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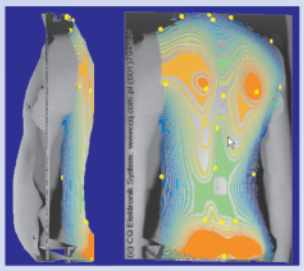

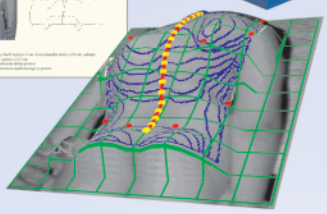

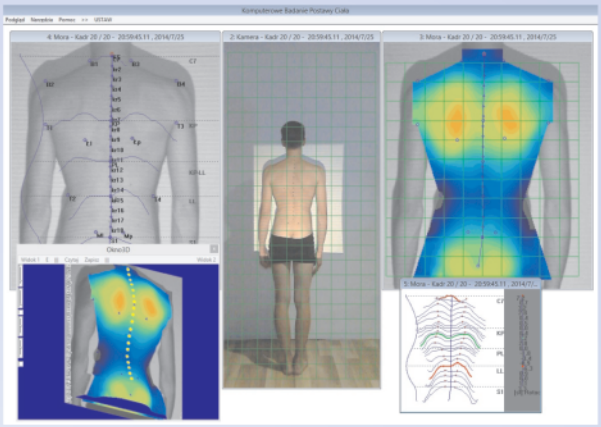

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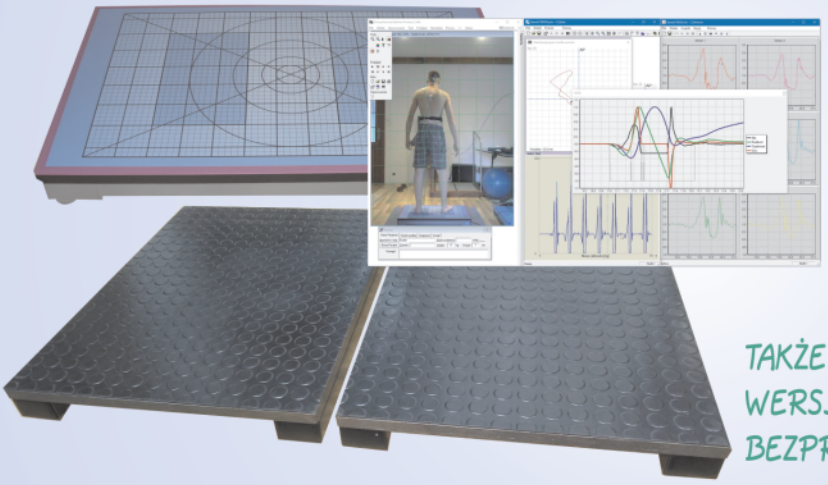

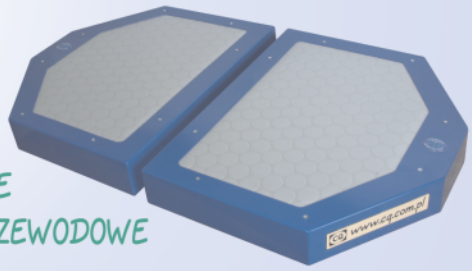

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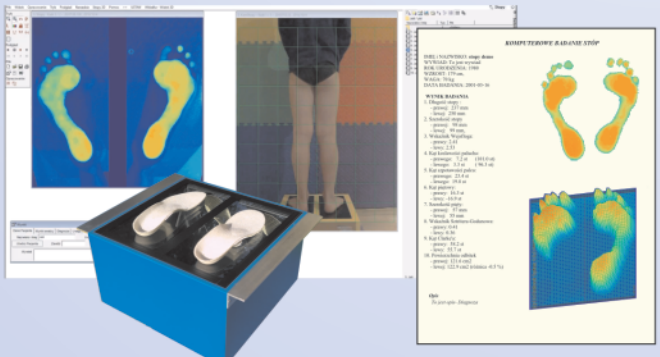

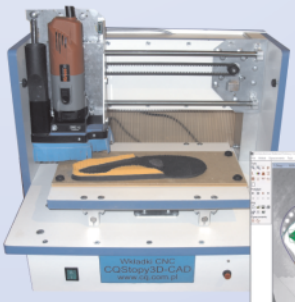

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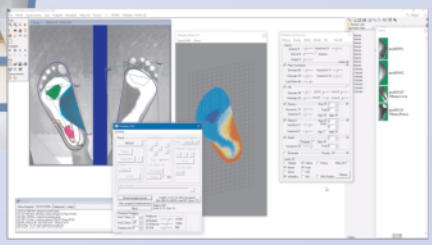

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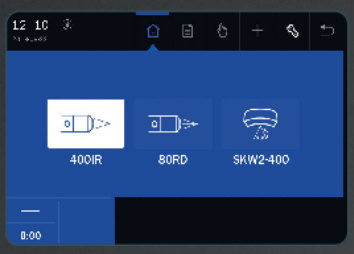

