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Telerehabilitation Program Impact on Overactive Bladder Symptoms and Metabolic Health in Obese Women: a Randomized Controlled Trial

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ABSTRACT

INTRODUCTION. Overactive bladder syndrome is caused by many factors including obesity, insulin resistance and poor dietary habits. Since it is a chronic disease and needs time to be treated, introducing telepilates in addition to Mediterranean diet would encourage better adherence and results to the treatment program.

AIM. To assess the impact of a virtual group-based telerehabilitation program on overactive bladder symptoms and metabolic health in women with obesity.

MATERIAL AND METHODS. Eighty obese women (BMI 30.0–34.9 kg/m^2) between the ages of 35 and 45 were allocated into two equal groups, 40 for each: (A) supervised telepilates and (B) unsupervised telepilates. The supervised group participated in a 12-week Pilates workout program over videoconference platforms three times a week. Meanwhile, the unsupervised group only received four online meetings. The groups' diet was the Mediterranean style. The Hemostatic Model of Insulin Resistance (HOMA-IR), body mass index (BMI), waist circumference (WC), Patient Perception of Urgency Scale (PPIUS), Overactive Bladder Questionnaire Short Form (OAB-q SF), and Telehealth Usability Scale (TUS) were measured.

RESULTS AND DISCUSSION. The supervised telepilates group exhibited statistically significant amelioration of overactive bladder symptoms and a reduction in HOMA-IR ($p < 0.001$), while the unsupervised telepilates group showed insignificant changes in these measures ($p > 0.05$). Furthermore, the supervised telepilates group showed significantly greater reductions in BMI and WC ($p < 0.001$) than the unsupervised telepilates group ($p < 0.05$). Additionally, the supervised telegroup outperformed the unsupervised telegroup on all parameters of TUS ($p < 0.001$)

CONCLUSION. Women with obesity experienced decrease in overactive bladder symptoms and improved metabolic health after completing a 12-week telepilates training program.

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KEYWORDS: telerehabilitation, obesity, lower urinary tract symptoms, videoconferencing.

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Влияние телереабилитационной программы на основе виртуальной группы на симптомы гиперактивного мочевого пузыря и метаболическое здоровье у женщин с ожирением: рандомизированное контролируемое исследование

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РЕЗЮМЕ

ВВЕДЕНИЕ. Синдром гиперактивного мочевого пузыря вызывается многими факторами, включая ожирение, инсулинорезистентность и неправильное питание. Поскольку это хроническое заболевание и требует времени для лечения, введение телепилатеса в дополнение к средиземноморской диете будет способствовать лучшей приверженности и результативности программы лечения.

ЦЕЛЬ. Оценить влияние виртуальной групповой программы телереабилитации на симптомы гиперактивного мочевого пузыря и метаболическое здоровье у женщин с ожирением.

МАТЕРИАЛЫ И МЕТОДЫ. Восемьдесят женщин с ожирением (индекс массы тела (ИМТ) 30,0–34,9 кг/м^2) в возрасте от 35 до 45 лет были разделены на две равные группы по 40 человек в каждой: (А) телепилатес под наблюдением и (Б) телепилатес без наблюдения. Группа под наблюдением участвовала в 12-недельной программе тренировок по пилатесу по видеоконференцсвязи три раза в неделю, в то время как группа без наблюдения получала только четыре онлайн-встречи. Диета в группах была средиземноморской. Измерялись гемостатическая модель инсулинорезистентности (HOMA-IR), ИМТ, окружность талии, использовались шкала восприятия пациентом ургентности (PPIUS), краткая форма опросника гиперактивного мочевого пузыря (OAB-q SF) и шкала удобства использования телемедицины (TUS).

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ. В группе телепилатеса под наблюдением наблюдалось статистически значимое облегчение симптомов гиперактивного мочевого пузыря и снижение HOMA-IR ($p < 0,001$), тогда как в группе телепилатеса без наблюдения эти показатели изменились незначительно ($p > 0,05$). Кроме того, в группе телепилатеса под наблюдением наблюдалось значительно большее снижение ИМТ и окружности талии ($p < 0,001$), чем в группе телепилатеса без наблюдения ($p < 0,05$). Кроме того, контролируемая телегруппа превзошла неконтролируемую телегруппу по всем параметрам TUS ($p < 0,001$).

