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THE EFFECTIVENESS OF MASSAGE THERAPY FOLLOWED BY CORE STABILITY EXERCISES FOR HEALING CHRONIC PELVIC INJURIES

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Ключові слова: *хронічна травма таза, масаж Тепурак, вправи для стабілізації м'язів кора, зменшення болю, діапазон рухів, реабілітація опорно-рухового апарату*

Abstract. The effectiveness of massage therapy followed by core stability exercises for healing chronic pelvic injuries. Subagio I., Sabillah M.I., Ockta Yo., Pranoto N.W., Saputra D.E.W., Sari N.S., Asmawati P. *Chronic pelvic injuries, commonly caused by overuse, poor ergonomics, or physical strain, often lead to limited mobility and decreased quality of life due to pain and reduced joint range of motion (ROM). Non-pharmacological approaches offer a safer alternative to drug-based treatments, with growing interest in manual therapy and targeted exercise interventions. This study aims to evaluate the effectiveness of massage therapy followed by core stability exercises in the healing process of chronic pelvic injuries, particularly in reducing pain and improving ROM, as well as assessing the extent to which this combined intervention enhances musculoskeletal function and accelerates recovery. A pretest-posttest design without a control group was conducted with 20 participants from Yogyakarta and East Java. Pain levels were assessed using the Visual Analogue Scale (VAS), while hip joint ROM was measured with a goniometer across six primary movements. Data normality was tested using the Shapiro-Wilk test, and statistical analysis of pretest and posttest differences was performed with the Wilcoxon signed-rank test. The results showed a highly significant reduction in pain, with a decrease of 92.28% (p<0.05) post-intervention. All measured ROM parameters also showed significant improvement, with the greatest increase observed in hip extension at 21.63%. The average improvement across all movements was 16.24%, indicating that the combined intervention had a positive effect on pelvic joint function. Massage therapy followed by core stability* *exercises is effective in reducing pain and improving joint ROM in chronic pelvic injury cases. These findings support the application of integrative non-pharmacological therapies as a safe and effective musculoskeletal rehabilitation strategy that enhances function and quality of life for individuals with chronic pelvic disorders.*

Реферат. Ефективність масажної терапії з подальшим виконанням вправ для стабілізації м'язів кора у відновленні при хронічних травмах тазової ділянки. Субагіо І., Сабіллах М.І., Окта Йо., Пранoто Н.В., Сапутра Д.Е.В., Сарі Н.С., Асмаваті П. *Хронічні травми тазової ділянки, які зазвичай виникають унаслідок надмірного навантаження, неправильної ергономіки або фізичного перенапруження, часто призводять до обмеження рухливості та зниження якості життя через біль і зменшення обсягу рухів у суглобах. Нефармакологічні підходи пропонують безпечнішу альтернативу медикаментозному лікуванню, при цьому зростає інтерес до мануальної терапії та цілеспрямованих фізичних вправ. Це дослідження має на меті оцінити ефективність масажної терапії з подальшим виконанням вправ для стабілізації м'язів кора в процесі відновлення при хронічних травмах тазової ділянки, зокрема щодо зменшення болю та покращення обсягу рухів, а також визначити, наскільки така комбінована терапія покращує функцію опорно-рухового апарату та прискорює відновлення. Було проведено дослідження за схемою «до–після» без контрольної групи за участю 20 осіб з Джок'якарти та Східної Яви. Рівень болю оцінювали за допомогою візуальної аналогової шкали (VAS), тоді як обсяг рухів у кульшовому суглобі вимірювали гоніометром у шести основних рухах. Нормальність розподілу даних перевіряли за допомогою тесту Шапіро–Вілка, а статистичний аналіз відмінностей між показниками до та після втручання проводили за допомогою критерію знакових рангів Вілкоксона. Результати показали високодостовірне зменшення болю після втручання — на 92,28% (p<0,05). Усі вимірювані показники обсягу рухів також продемонстрували значне покращення, причому найбільше збільшення спостерігалося при розгинанні кульшового суглоба — на 21,63%. Середнє покращення за всіма рухами становило 16,24%, що свідчить про позитивний вплив комбінованого втручання на функцію тазових суглобів. Масажна терапія з подальшим виконанням вправ для стабілізації м'язів кора є ефективною для зменшення болю та покращення обсягу рухів у суглобах при хронічних травмах тазової ділянки. Отримані результати підтверджують доцільність застосування інтегративних нефармакологічних методів терапії як безпечної та ефективної стратегії реабілітації опорно-рухового апарату, що сприяє покращенню функціонального стану та якості життя осіб із хронічними порушеннями тазової ділянки.*