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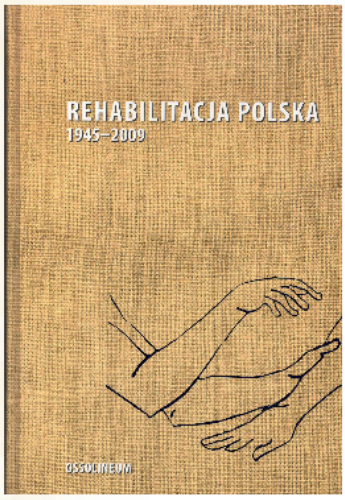

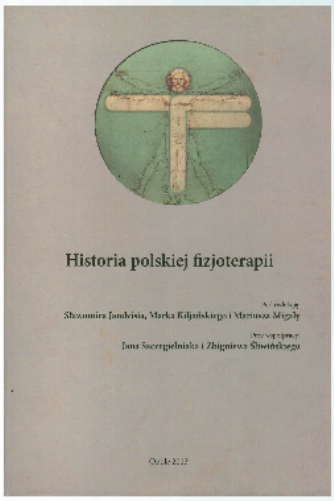

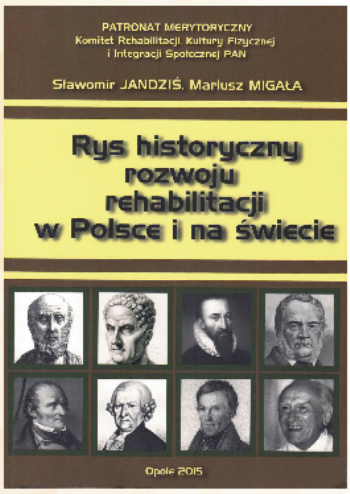

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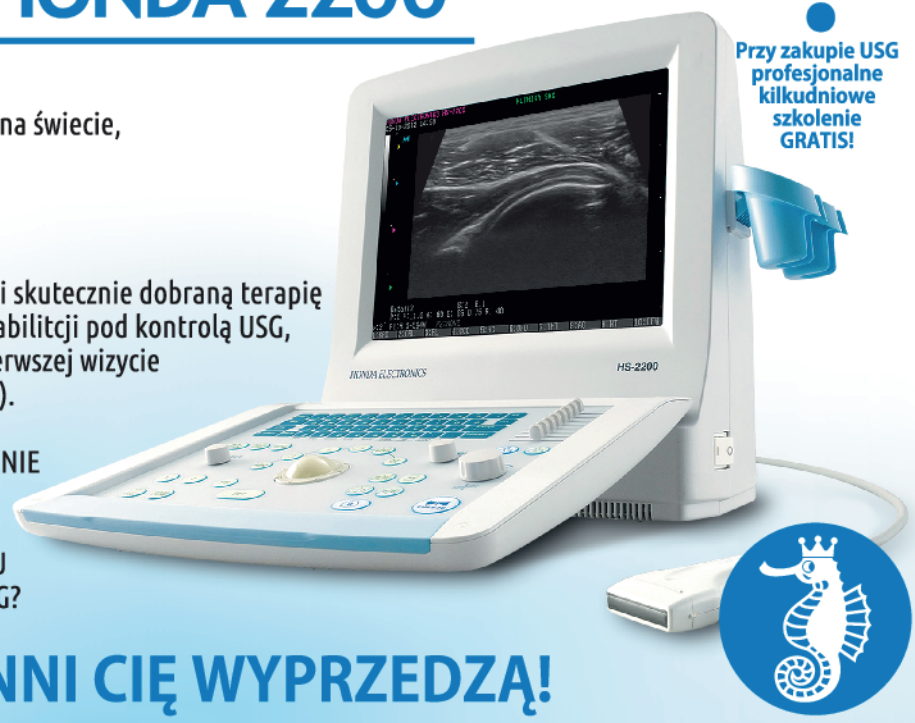

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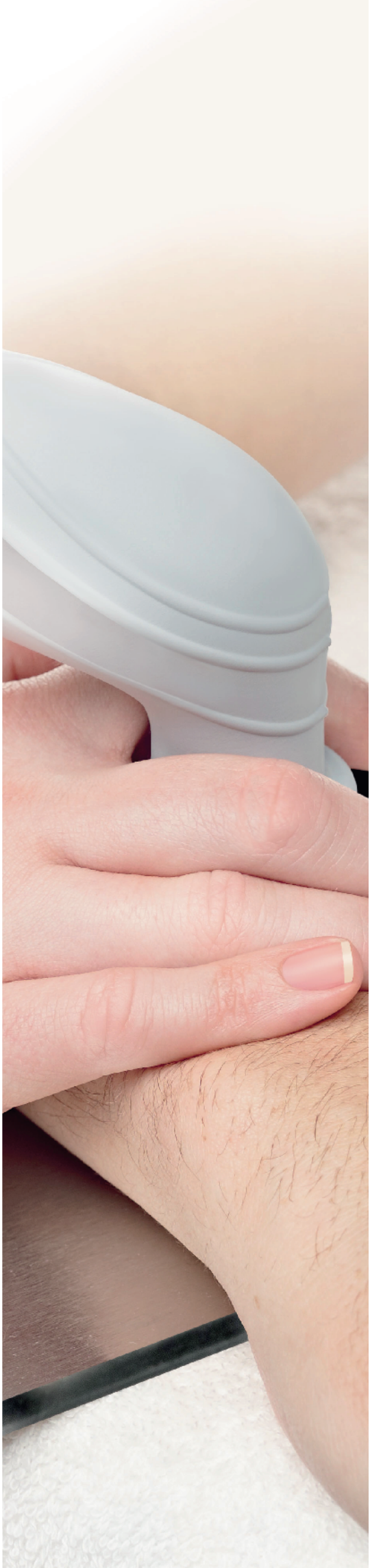

