PFM exercises from crock lying position then from sitting and finally from standing. -By increasing time of hold of muscle contraction: Start by holding for 10 seconds then increase to 1 minute hold.

Pilates exercises for group B (study group)

It consisted of 13 different Pilates postures That mostly activate both abdominal and pelvic floor muscles like: Pilates Breathing, bent knee fall out, Swan dive, Shoulder Bridge, Single Leg Kick, Hundreds, stretching double Legs, Heel Slides, rolling up, stretch single leg, pull back leg, Front and back Kicks, side lying side kick, Single Leg Circle. Before and after exercise, warming up and cooling down movements were performed [8]. Progression of the exercises:Such progression gained via more repetitions, changing position as being advanced (harder). Repeat each exercise six up to eight [9].

Outcome measures

Both groups of participants were assessed before and after the 12-week therapy session.

Revised Urinary Incontinence Scale (RUIS): to evaluate the incontinence level, the scale comprises five questions; urgency related urine leakage, dribbling associated to physical exertion or sneeze or cough, little dribbling (leakage) amount, how frequently dose that lady leak urine? How much urine the lady urinates each time? Add the scores for each of the five questions to obtain a possible range of scores from 0 to 16) [5].

Pelvic muscle strength assessment: for each participant was measured by using perineometer (pneumatic pelvic muscle trainer XFT-0010): Every patient was instructed to stay in a comfortable crock lying and slight abducted hips position. Every patient was asked to contract her pelvic floor muscles, hold, and then relax. This will be repeated for about 10 times for all patients in all groups (A and B) before starting the assessment to increase her pelvic floor muscle awareness. The sterilized lubricated covered vaginal probe inflated with air from the air tube and inserted into the vagina until only 1 cm of the lower edge of the probe pressure area was left outside. Then each patient is asked to contract the pelvic floor muscles, lift, and squeeze the vaginal probe inward. The mean value of five

contractions of the pelvic floor muscles is recorded on the data sheet and used as the evaluation value [6].

Statistical analysis

Statistical analyses were done via the Statistical Package for the Social Sciences (SPSS) version 20 (SPSS, Inc., Chicago, IL). Study population characteristics determined through chi-squared test and Analysis of variance (MANOVA- mixed multivariate plus 0.05 values of significance), as well their distribution using Shapiro Wilk test (normally distributed variables).

Statistical analyses based on 2x2 mixed multivariate MANOVA showed non-significant impact of 1st independent variable on all other dependent items; Squeeze vaginal pressure and revised urinary incontinence scale (F = 0.91, p = 0.414, Partial Eta Square = 0.063). As well, a statistical significance impact detected for measuring periods (2nd independent item) on tested dependent variables (F = 40.213, P = 0.0001*, Partial Eta Square = 0.749). Furthermore, non-significant interaction of two independent variables, indicate the influence of (1st independent variable) on the dependent ones was not affected by measuring periods (2nd independent item) (F = 2.289, P = 0.121, Partial Eta Square = 0.145).

Results

The population demographics (age, weight, height, BMI) shown no differences of both control& study groups pre-treatment (Table 1).

Table 1. Participants` demographics of both groups

Characteristics	Exercise group (n = 18)	Diet group (n = 18)	p value
Age [years]	55.13 ± 4.48	53.73 ± 4.00	0.375^{NS}
Body mass [kg]	68.53 ± 6.44	71.23 ± 4.47	0.217^{NS}
Height [m]	157.93 ± 3.8	160.66 ± 4.27	0.075^{NS}
BMI [kg/m^2]	26.86 ± 1.92	27.73 ± 1.62	0.193^{NS}

NS P > 0.05 = non-significant, P = Probability

A significant Squeeze vaginal pressure improvement revealed, and significant reduction of Revised urinary incontinence scale, as well in both subgroups after treatment program. However, a non-significant variance detected in post-test mean values in the two tested variables in the two subgroups. In addition, analysis revealed a clinically significant improvement in group B than group A (table 2).

Table 2. Descriptive analysis (mean ± SD) and Post hoc test of squeeze vaginal pressure and Revised Urinary Intensive Scale

		Group (A) (n = 15)	Group (B) (n = 15)	p value
Squeeze vaginal pressure	Pre-treatment	18.1 ± 6.25	18.33 ± 6.45	0.921^{NS}
	Post-treatment	23.33 ± 9.29	26.66 ± 9.29	0.334^{NS}
	% of Improvement	28.89%	45.44%	
	P value**	0.003^{S}	0.0001^{S}	
Revised urinary incontinence scale	Pre-treatment	11.46 ± 1.95	10.93 ± 2.08	0.476^{NS}
	Post-treatment	10.33 ± 2.19	9.06 ± 1.62	0.083^{NS}
	% of Improvement	9.86%	17.1%	
	P value**	0.0001^{S}	0.0001^{S}	

** Inter-group comparison; ** intra-group comparison of the results pre- and post-treatment.*
NS P > 0.05 = non-significant, S P < 0.05 = significant, P = Probability.