In the current millennial era, humans cannot be separated from various daily activities such as work, sports, and other individual interests [1]. These activities can cause a decline in physical condition and disruption in activities, known as musculoskeletal disorders [2]. This illness affects muscles, bones, joints, ligaments, and other tissues, it is characterized by persistent pain and movement limitations [3]. The pelvis is a structure that supports and maintains equilibrium in the body, it joins the upper and lower limbs [4]. Because of its important role, the pelvis is susceptible to irritation and impaired movement function due to injuries such as muscle tension, tears of muscle tissue and ligaments, and shifting of bones and joints. Activities that can trigger pain in the pelvis include walking, sitting for too long, lifting heavy objects in the wrong position, and unergonomic body positions. The pelvis serves as the connection between the upper and lower limbs, playing a crucial role in maintaining balance and supporting the body's weight [5]. The hip joint is created by the articulation of the femoral head with the acetabulum of the os coxae, also known as the synovial ball and socket joint is one type of enarthrosis joint [6]. Because it may move in all planes-flexion, extension, abduction, adduction, and rotation, the hip joint is multiaxial. Numerous anatomical characteristics of the hip joint make it appropriate for supporting weight and providing stability during standing, walking, and sprinting. The constituent parts support and strengthen the pelvis, enabling it to stand erect and develop into a fully functional entity.

The mechanism of injury occurs in soft tissue (muscles, tendons, ligaments) which will result in closed bleeding in the tissue and swelling [7]. This swelling causes increased pressure on the tissue and will result in pain and stiffness. An injury is a physical anomaly brought on by excessive movement or accidents that causes discomfort, heat, redness, swelling, and the incapacity of the muscles, tendons, ligaments, joints, or bones to function normally. Injuries are closely related to the emergence of discomfort in the body [8]. This is a form of the body's natural response that signals that something is not right in a person's body, discomfort can include pain. Pain is an unpleasant emotional and sensory experience connected to prospective or existing tissue damage [9]. This general symptom is also present in the majority of injuries. Over 50, women in Asia have a 20% risk and males a 5.6% chance of hip joint damage. Of the 46 individuals surveyed, 45.5% reported having pelvic pain in a Surabaya hospital in Indonesia. Low back pain has been related to a number of issues, including an excessive physical exertion and an uncomfortable working position [10, 11].

Hip joint disorders require greater therapy right away in an attempt to mend the joint and prevent worsening consequences. The healing process of an injury is influenced by its type and timing, whether it's acute or chronic. Acute injuries typically heal within 4-6 days, while chronic injuries can take from 3 weeks to 12 months to heal, depending on the affected tissue and the severity of the damage [12]. Treatment to cure muscle pain can be done through pharmacological or non-pharmacological therapy, pharmacological therapy uses drugs that are often used to treat joint pain, even though they have side effects that are not good for the body's health. Many techniques, including shiatsu, acupuncture, cold therapy, heat therapy, chiropractic adjustments, and massage, are included under non-pharmacological therapy [13]. Because they wish to avoid the negative effects of medication, people frequently choose non-pharmacological treatment for musculoskeletal diseases, particularly those affecting the hip joint. Therapeutic massage, like Tepurak Massage (Tekan, Tepuk, Gerak), is one type of non-pharmacological treatment that is used.