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Effect of Lumbar Stabilization Exercises versus Kinesio Taping on Non-Specific Low Back Pain in Post-Menopausal Women. A randomized Controlled Trial

Wpływ ćwiczeń na stabilizację kręgosłupa lędźwiowego w porównaniu do kinesiotapingu na niespecyficzny ból krzyża u kobiet po menopauzie. Randomizowane badanie kontrolowane

Hanaa Kenawy Atta[1(A,B,C,D,E,F)], Abeer Mohamed ElDeeb[2(A,C,D,E,F)], Hamada Ahmed Hamada[3(A,C,D,E,F)], Magda Ramadan Zahran[1(A,B,C,D,E,F)]

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Abstract
Purpose. This study aimed to investigate and compare the effect of lumbar stabilization exercises versus Kinesio taping on pain intensity level, functional disabilities, and lumbar range of motion (ROM) on non-specific LBP in post-menopausal women. Materials and Methods. 60 post-menopausal women diagnosed with chronic non-specific LBP participated in this study. Their ages ranged from 50 to 60 years. They were randomly assigned into three groups equal in numbers. Group A received traditional physical therapy only. Group B received lumbar stabilization exercises and traditional physical therapy. Group C received Kinesio taping technique and traditional physical therapy. All patients received the treatment 3 times per week for 6 weeks. The pain was measured by visual analogue scale (VAS), functional disability was measured by the Oswestry disability index (ODI), and lumbar ROM was measured by a double inclinometer. Results. The group A, B, and C revealed significant decreases in VAS score, ODI score, and significant increases in lumbar flexion and extension ROM post-treatment. Group B and C showed significant decreases in VAS score, and ODI score, and significant increases in lumbar flexion and extension ROM when compared to group A. However, there were no significant differences between group B and group C in all variables post-treatment. Conclusions. Both lumbar stabilization exercises and Kinesio taping have beneficial and similar effects in reducing pain, improving functional ability, and increasing ROM in postmenopausal women with non-specific LBP.

Key words:
Lumbar stabilization, Kinesio taping, Non-specific low back pain, Post menopause

Streszczenie
Cel. Niniejsze badanie miało na celu zbadanie i porównanie wpływu ćwiczeń na stabilizację kręgosłupa lędźwiowego w porównaniu z kinesiotapingiem na poziom natężenia bólu, niepełnosprawność funkcjonalną, zakres ruchu kręgosłupa lędźwiowego (ROM) i niespecyficzny ból krzyża u kobiet po menopauzie. Materiały i metody. W badaniu wzięło udział 60 kobiet po menopauzie, u których zdiagnozowano przewlekły niespecyficzny ból krzyża. Ich wiek wahał się od 50 do 60 lat. Zostały losowo przydzielone do trzech równych liczbowo grup. Grupa A była poddawana tradycyjnej fizjoterapii. Grupa B wykonywała ćwiczenia na stabilizację kręgosłupa lędźwiowego i była poddawana tradycyjnej fizjoterapii. Grupa C była poddawana kinesiotapingowi i tradycyjnej fizjoterapii. Wszystkie pacjentki były poddawane leczeniu 3 razy w tygodniu przez 6 tygodni. Ból mierzono za pomocą wizualnej skali analogowej (VAS), niepełnosprawność funkcjonalną mierzono za pomocą wskaźnika niepełnosprawności Oswestry (ODI), a zakres ruchu kręgosłupa lędźwiowego mierzono podwójnym inklinometrem. Wyniki. W grupie A, B i C zaobserwowano znaczący spadek wyniku VAS, ODI oraz ograniczenie w zakresie zgięcia kręgosłupa lędźwiowego i wyprostu po leczeniu. W grupie B i C zaobserwowano spadek w zakresie VAS, ODI oraz znaczący wzrost w zakresie zgięcia kręgosłupa lędźwiowego i wyprostu w porównaniu do grupy A. Jednakże, nie zaobserwowano znaczących różnic między grupą B i C dla wszystkich zmiennych po zakończonym leczeniu. Wnioski. Zarówno ćwiczenia na stabilizację kręgosłupa lędźwiowego i kinesiotaping okazały się korzystne i miały podobne rezultaty, jeśli chodzi o ograniczenie dolegliwości bólowych, poprawę zdolności funkcjonalnych oraz zwiększenie zakresu ruchu u kobiet po menopauzie o niespecyficznym bólu krzyża.