ЗАКЛЮЧЕНИЕ. У женщин с ожирением уменьшились симптомы гиперактивного мочевого пузыря и улучшилось метаболическое здоровье после прохождения 12-недельной программы телетренировок по пилатесу.

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INTRODUCTION

The term “overactive bladder syndrome” (OAB syndrome) refers to the sudden, intense, and frequent need to urinate, which may or may not be accompanied by involuntary urination, a condition that is caused by urinary tract malfunction, not bladder infection [1]. It affects 11.8 to 35.6 % of people worldwide [2]. Few of them seek medical attention as a result of lack of awareness about potential treatment options or mistaking their urological symptoms for an age-related condition [3]. Women are more likely than men to experience overactive bladders, which are known to interfere with everyday activities and minimize patients' quality of life and self-esteem [4]. Moreover, Obesity is among the most prominent factors responsible for developing and aggravating OAB symptoms, so, detrusor dysfunction is linked to increased weight and body mass index (BMI), with a focus on central obesity, as these factors raise bladder pressure against sphincter resistance and disrupt the blood supply to the bladder wall, affecting its function [5]. Furthermore, obesity is regarded as one of the key causes of peripheral tissue insulin resistance. It is hypothesized that nitric oxide causes detrusor relaxation and that its release is regulated by the accessibility of mucosal insulin [6].

Pharmacological treatment for OAB is always administered in conjunction with behavioural counselling, which includes weight loss, electrical stimulation, eating pattern modification, and pelvic floor muscle training (PFMT) [7]. The voluntary urinary inhibition reflex, which involves coordinated contractions of the puborectalis muscle and external urethral sphincter, is triggered by pelvic floor muscle contractions to achieve detrusor relaxation and the prevention of uncontrollable voiding [8].

Consequently, the Pilates exercise program that combines breathing exercises with pelvic floor training helps to improve overactive bladder symptoms due to its impact on regaining pelvic floor strength and sustaining core stability [9]. Pilates has been shown to be as beneficial as regular PFMT in controlling lower urinary tract problems, improving overall quality of life, and offering the benefit of a higher adherence level [10].

Because bladder function is heavily influenced by nutrition and dietary habits, a Mediterranean diet has been shown to improve bladder function and metabolic health besides its anti-inflammatory effect through minimizing red meat and substituting it with more vegetables and olive oil [11].

The medical community has recently seen a significant increase in using of telerehabilitation, which treats both acute and chronic illnesses and is well-liked by both patients and medical staff for reducing time, effort, and transportation costs and enabling distant therapy [12].

AIM

To investigate if a 12-week telerehabilitation program can help obese females with overactive bladders with their symptoms and improve their metabolic health.

MATERIALS AND METHODS

This 12-week randomized, double-blinded study was conducted according to the latest CONSORT statement and the Helsinki Declaration. The study was conducted between September 2023 and January 2024. Before being included in the study, each participant gave their informed consent after being thoroughly informed about it.

Study participants

The study involved 80 obese females who were recruited from the hospital urological clinic (Figure 1). The participants in the trial had to be between the ages of 35 and 45, obese class I (BMI between 30.0 and 34.9 kg/m^2), have a waist circumference greater than 88 cm, and have HOMA-IR > 2.5. The presence of OAB symptoms, as stated by the International Continence Society, was validated by the OAB questionnaire SF's features and urine urgency symptoms. Subjects with pregnancy, urinary tract infection, surgically treated gynecological and urological conditions, diabetes, uncontrolled hypertension, oncological and neurological urinary tract disease, and any musculoskeletal injuries that precluded them from engaging in the exercise program were excluded from participating in the study.

Randomization

The randomization was carried out by an independent individual who did not engage in any of the study's subsequent phases, using Microsoft Office Excel 2010. The participants were sorted according to the random number they were assigned; those with odd numbers were allocated to supervised telegroup, while those with even numbers were placed in the unsupervised telegroup.