Massage is manipulation using the hands with various movements to reduce stiffness and muscle tension. Tepurak manipulation presses trigger points to relax muscles, increase joint range of motion, and reduce pain. This movement realigns the joints and loosens tight muscles. The advantages of Tepurak include increasing range of motion (ROM), reducing pain, and actively involving the patient making it safer. Massage techniques are very diverse and have undergone many developments, such as Frirage massage, fitness massage, acupressure, deep tissue massage, Tepurak, and others. Exercises utilizing the capabilities of the trunk, lumbar spine, pelvis, hips, abdominal muscles, and tiny muscles along the spine are referred to as core stability training [14]. Together, these muscles create strength that tries to stabilize the body and preserve the spine through symmetrical alignment. The body can move more effectively and efficiently when the spine is robust and solid. Effective and efficient movement of the body can lower the chance of injury, improve athletic capabilities including strength, speed, and functionality, and support the body during all dynamic motions, while having a strong core improves strength and balance, lowers the risk of back problems, and maximizes movement and balance in the upper and lower limbs. Based on the description above, researchers want to further explore the efficacy of combining massage therapy with Core Stability Exercises in the treatment of chronic pelvic injuries.

MATERIALS AND METHODS OF RESEARCH

In this study, a pretest-posttest design was utilized without a control group to assess the impact of Tepurak manipulation followed by core stability exercises on pain and range of motion in individuals with chronic pelvic injuries. The participants were residents of the Special Region of Yogyakarta (DIY) and East Java, selected using incidental sampling based on specific inclusion and exclusion criteria. The inclusion criteria were individuals who had experienced pelvic injuries for more than three weeks and who were willing to provide informed consent. The exclusion criteria included individuals with severe pain preventing walking, fractures, fever, or urinary issues. The sample size was calculated using the Slovin formula, which resulted in a minimum of 17.65 participants, and a total of 20 participants were included in the study. The exclusion criteria included individuals with severe pain preventing walking, fractures, fever, urinary disorders, structural abnormalities of the hip joint that could affect range of motion and pain syndrome (such as hip osteoarthritis, hip dysplasia, adhesive processes, or other degenerative joint conditions), as well as participants presenting neurological symptoms including radiating pain, numbness, muscle weakness, or impaired motor control. Participants with a history of hip surgery or other musculoskeletal disorders unrelated to chronic pelvic injury were also excluded from the study.

The inclusion criteria were individuals who had experienced chronic pelvic injuries for more than three weeks during January-May 2020, were willing to participate in the study, and were able to provide written informed consent. Eligibility was confirmed through medical records, anamnesis, injury history, and physical examination results, including pain assessment and hip joint ROM evaluation.

Data collection was carried out using two primary instruments: the Visual Analogue Scale (VAS) to measure pain levels and a goniometer to assess ROM in hip movements such as flexion, extension, abduction, adduction, and internal and external rotations. Pain was rated on a scale from 0 to 10, with higher scores indicating greater pain intensity. ROM was measured in degrees using a goniometer before and after the intervention to evaluate the effects of the treatment on the participants' range of motion. The sampling method employs the Slovin formula with a significance level of 20%, which uses quota sampling to calculate the sample size [15].

Slovin's formula: $n=\frac{N}{1+N\,(It\ is)^2}$

Information:

n= sample size

e= percent clearance (20%=0.2)

N= population: 60

$n=\frac{60}{1+60\,(0.2)^2}$

$n=\frac{60}{1+2.4}$

$n=\frac{60}{3.4}$

n=17.6471

Based on calculations, the minimum sample size is 17.6471, but in this study, 20 people were involved. The sample consisted of 20 people who met two inclusion criteria: (1) had experienced a pelvic injury longer than three weeks ago; and (2) were willing to participate in the study and could provide documentation of their informed consent. Broken bones, excruciating pain that prevents you from walking, fever, and issues with urinating are among the exclusion criteria. In this study, researchers used instruments in the form of medical records of anamnesis and examination results. The history includes the duration of the injury, the cause of the injury, and the history of the injury. Meanwhile, the examination includes a pain scale and ROM.

The intervention protocol consisted of two sequential treatment components: Tepurak massage therapy followed by Core Stability exercises. Each participant received the intervention three times per week for four consecutive weeks, with each session lasting approximately 45-60 minutes. The intervention was administered by trained therapists and supervised by the research team.

The first stage involved Tepurak massage therapy (Tekan, Tepuk, Gerak), which was performed for approximately 20-30 minutes. The procedure included trigger point pressure, tapping techniques, passive joint mobilization, and assisted movement targeting the pelvic, lower back, gluteal, and hip muscle regions. The massage intensity was adjusted according to participant tolerance and pain response, with moderate pressure applied to avoid discomfort or tissue irritation.