Słowa kluczowe:
Stabilizacja kręgosłupa lędźwiowego, Kinesiotaping, niespecyficzny ból krzyża, okres pomenopauzalny

Introduction

Non-specific low back pain (LBP) is a common musculoskeletal problem that most people, mainly females, experience during their life [1]. It is defined as a pain localized below the margin of the last ribs and above the inferior gluteal line, with or without lower limb pain. It is characterized by the absence of structural anatomical changes [2]. Non-specific LBP affects 85% of all individuals [3]. Its prevalence was estimated to be 32.9% in post-menopausal women [4]. Non-specific LBP is more prevalent in women than in men due to interactions between biological, psychological, and sociocultural factors [3]. Menopause is associated with several changes, including decreased muscle strength and mass, joint pain, psychological problems, and obesity that are risk factors of LBP [3]. Non-specific LBP affects the physical and psychological aspects of women's life and increases absence from work and socioeconomic costs [5].

The European guidelines for the management of chronic non-specific LBP recommend supervised exercise therapy as a first-line treatment [6]. A systematic review reported that specific stabilization exercise intervention appears to be more effective than no treatment in treating non-specific LBP [7]. Also, Vikranth [8] proved that localized stabilizing exercises reduced pain and disability more than global stabilization among non-specific mechanical LBP subjects. A more recent study recommended stabilizing exercises and walking exercises for patients with chronic LBP because they could prevent and relieve back pain by improving muscle endurance [9]. Another randomized study stated that core stabilization exercise is more effective than routine physical therapy exercise in reducing pain in patients with non-specific LBP [10].

Kinesio taping is a widely used method in physical therapy. Keles et al. [11] demonstrated that the short and long-term uses of Kinesio taping are effective in reducing pain and disability, increasing the lumbar flexion movement, and improving quality of life in patients with LBP due to lumbar disc herniation. Also, Kelle et al. [12] have reported improved pain and disability after 12 days of applied Kinesio taping in patients with acute non-specific LBP compared with their controls. However, Kachanathu et al. [13] reported that a program of stretching of back, hamstring, and iliopsoas with or without Kinesio taping has similar effects on pain and ROM in patients with non-specific LBP. A recent systematic review reported that Kinesio taping is effective when used as adjunctive therapy in reducing pain and improving ROM, muscular endurance, and motor control. However, high-quality studies are needed to strengthen the evidence of the effectiveness of Kinesio taping on chronic LBP [14].

To the authors' knowledge, there is a lack of literature that compare the effects of stabilizing exercises and Kinesio taping on non-specific LBP in post-menopausal women and decide the most effective treatment. Therefore, the study aimed to compare the effect of lumbar stabilization exercises and Kinesio taping on pain intensity level, functional disabilities, and lumbar ROM on non-specific LBP in post-menopausal women. It was hypothesized that both treatments would have similar effects in treating non-specific LBP in post-menopausal women.

Material and Methods

Design of the study

The study was designed as a prospective, randomized, double blind, pre- post-test, controlled trial.

Participants

A Convenient sample of sixty post-menopausal women were recruited by a physician and referred to the outpatient clinic, Etay El Baroud Hospital, Al Behaira. They were enrolled and assessed for their eligibility to participate in this study. All participants complained from non-specific LBP for at least 3 months. Pain was localized below the margin of the last ribs and above the inferior gluteal line, with or without lower limb pain [2]. All tests were performed to confirm the diagnosis of non-specific LBP. Their ages ranged from 50 to 60 years, and their body mass index ranged from 25 to 29.9 Kg/m2. They experienced menopause for at least 3 years. They were not receiving any hormonal replacement therapy. Exclusion criteria included disc prolapse, spondylolisthesis, fractures, tumor, osteoporosis, back or lower limb surgeries, scoliosis, neurological diseases, rheumatologic diseases, psychiatric diseases, or skin allergy. Written informed consent was obtained from each patient. This study was performed according to the Statement of the Declaration of Helsinki.

Randomization

Randomization was implemented simply using a computer-generated randomized table using the SPSS (version 16 for Windows; SPSS Inc., Chicago, Illinois, USA) program. A specific identification number was assigned for each participant. These numbers were randomized into three groups equal in number (n = 20). Sequentially numbered index cards were secured in opaque envelopes. A blinded and independent research assistant opened the sealed envelope and allocated the patients according to their groups. Group A (control group) received traditional physical therapy for a total of 40 minutes per session for 3 sessions per week. Group B received lumbar stabilization exercises for 3 sessions per week and the same traditional physical therapy. Group C received Kinesio taping technique and the same traditional physical therapy. The duration of the treatment for all groups was 6 weeks. The patients were informed about the study procedures to gain their cooperation during the study course. No subjects dropped out of the study after randomization (figure 1).

Intervention

Traditional treatment

Each patient in all groups received traditional physical therapy. It consisted of application of hot pack for 20 minutes, interferential current therapy for 15 minutes, and ultrasound for 5 minutes on the lower back. Treatment was performed 3 sessions per week for 6 weeks [15].