Intervention

For a period of 12 weeks, supervised telegroup received a group Pilates exercise program via videoconference sessions under the supervision of a physiotherapist three times a week. The unsupervised telegroup got an initial descriptive online meeting, followed by three

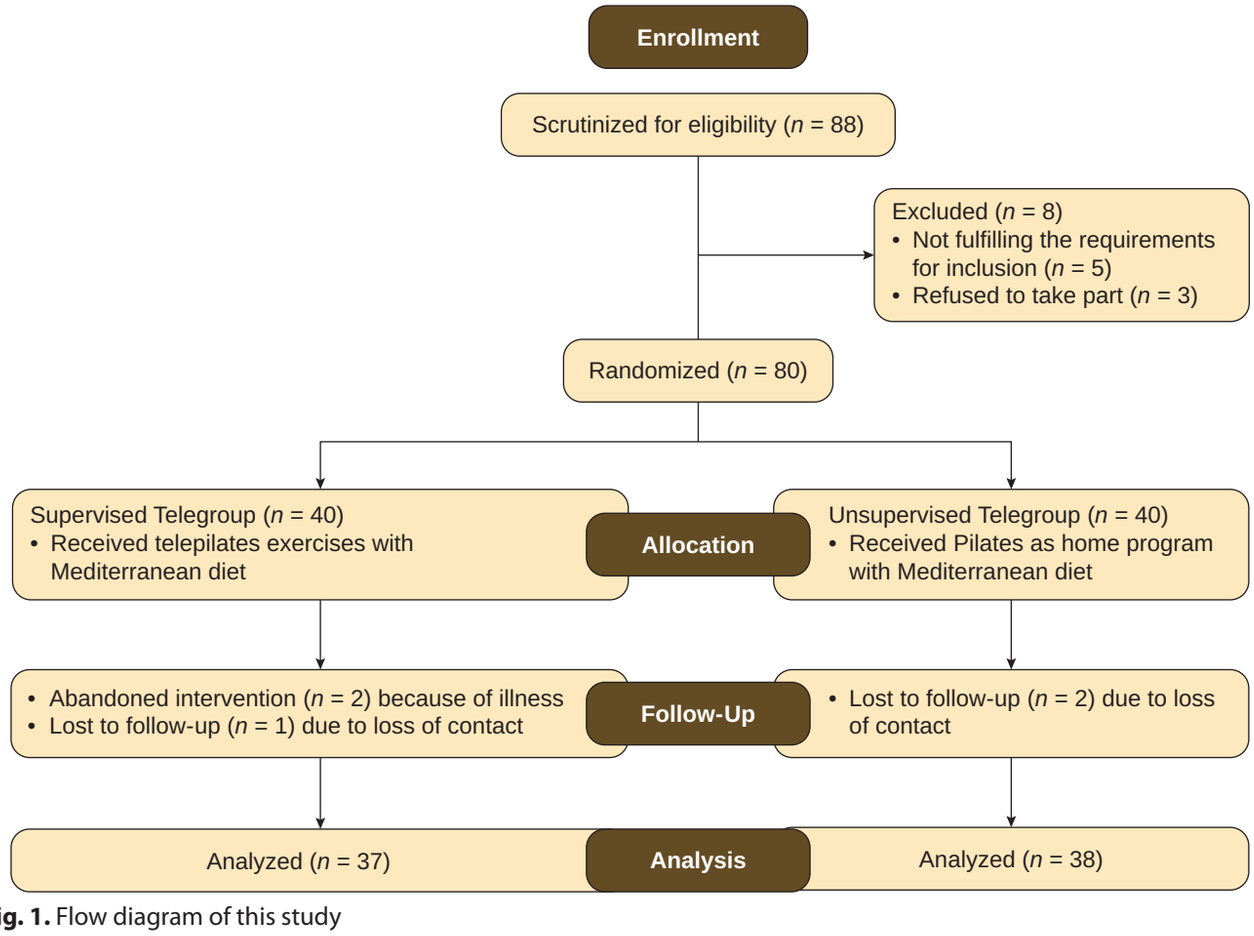

Fig. 1. Flow diagram of this study

follow-up video meetings over the course of 12 weeks. During the study period, they were directed to complete the exercises as a home program. Throughout the study, both groups were given instructions to comply with a Mediterranean diet. Written exercise guidelines with pictures and videos for clarification, together with dietary guidelines, were distributed to both groups through the What's Up group.