Following the massage intervention, participants performed Core Stability exercises for approximately 20-30 minutes. The exercise program included pelvic bridge, plank, side plank, bird-dog, and abdominal drawing-in maneuvers. Each exercise was performed in 2-3 sets with 10-15 repetitions or maintained for 20-30 seconds depending on the movement type. Exercise intensity was progressively adjusted based on the participant's functional capacity and tolerance. A short rest interval of 30-60 seconds was provided between sets.

The intervention sequence was standardized for all participants, where massage therapy was consistently performed before the exercise session to promote muscle relaxation, reduce pain, and improve joint mobility prior to active stabilization training.

For statistical analysis, descriptive statistics was used to calculate the mean, standard deviation, and range for both pain and ROM at pretest and posttest. The normality of the data was tested using the Shapiro-Wilk test, and since the data were not normally distributed, non-parametric methods were applied. The Wilcoxon Signed-Rank Test was used to analyze the differences between pretest and posttest data. A significance level of 0.05 was used, and any p-value less than 0.05 was considered statistically significant, indicating that the treatment had an effect.

The assessment is conducted by gauging pain levels through the utilization of the VAS. This scale assesses the intensity of pain felt by the patient from 0-10. Patients are asked to move the marks on the VAS to measure how much pain they feel. The higher the number on the pain scale, the greater the pain felt by the patient, and vice versa. ROM examination of the hip is carried out by measuring the angle of movement in degrees using a goniometer. This ROM measurement involves several positions, namely flexion, extension, abduction, adduction, internal rotation, external rotation. A goniometer is used to measure the ROM angle to determine the influence between data before and after treatment.

The research was conducted in accordance with the principles of bioethics set out in the WMA Declaration of Helsinki – "Ethical principles for medical research involving human participants" and "Universal Declaration on Bioethics and Human Rights" (UNESCO).

This approach allowed the study to assess the impact of the intervention on both pain and ROM, ensuring the validity of the findings. All statistical analyses were performed using SPSS Version 26.0 (IBM SPSS Statistics, Chicago, IL, USA), and the software was licensed under WHIQVZYWLARL9JEYQEGDUBLH8Z3ZCJAL3 FLXMS98V95TSDYI7FOEXUPRR.

RESULTS AND DISCUSSION

Descriptive Analysis of Research Subjects

The subjects in this study were sufferers of chronic pelvic injuries who lived in the Special Region of Yogyakarta and East Java during January-May 2020. The research involves a total of 20 participants, with Figure 1 illustrating that 12 of them were female (60%), while 8 were male (40%) (Fig. 1).

Women are twice as likely to get injured compared to men. This is caused by differences in anatomical structure, where women's pelvis is larger and has a more hyperextended ROM than men's. Women tend to have a gynecodal pelvic type which has an oval-shaped pelvic cavity, shallower and wider than the male pelvis. The curve of the female sacrum also tends to be wider. The individuals involved in the study ranged from 21 to 32 years old, with an average age of 24.25 and a standard deviation of 3.492. The following histogram displays the age statistics of the research subjects (Fig. 2).

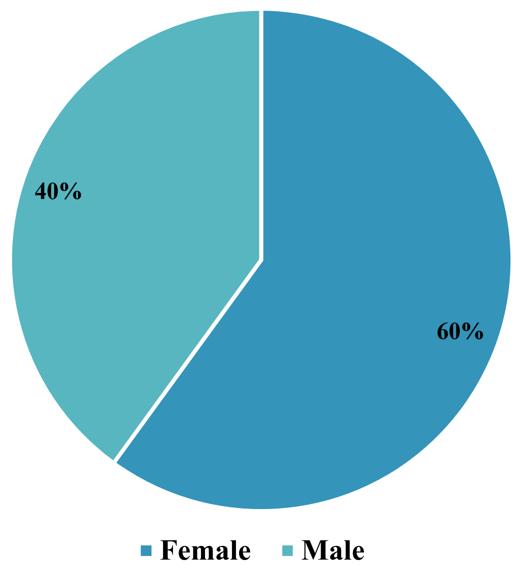

Fig. 1. Gender Pie Chart

Based on Figure 2, the majority of injuries occur between the ages of 23 and 24. This is because the majority of the research sample consisted of daily exercisers who were also athletes. Regularly training athletes run the risk of overusing themselves to the point of injury, which can result in inflammation and ischemia. On average, eight participants (40% of the total sample) were either students or entrepreneurs.