Lumbar stabilization exercises

The lumbar stabilization exercise program included: 1) a warm-up phase for 5 minutes consisted of stretching exercises, 2) lumbar stabilization exercises for 30 minutes, and 3) a cool-down phase for 5 minutes consisted of stretching exer-

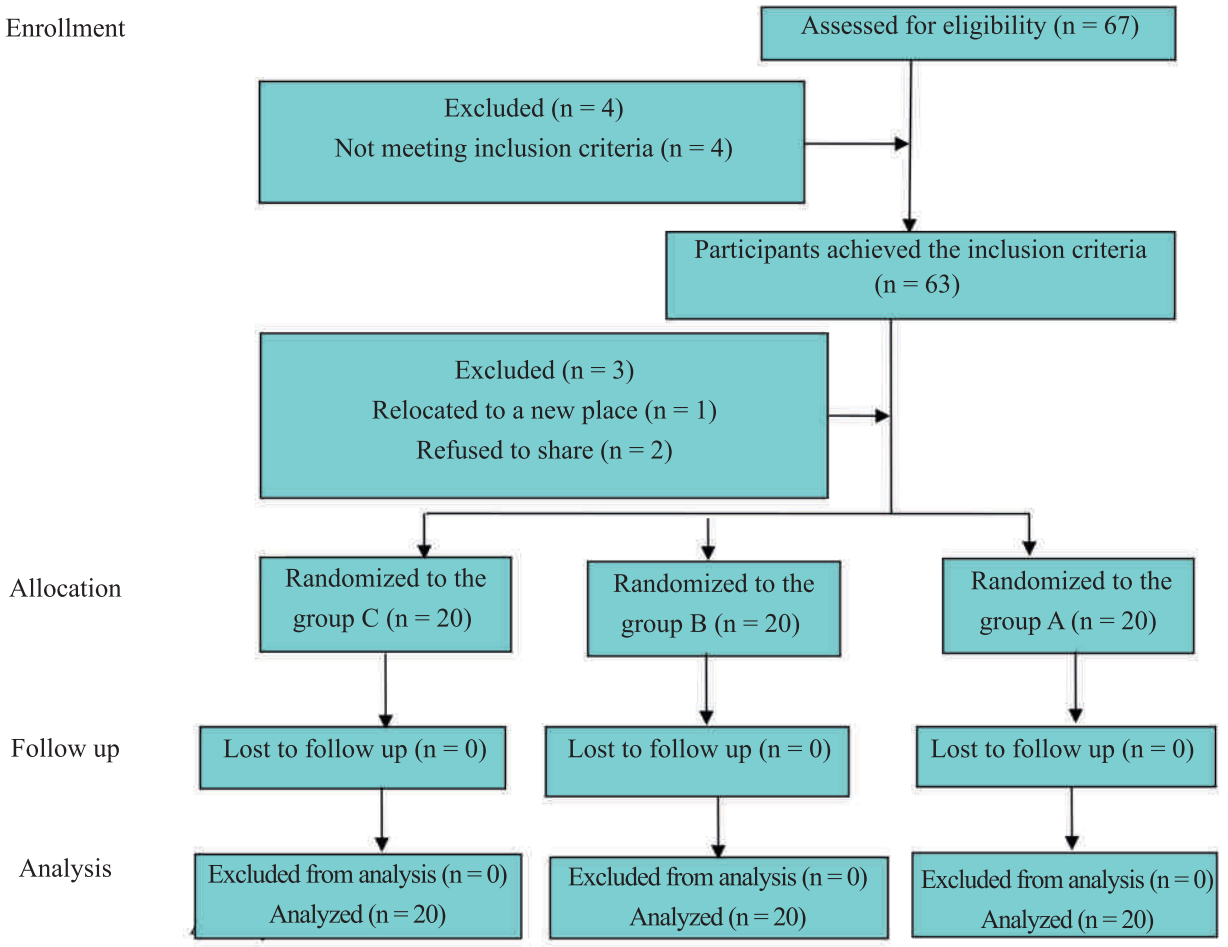

Figure 1. Flow chart of the participants during the trial

cise. The lumbar stabilizing exercise was performed by straining the transversus abdominis muscle, pelvic diaphragm, and the upper abdominal muscles for 10 seconds with a 5 seconds rest in between.

Before each exercise, the physical therapist gave detailed verbal explanation and visual instructions as pictures, regarding the starting and end positions. Exercises were graduated as follows: First, in the supine position, the patients placed both arms in contact with the sides of their trunk and bent their knees. Then, the patients raised their left and right arms in an alternating fashion above their head, raised their left and right legs in an alternating fashion from the ground, raised one arm and the opposite side leg in an alternating fashion and raised their hip and maintained the posture for 10 seconds.

Second, the patients assumed a crawling position, and they raised their left and right hands in an alternating fashion from the ground, raised their left and right legs in an alternating fashion, raised one leg from the ground while raising the hand on the opposite side simultaneously, and finally moved their hip backward and forward. The patients repeated each exercise for 5 repetitions and increased it to be 10 repetitions [15].