Pilates exercise program

Telepilates lasted 40–60 minutes, comprising a 10–15-minute warm-up and cool-down period, followed by 30–45 minutes of main Pilates exercises. Twelve Pilates exercises were included in the set, which targeted the abdominal and pelvic floor muscles. These exercises include the following: bridge, rolling down, swan exercise, single and double leg stretch, single leg circles, scissors, lower and lift, crisscross, hundreds, frog, and walking [13].

Exercise progression

Exercise progression was achieved by increasing the number of repetitions for each exercise, which ranged from four to 10 [14].

Mediterranean diet

For a duration of 12 weeks, both groups were instructed to follow the Mediterranean diet guidelines. The participants were instructed to increase their intake of vegetable proteins like beans, peas, and almonds and to eat fish, at least twice or three times a week. Fast food was avoided, red meats such as beef should only be eaten once a week and white meats such as chicken every two to three days. This diet also included utilizing olive oil and consuming less butter. The emphasis was on boosting vegetable consumption, Fruit consumption was also promoted, with the goal of eating at least two seasonal fruits per day. Rice consumption was limited to twice a week, with whole-meal and whole-grain bread preferred over bran-free types. Finally, it was recommended to limit the quantity of simple sugar found in cakes, desserts, sweets, candies, and soft drinks [15].

Outcomes

Anthropometric measures

A wall-mounted device was used for measuring the height and weight to determine the body mass index, which was derived by dividing weight in kg and height in meters squared [16]. A flexible, non-stretchable measuring tape was used to measure the waist circumference halfway between the lowest rib and the iliac crest.

HOMA-IR

Venous samples of blood were taken at the beginning and conclusion of the 12-week trial period (after 8 hours of fasting) to measure the homeostasis model assessment of insulin resistance (HOMA-IR) index. Using the DSL-10-1600 ACTIVE insulin enzyme-linked immunosorbent ELISA, plasma insulin was quantified. HOMA-IR index was calculated according to the following equation:

(Fasting Insulin Concentration (μU/L) × Fasting Glucose Concentration (mg/dL)) / 405 [17].

The Patient Perception of Intensity of Urgency Scale (PPIUS)

Bladder overactivity symptoms were graded on a 4-point PPIUS, with 0 indicating no urgency at all. Higher scores indicate a greater sense of urgency, where 4 is the most urgent [18].

Overactive bladder questionnaire, short form (OAB-q SF)

The questionnaire aims to evaluate two key areas: overactive bladder symptoms and their influence on overall quality of life. It consists of six questions to assess the degree of symptoms, yielding a score that is converted into a scale of 0 to 100, with 0 denoting no symptoms and 100 representing the most severe symptoms. In terms of quality of life, thirteen questions address how having an overactive bladder affects daily life. The scoring is guarded, with 100 signifying the greatest quality of life and 0 being the lowest [19].

Telehealth usability scale

At the end of the intervention period, the TUS was used to assess participants' satisfaction with the use of the telehealth platform for providing Pilates exercises and a Mediterranean diet. It covers six subdomains, including utility and ease of use, with three questions each. Four questions were used to assess the interface and interaction quality. In addition, the questionnaire has four questions on satisfaction and future use, as well as three questions about reliability [20].

Statistical Analysis

The data was processed with the statistical software for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). The paired sample t-test was employed when comparing related samples, and the independent-sample t-test was utilized when comparing two means. The confidence interval was set at 95%, and the acceptable margin of error was 5 %.

RESULTS AND DISCUSSION

Table 1 indicates that, according to the pre-parameters and baseline characteristics, there was no statistically significant difference between supervised telegroup and unsupervised telegroup ($p > 0.05$).

The supervised telegroup shows a highly significant improvement in all parameters ($p < 0.001$) when comparing the mean values of weight, BMI, WC, IR, PPIUS and OAB-q SF (symptoms and quality of life) between the pre- and post-treatment periods. On the other hand, the unsupervised telegroup did not exhibit any variation in the previously mentioned parameters except for a significant reduction in weight, BMI, and WC ($p < 0.05$) (Table 1).

At the end of the study, significant differences in BMI, WC, IR, PPIUS and OAB-q SF (symptoms and quality of life) were found between groups in favor of the supervised telepilates group ($p < 0.001$) (Table 1). Concerning the telehealth questionnaire, the supervised telegroup exhibited higher significant differences than the unsupervised tele-group ($p < 0.001$) regarding usefulness, ease of use, interface quality, interaction quality, reliability, and satisfaction of use (Table 2).