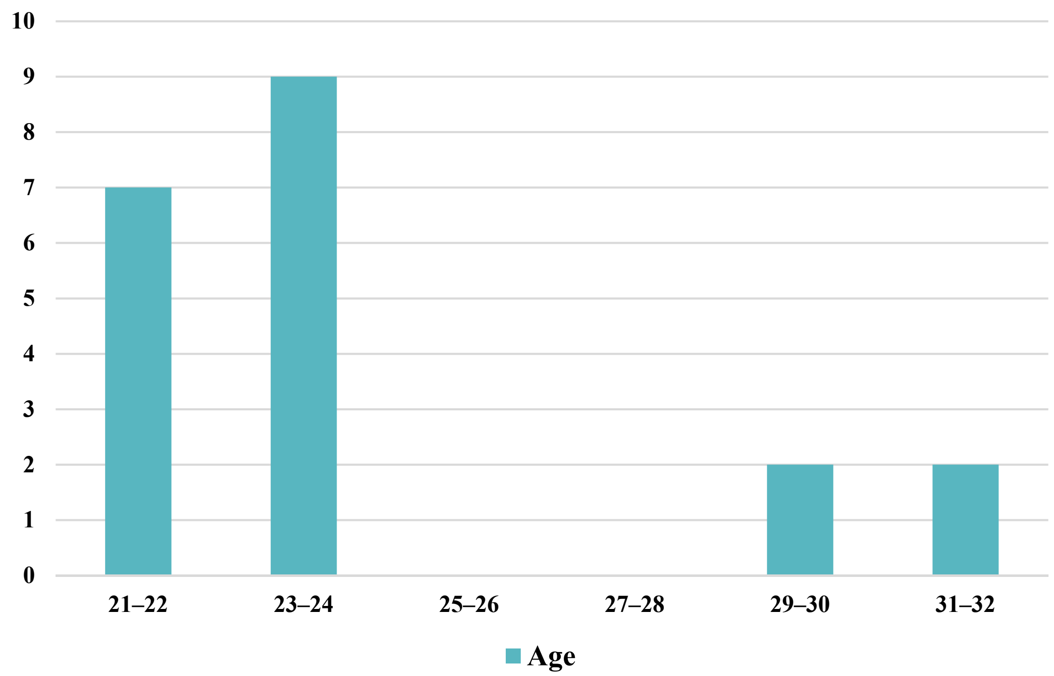

Fig. 2. Subject Age Histogram

Based on Figure 3, the majority of research subjects consisted of students and entrepreneurs, each accounting for 8 participants (40%). This is due to high physical activity in these two groups, which can cause ergonomic problems and musculoskeletal disorders.

The typical length of time for the injury to heal falls within the span of 3 to 13 months. Duration of subject's injury data are presented in the Figure 4.

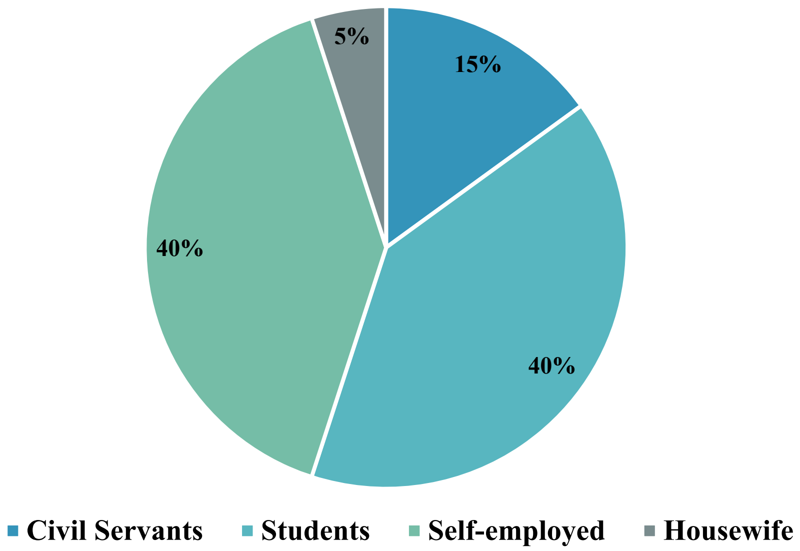

Fig. 3. Subject Job Diagram

It can be seen that most research participants had their injuries for three to thirteen months. The fact that the injury is comparatively not felt acutely means that this time is included in the chronic phase. Three categories can be used to categorize injury length:

1. An acute injury lasts between four and six days after it occurs;

2. Sub-acute stage: this phase follows an injury and can extend for 4-21 days or 10-17 days;

3. Chronic stage: this phase might linger anywhere from three weeks to a year, depending on the tissue and degree of injury.

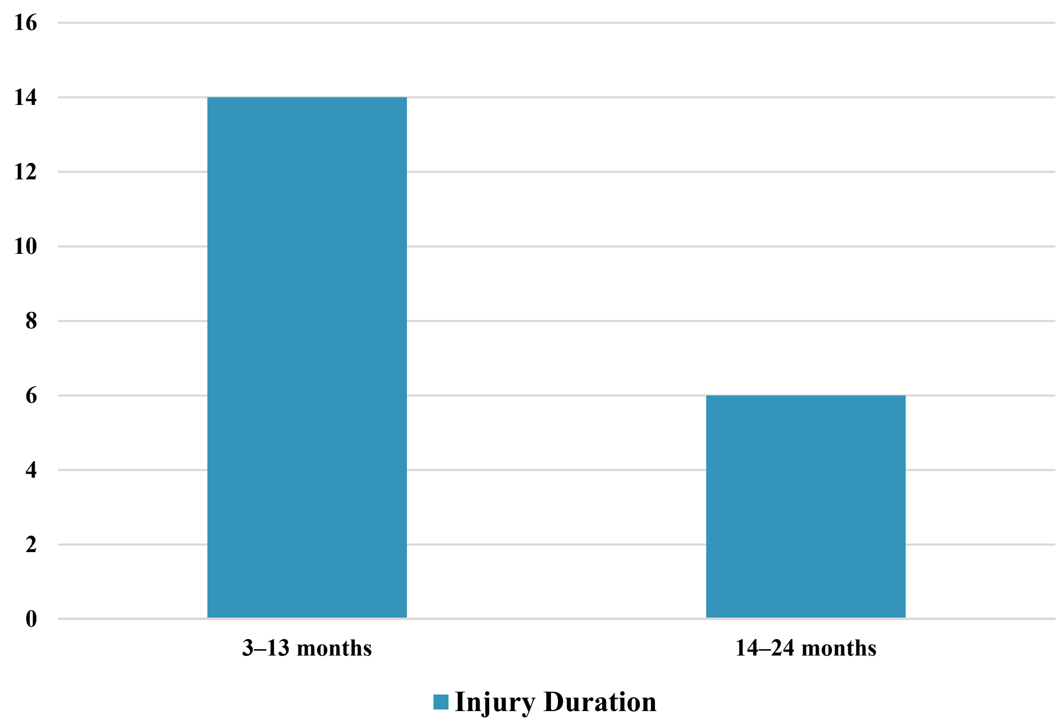

Fig. 4. Subject's Injury Duration Diagram

Descriptive Statistics of Research Variables

Painful

The pain scale is measured using a VAS with a number range of 0-10, where the higher the number on the VAS, the higher the level of pain felt. The mean outcomes and the variability represented by the standard deviation on the pain scale examination of 20 research subjects before and after Tepurak manipulation are presented in the Table 1 and the Figure 5.

Table 1

Results of Descriptive Analysis of Pretest-Posttest Pain Scale Data

Variable	Pretest		Posttest		Decline
	mean	std. dev	mean	std. dev	
Painful	7.3	0.801	0.6	0.68	6.7

Histogram illustrates how the average value of the pretest and posttest pain scales differed during Tepurak manipulation. The decrease in the average pain scale from the pretest to the posttest shows that Tepurak manipulation has the effect of reducing pain in research subjects. The smaller standard deviation at the posttest compared to the pretest may indicate that intersubject pain variability was reduced after treatment, indicating increased uniformity of response to the Tepurak manipulation.