Kinesio taping technique

Cure-Tape (Tape Concept Ltd, Cyprus) was used in the present study. The two I-Tapes were applied from the origin of the lumbar erector spinae (iliocostalis lumborum) to its insertion. The area to be treated was cleaned and the tape was measured while the lumbar spine was flexed to the maximum. In the case of flexion disturbances, the patient was able to support herself during flexion. The first 4 cm to 5 cm of tape was carefully removed from its paper backing. The base of the tape was applied to the sacrum in the neutral position at the S1 without tension (0%).The patient was asked to perform a maximum flexion of the spine and the paper backing of the tape was removed, except for the final 4 cm to 5 cm and the tape was used on one side paravertebrally in the direction of the cranium, under slight traction. Finally, the final 4 cm to 5 cm of the tape was applied without traction. The final anchor point was fixed directly above the T12 with 0% tension. The same procedure was then applied to the other side. The tape was rubbed by hand several times to warm the adhesive film to achieve adhesion [13].

Outcomes measurements

1. Pain level

Visual analogue scale (VAS) was used to assess the intensity of pain. The VAS is a reliable and valid tool for the quantification of perceived pain. It is a 10-cm line with 0 indicating no pain and 10 indicating the worst possible pain. It was given to each patient in all groups to detect the level of their pain pre- and post-treatment [16].

2. Functional disability

The Oswestry disability index (ODI) was used to assess functional disability. The ODI contains ten sections including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and traveling. Each question was scored from 0 to 5, according to the patient's ability to perform various functions. The possible total ODI score is 50; higher scores indicated higher functional disability [17].

3. Lumbar flexion and extension ROM

The inclinometer was used for the measurement of lumbar spine ROM. The inclinometer is a pendulum-based goniometry consisting of a 360-degree scale protractor with a counterweighted pointer maintained in a constantly vertical position. It is a handheld, circular, fluid-filled disk with a weighted gravity needle that indicates the number of degrees on a scale of a protractor that remains oriented in the vertical direction and it is used to measure spinal motion [18].

Two inclinometers were used to measure lumbar flexion and extension. The examiner stood behind the standing patient. The skin was marked along the spine midway between the two posterior superior iliac spines (PSIS), and one mark was made on the spinous processes and 15 cm superior to the PSIS line. Both inclinometers were placed over the skin marks. The inclinometers were set as close to 0 degree as possible. While holding the inclinometers, the examiner instructed the patient to bend forward. When the patient bent forward into full lumbar flexion, the angles on each inclinometer was recorded to the nearest degree. The angle measured on the upper inclinometer indicated the gross flexion motion of the lumbar spine and hips. The angle measured on the lower inclinometer indicated hip flexion alone. Lumbar flexion ROM was calculated by the subtraction of the lower inclinometer reading from the upper inclinometer reading. For measuring lumbar extension, the same procedures were used. However, the examiner instructed the patient to bend backward and record the angles on the inclinometers. Lumbar extension ROM was calculated by subtraction of the two readings [18].

Statistical analysis and sample size

The sample size was determined by the accessibility of participants that could be enlisted within the fixed time of information gathering. Test size estimation was performed preceding the investigation utilizing G*POWER statistical programming (version 3.1.9.2; Franz Faul, Universitat Kiel, Germany) as shown in figure (2). The effect size measured from pilot study on10 participants (5in each group). Statistical analysis was conducted using SPSS for Windows, version 18 (SPSS, Inc., Chicago, IL). 3×2 mixed design MANOVA was used to compare the tested variables of interest at different tested groups. Data were screened for normality assumption, homogeneity of variance, and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculations of the analysis of difference. P-value was set at < 0.05.