Table 1. Comparison of baseline characteristics between the supervised telegroup and unsupervised telegroup

Baseline characteristics	Supervised telegroup		Unsupervised telegroup		*t*-test		
	Mean	±SD	Mean	±SD	*t*	*p*-value	Sig.
Age "years"	38.97	2.72	39.61	2.95	−0.963	0.339	NS
Height, cm	165.05	3.55	164.05	3.54	1.223	0.225	NS
Weight, kg							
Before	89.24	4.44	88.32	4.17	0.932	0.354	NS
After	82.30	4.32	86.03	3.24	−3.998	0.000	HS
p-value (within groups)	< 0.001 (HS)		0.030 (S)				
BMI, kg/m²							
Before	32.74	1.07	32.82	1.12	−0.319	0.750	NS
After	30.18	1.07	31.80	1.05	−6.349	0.000	HS
p-value (within groups)	< 0.001 (HS)		0.021 (S)				
WC							
Before	102.86	3.74	103.03	3.40	−0.196	0.846	NS
After	90.86	2.77	100.03	2.42	−13.961	0.000	HS
p-value (within groups)	< 0.001 (HS)		0.048 (S)				
IR							
Before	3.74	0.40	3.82	0.37	−0.903	0.369	NS
After	2.59	0.58	3.10	0.32	−4.736	0.000	HS
p-value (within groups)	< 0.001 (HS)		0.157 (NS)				
PPIUS							
Before	1.86	0.59	1.95	0.73	−0.538	0.592	NS
After	0.41	0.24	1.71	0.90	−7.219	0.000	HS
p-value (within groups)	<0.001 (HS)		0.474 (NS)				
OAB-q (symptoms)							
Before	55.15	7.72	55.89	7.40	−0.425	0.672	NS
After	19.91	6.74	48.16	7.86	−16.686	0.000	HS
p-value (within groups)	< 0.001 (HS)		0.416 (NS)				
OAB-q (quality of life)							
Before	44.28	11.03	45.23	8.10	−0.424	0.673	NS
After	69.98	6.64	48.70	7.57	12.930	0.000	HS
p-value (within groups)	< 0.001 (HS)		0.682 (NS)				

Note: *Between-group differences (p-values) were analyzed using an independent-samples t-test (Mean ± SD); NS — Nonsignificant; S — Significant; HS — Highly significant.*

Table 2. Comparison of supervised telegroup and unsupervised telegroup based on telehealth

Telehealth	Supervised telegroup		Unsupervised telegroup		*t*-test		
	Mean	±SD	Mean	±SD	*t*	*p*-value	Sig.
Usefulness	6.11	0.49	4.35	0.37	17.605	0.000	HS
Ease of use	5.78	0.35	5.40	0.47	3.967	0.000	HS
Interface quality	6.58	0.30	5.31	0.28	18.970	0.000	HS
Interaction quality	6.69	0.22	4.13	0.33	39.764	0.000	HS
Reliability	6.20	0.36	5.28	0.56	8.467	0.000	HS
Satisfaction of use	6.91	0.17	3.72	0.47	38.875	0.000	HS

Note: *Between-group differences (p-values) were analyzed using an independent-samples t-test (Mean ± SD); HS — Highly significant.*

Although there has been a major push for telemedicine services since the COVID-19 pandemic, there has been very little research on the utility of telehealth for OAB. The study is the first to use telepilates to deal with overactive bladder syndrome. The results of the current study showed that both groups' waist circumference and BMI significantly decreased, with a superiorly significant improvement in these outcomes for the supervised telepilates group.

Furthermore, compared to the unsupervised telegroup, which showed no changes, the supervised telegroups' insulin resistance and OAB symptoms significantly improved. While both groups expressed satisfaction with the treatment plan's ability to save time and effort and facilitate their adherence, the treatment group expressed greater satisfaction.

In keeping with the findings of our study, meta-analyses were conducted to demonstrate the efficacy of telehealth in treating urological dysfunction. These analyses made it clear that telehealth platforms not only help manage the symptoms of urine incontinence but also enhance self-esteem and quality of life [21]. Furthermore, telepilates were found to be beneficial in strengthening the core muscles and promoting pelvic stability in a study that involved eight weeks of pregnant women. This suggests that telepilates might be conducted efficiently and remotely [22].