Discussion

Urinary incontinence (UI) is the most prevalent urinary problem among menopausal women. It is considered a public health issue worldwide, so the current study was conducted to investigate the effects of adding Pilates exercises to pelvic floor exercises aiming to manage postmenopausal women stress urinary incontinence. By the twelve weeks of study program ending, all participants had a significant increase of Squeeze vaginal pressure at post treatment in compared to pre-treatment, as well a significant Revised urinary incontinence scale reduced by the end of study in both groups, with non-significant variation of both groups post treatment results. Furthermore, analysis revealed a clinical improvement for group B favor with high significant percentage of improvement.

These results come in agreement with Kang and his colleagues [10] when they stated clinically significant alleviation of incontinence symptoms using Kegel training and explained through detected gain of elasticity and strength of weak pelvic floor musculatures.

Kegel exercising could significantly improve the resting urethra pressure, extending its functional length, converting its pressure into positive values, when the intra-abdominal pressure increases, and activate the striated muscles around the urethra to increase the resting tension of the levator ani muscle and improve the reception of sensory stimulation from the vagina during sexual intercourse. [11].

Lausen et al. [2] concluded a study that adding Pilates exercises to the standard physiotherapy care showed improvement in self-esteem, decreased social embarrassment, and improved personal relationship, symptoms improvement and pelvic floor musculatures strengthen, as well raise involved musculatures awareness while their used for leakage of urine avoidance.

In addition, Mushtaq and Ahmed [13] supported our study results when compared effectiveness of pelvic floor musculatures exercises with Pilates exercises for the treatment of stress urinary incontinence among females. They found that the Pilates method promoted similar outcomes in comparison to pelvic floor muscle training, when applied to patients for a span of 6 weeks. None of the group is superior statistically over the other.

Also, Culligan et al [8] ensured Pilate's exercise feasibility with same efficient strength gained as PFM exercising program as measured via perineometer (cmH_2O) in women with little or no pelvic floor dysfunction. Souza et al [14] reported a significant improvement of pelvic floor musculature contractility and pressure in elderly females after a program of Pilates treatment, which evaluated by perineometer (cmH_2O) and PERFECT scheme.

Furthermore, Gordon et al [15] has documented a supporting conclusion, where Pilates exercises whether practiced alone or added to manual therapies do decrease episodes of leakage of urine due to sudden intra-abdominal pressure raise, PFM strengthened, plus fast contracting numbers and endurance, as well enhances elderly women's quality of life. As well, single Pilates exercising reported improved repeating slow contractions.

Hein et al. [16] added that practicing Pilates Pelvic Floor-Strengthening Program for 12-weeks resulted in improved self-reported measures of SUI in women of age 45–70 years. They indicated that a community-based Pilates pelvic floor program could be an effective and sustainable method that decreases SUI.

Nightingale et al also [4] found that there was Higher pelvic floor muscle EMG readings during 'core' and 'plank' Pilates positions (modified Pilates positions), Also, as stated by Khot and Hande [17] both Pilates Training or Conventional Therapy were effective in terms of increase in quality of life (QoL) and Pelvic floor strength irrespective of the treatment received. However, the group which received Pilates Training showed more significant improvement as compared to the Conventional group in overall outcomes. So, as they found the Pilates treatment can be effective treatment to improve the quality of life and increase pelvic musculature strength in stress post-partum urinary incontinence. As well, results of this study were supported by Pedriali et al. [18] stated the effect of Pilates exercising in continence improvement in post-prostatectomy patients. At short term, Pilates's training regained extra rate of full continence.

But the results of Pavithralochani et al [19] had conducted a comparing study in between Kegel and Pilates exercise for pregnant women suffering from urinary incontinence. They concluded that the frequency of urine leakage decreased in both groups. However, compared with Kegel exercise subjects, the reduction in urine leakage during Pilate's exercise was very significant. Therefore, Pilates was concluded to be more efficient in pregnant frequent urine leakage reducing.

Both Pilates exercises and pelvic floor exercises are effective non-invasive methods for treating stress urinary incontinence, but Pilates exercises proved to be more effective in the clinical aspect when it is added to PFE.

The limitation of this study was that the results were concerned only with post-menopausal stress urinary incontinence and can't be generalized to stress incontinence on female different life spans so further research are needed to examine effect of Pilates exercise on ante and post-natal stress incontinence also these results cannot be generalized on other types of incontinence as it is only concerned with SUI. further research using different investigation as urodynamics may also be needed to ensure the study results which was difficult to apply due to pandemic corona virus circumstances.

Conclusion

PFE is effective in improving post-menopausal stress incontinence either alone or with Pilates exercises but doing both types of exercise together is more clinically valuable.

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