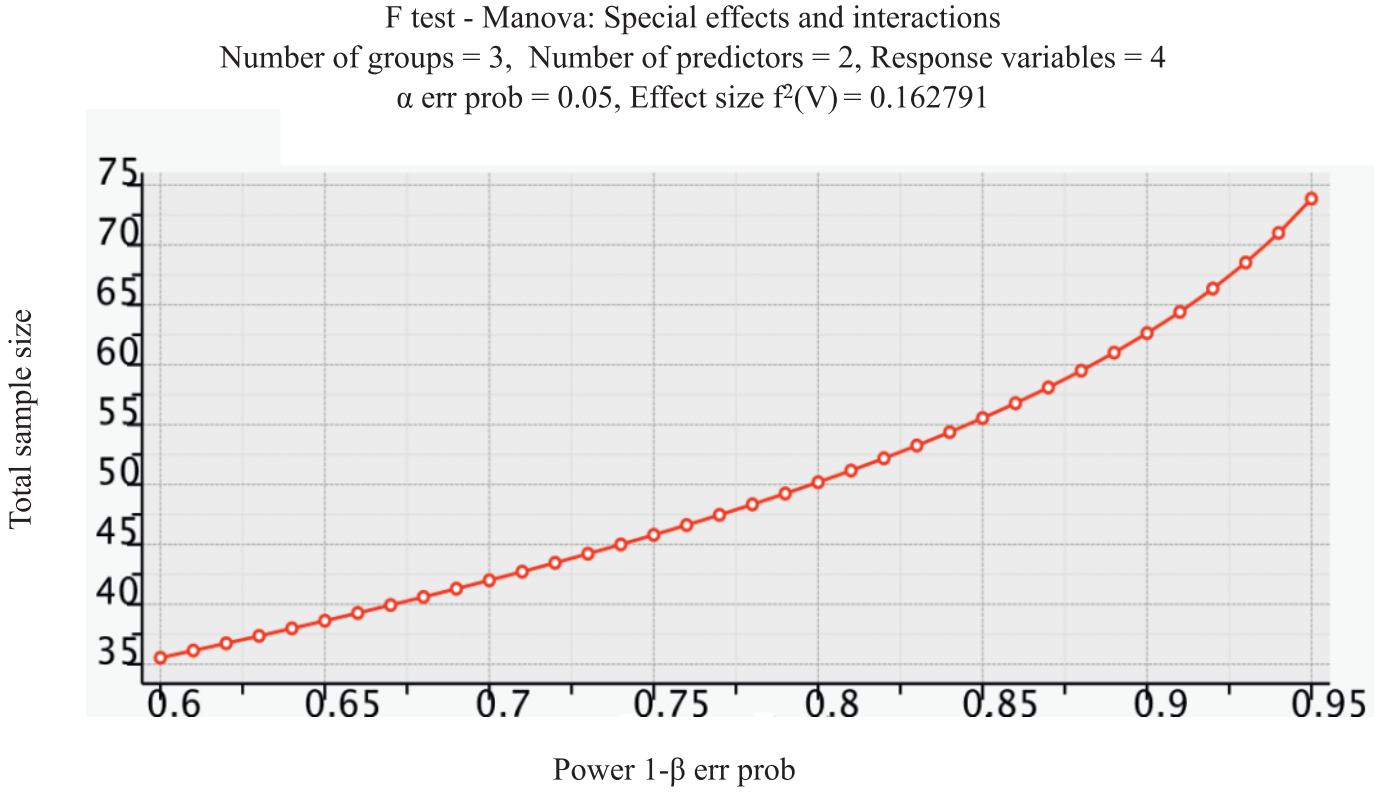

Figure 2. Plot of sample size calculation

Results

As presented in table 1, there was no significant difference ($p > 0.05$) between three groups in their ages, weight, height, and BMI.

Multiple pairwise comparisons showed that the group A, B, and C revealed significant decreases ($p < 0.05$) in VAS and ODI scores, and significant increases ($p < 0.05$) in lumbar flexion and extension ROM post-treatment as presented in table 2.

Table 1. Physical characteristics of participants in each group (Mean ± SD)

General characteristics	Group A (n = 20)	Group B (n = 20)	Group C (n = 20)	F-value	P-value
Age (years)	57.4 ± 1.8	57.4 ± 1.7	58.4 ± 2.1	1.78	0.177
Weight (kg)	72.1 ± 8.4	70.1 ± 6.9	73.8 ± 8	1.08	0.334
Height (cm)	164.3 ± 6.3	161 ± 5.1	165.4 ± 5.5	2.8	0.067
BMI (kg/m^2)	26.2 ± 2.5	27.1 ± 2.4	26.6 ± 1.7	0.721	0.491

*Data are represented as mean ± standard deviation; BMI: body mass index; *p < 0.05: significant*

Table 2. Descriptive statistics and mixed design MANOVA for VAS score, ODI score, lumbar flexion and extension ROM

Dependent Variable		Group A (Mean ± SD)	Group B (Mean ± SD)	Group C (Mean ± SD)	F-value	P-value
VAS score	Pre-treatment	6.6 ± 1.3	6.5 ± 1.6	5.75 ± 1.3	2.28	0.107
	Post-treatment	5.7 ± 1.5	4.5.7 ± 1.8	4.65 ± 1.2	11.86	0.001*
	% of change	13.6% ↓	30.8% ↓	19% ↓		
	p-value	0.048*	0.001*	0.016*		
ODI score	Pre-treatment	68 ± 7.6	70.1 ± 8.4	70 ± 8.6	0.335	0.716
	Post-treatment	62.4 ± 8.2	59.3 ± 1.7	61 ± 8.5	8.3	0.001*
	% of change	8.2% ↓	15.4% ↓	12.9% ↓		
	p-value	0.047*	0.001*	0.002*		
Lumbar flexion ROM	Pre-treatment	29.5 ± 6.1	35.6 ± 7.7	31.4 ± 9.7	0.33	0.52
	Post-treatment	42.3 ± 9.8	75.4 ± 3.5	64 ± 9.5	145	0.001*
	% of change	43.4% ↑	113% ↑	103.8%↑		
	p-value	0.001*	0.001*	0.001*		
Lumbar extension ROM	Pre-treatment	9.8 ± 3.8	10.2 ± 3.5	9.7 ± 3.6	0.25	0.883
	Post-treatment	17.8 ± 2.5	24.7 ± 1.8	22.2 ± 2	52.8	0.001*
	% of change	81.6 ↑	142% ↑	128.8%↑		
	p-value	0.001*	0.001*	0.001*		

*Data are represented as mean ± standard deviation; ODI: oswestry disability index; ROM: range of motion; VAS: visual analogue scale; *p < 0.05: significant.*

Post hoc tests among different groups revealed significant decreases ($p < 0.05$) in VAS and ODI scores and significant increases ($p < 0.05$) in the lumbar flexion and extension ROM of the group B and group C when compared to the group A. However, there was no significant differences in VAS score, ODI score, and lumbar flexion and extension ROM ($p > 0.05$) between group B and C as presented in table 3.