Like this, Raheman Qureshi K.A. [23] compared the effects of six weeks of Pilates versus traditional pelvic floor muscle training and discovered that Pilates exercises significantly increased pelvic floor muscle strength, which in turn reduced symptoms of urine incontinence and enhanced quality of life. Both exercises yielded nearly the same significant outcome.

Similarly, after being used for four weeks, Pilates exercises significantly reduced postpartum women's UI symptoms and strengthened their pelvic floor muscles, leading to the previous study's conclusion that Pilates is preferable to traditional Kegel [24].

The rationale for exercising the pelvic floor muscles to treat OAB symptoms is that it causes a permanent change in the morphology of the pelvic floor, which stabilizes neurogenic activity while also lowering detrusor pressure, boosting the maximum pressure of the urethra, and inhibiting the micturition reflex [25].

The results of this study, which examined the impact of Pilates exercise on metabolic parameters, showed that the supervised telegroup reduced BMI, waist circumference, and insulin resistance more than the unsupervised telegroup. These results are consistent with another study that found Pilates was superior to aerobic exercise in lowering BMI and HOMA-IR in women with type 2 diabetes who were overweight or obese [26].

Another study found that doing Pilates three times a week for 90 minutes each for eight weeks was beneficial for lowering body fat, BMI, and waist circumference [27]. This confirms our findings, which showed that the supervised telegroup had a lower waist circumference and BMI.

The improvement of overactive bladder symptoms is not only attributed to pelvic floor strength but also to the reduction of body weight and improvement in insulin resistance achieved through exercise [4], given the strong correlation that exists between body weight, insulin resistance, and overactive bladder syndrome [5, 6].

It is imperative to remember that not all research has indicated a substantial relationship between Pilates and waist circumference, or BMI. Our results are in contradiction with Segal et al. [28], who showed improvements in flexibility but no change in body composition in 47 adults after six months of Pilates exercises.

A contrary study asserted that doing Pilates exercises had no discernible effect on body composition measures, such as BMI [29]. This could be due to individuals who maintain a healthy weight often experience weight loss more slowly than those who are obese or overweight.

Incorporating the Mediterranean diet into our treatment regimen enhances the findings of the present study, as inadequate dietary habits impact urological functions directly through elevated inflammatory processes [11] or indirectly through excessive weight gain that alters the body's metabolic state [30].

This is in line with the findings of our study, which was supported by a study that involved 326 patients with chronic urological problems. The patients' daily habits improved significantly when they incorporated a Mediterranean diet, and their weight decreased as well [31].

Likewise, a 12-month trial found that the Mediterranean diet reduced fasting glucose levels, decreased BMI, and decreased HOMA-IR levels in both normoglycemic and diabetic individuals [32]. Nevertheless, the unsupervised telegroup group in this study showed non-significant improvement in insulin resistance or OAB symptoms, which may have been due to their lack of motivation to stick to the home exercise protocol as they attended fewer online video sessions than the supervised telegroup. On the other hand, a small improvement in their weight may have resulted from partially adhering to the diet.

Limitations

One of the study's limitations was the small sample size, which limited the applicability of the findings. Furthermore, studies on the management of overactive bladders often focus on quick effects and have limited follow-up periods. Determining the effectiveness of telepilates exercises requires assessing their long-term effects. Lastly, factors including participants' technology literacy, equipment availability, and issues with internet connectivity may have an impact on the sustainability and accessibility of telepilates programs.

CONCLUSION

Pilates exercise is simple and can be done online and at home. Telehealth has been shown to be effective in managing OAB patients; it provides a low-cost and time-saving tool.

ADDITIONAL INFORMATION

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Ethical Approval. The authors declare that all procedures used in this article are in accordance with the ethical standards of the institutions that conducted the study and are consistent with the 2013 Declaration of Helsinki. The study was approved by the Local Ethics Committee of faculty of physical therapy Cairo University, Egypt, Protocol No P.T.REC/012/004621 dated 11.06.2023.
Data Access Statement. The data that support the findings of this study are available on reasonable request from the corresponding author. Registration: Clinicaltrials.gov identifier No NCT06045728; registered September 19, 2023.

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