Table 3. Post hoc test between groups for measured variables post study

Post hoc test for dependent variables post study	VAS score	ODI score	Lumbar Flexion ROM	Lumbar Extension ROM
Group A versus group B (p-value)	0.001*	0.013*	0.001*	0.001*
Group A versus group C (p-value)	0.007*	0.037*	0.001*	0.001*
Group B versus group C (p-value)	0.988	0.074	0.102	0.213

*ODI: oswestry disability index; ROM: range of motion; VAS: visual analogue scale; *p < 0.05: significant.*

Discussion

Non-specific LBP affects multiple aspects of the individual's life including physical function, psychological well-being, and the ability to work [19]. It is a leading contributor to disease burden worldwide [20]. This randomized controlled trial aimed to investigate and compare the effect of lumbar stabilization exercises versus Kinesio taping on pain intensity level, functional disabilities, and lumbar ROM in post-menopausal women with non-specific LBP. The results revealed that both lumber stabilization and Kinesio taping in addition to traditional physical therapy are effective in reducing back pain intensity and functional disability, and increasing trunk flexion and extension ROM.

Similarly, Sipaviciene et al. [21] investigated the effects of a twelve-week program of lumbar-stabilization exercises on multifidus muscles isokinetic peak torque, and pain in women with chronic LBP. They concluded that exercises decreased disability and chronic LBP, increased multifidus muscle cross-sectional area, increased trunk muscles peak torque and decreased, significant improvement in the ability to contract the transversus abdominis. Also, these findings are in line with previous studies, which concluded that stabilization of the lumbar spine muscles is more effective in reducing the pain and functional disability in patients with chronic LBP when compared to lumbar extension exercises [22] or when compared to global stabilizing exercises [8].

Moreover, the results come in agreement with the findings of the previous studies, which reported that the localized stabilization exercises decreased functional disabilities compared with the control group in patients with non-specific LBP [7]. These findings could be explained by that lumbar stabilization exercises help to mobilize motor units coordinated by the large-unit muscle system and local muscle systems such as the transversus abdominis, diaphragm, and lumbar multifidus muscles. All of these responses contribute to increase postural control of the trunk [23, 24].

The stabilization exercises use drawing-in maneuver, which helps in coactivating the transversus abdominis and multifidus muscles than other exercises, which concentrate on strengthening the surrounding muscles. Exercises also strengthen the lumbar extensors thereby improving functional ability and lumbar ROM [24].

A recent systematic review showed that Kinesio taping is effective when used as an adjunctive therapy, in reducing pain, and improving trunk ROM, muscular endurance, and motor control [14]. Kaplan et al investigated the effect of lumbar Kinesio taping on pain intensity and disability in women with pregnancy-related LBP in comparison to paracetamol usage. They declared that Kinesio taping was superior to using paracetamol in decreasing pain and disability [25].

Similarly, Keles et al. [11] investigated the short and long-term effects of Kinesio taping on pain, lumbar flexion movement, disability, quality of life in patients with LBP due to lumbar disc herniation. They explained that Kinesio taping improved all parameters after short- and long-term use and also reduced the analgesic needs of these patients. Kinesio taping reduces pain through its effect on skin sensory receptors, lymphatic circulation, which prevents accumulation of waste products of muscular cells that may stimulate pain receptors [26].

Also, Kelle et al. [12] reported improved pain and disability after 12 days of applied Kinesio taping in patients with acute non-specific LBP. However, Kachanathu et al. [13] stated that Kinesio taping and conventional therapy have similar effects on pain and ROM in patients with non-specific LBP compared with the control group. Stabilizing exercises and Kinesio taping are cost effective and simple to apply. Also, stabilizing exercise can be used as a home training [25]. Kinesio tape is an elastic tape that does not restrict movement and can be stretched up to 120% to 140% of its original length allowing a full ROM [13,14].

However, this study is limited by that the women ‘s mood changes may be a factor that affect the outcomes of this study. Also, strength of multifidus and transversus abdominis was not measured. Future studies are needed to investigate and compare the effect of lumbar stabilization and Kinesio taping on isokinetic trunk flexion and extension torque, lumbar

lordosis angle, and pelvic tilting angle after a long period of application. Also, the long-term effects of these protocols cannot be predicted. Moreover, further studies are needed with longer follow-up periods.

Conclusion

Lumbar stabilization exercise and Kinesio taping technique have similar effects in reducing pain, improving functional disabilities, and increasing trunk ROM in postmenopausal women with chronic non-specific LBP. So, they can be used as alternatives for treating chronic non-specific LBP.

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