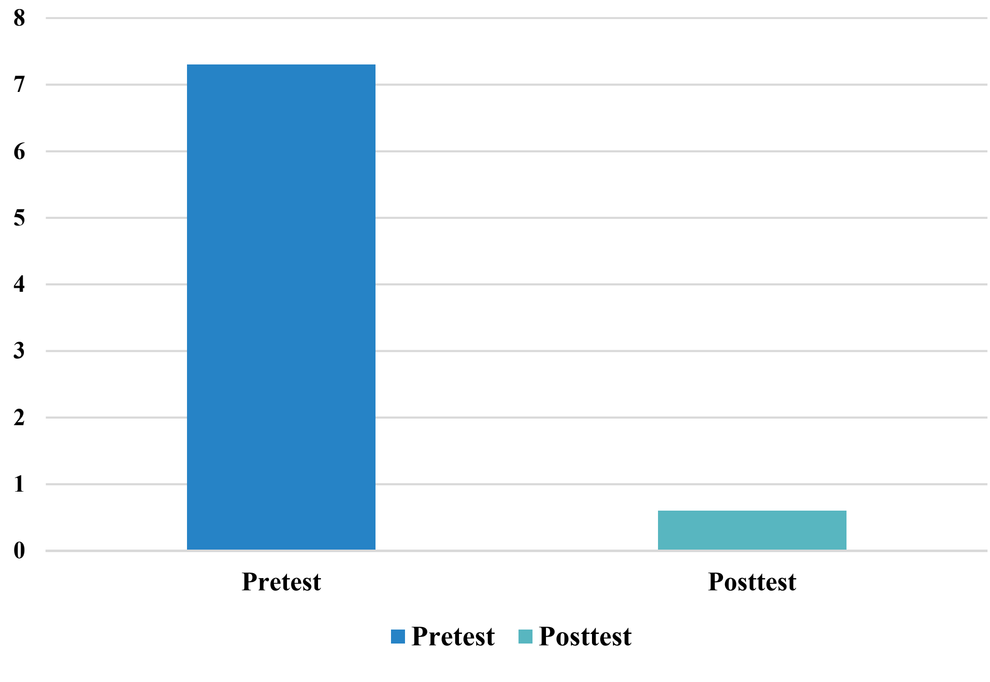

Fig. 5. Histogram of the average pretest-posttest pain scale

ROM

The ROM values for flexion, abduction, extension, internal rotation, external rotation, and adduction from the pretest and posttest were subjected to descriptive statistical analysis, and the findings are shown in the Table 2.

The average ROM values for flexion, abduction, extension, internal rotation, external rotation, and adduction following Tepurak manipulation may be observed based on the data in Table 2. Tepurak manipulation produces physiological effects such as muscular relaxation, which can lead to an increase in range of motion.

Figure 6 shows the difference in average scores between the pretest and posttest ROM on Tepurak manipulation. The table above presents the average value of ROM before (pretest) and after (posttest) Tepurak manipulation on research subjects. From this data, changes in ROM values can be seen for each movement observed. A decrease or increase in ROM values in the posttest compared to the pretest can provide an idea of the effectiveness of Tepurak manipulation in increasing flexibility or reducing stiffness in the movement. The increase in ROM after Tepurak manipulation is the explanation of Ambardini et al. This indicates that Tepurak manipulation is effective in increasing flexibility and reducing stiffness in the observed movements. Thus, the physiological effect of muscle relaxation caused by Tepurak manipulation made a positive contribution to the increase in ROM in the research subjects.

Table 2

Results of Descriptive Analysis of Pretest-Posttest ROM Data

Variable	Pretest		Posttest		Enhancement
	mean	std. dev	mean	std. dev	
Flexion	86.05	12.890	99.95	11.307	13.9
Extension	50,1	18.324	59.9	18.660	9.8
Adduction	43,35	12.093	51.65	13.192	8.3
Abduction	51,4	7.549	59.25	8.565	7.85
External rotation	41,3	3.04	47.6	5.365	6.3
Internal rotation	38.65	3.453	44.55	5.443	5.9

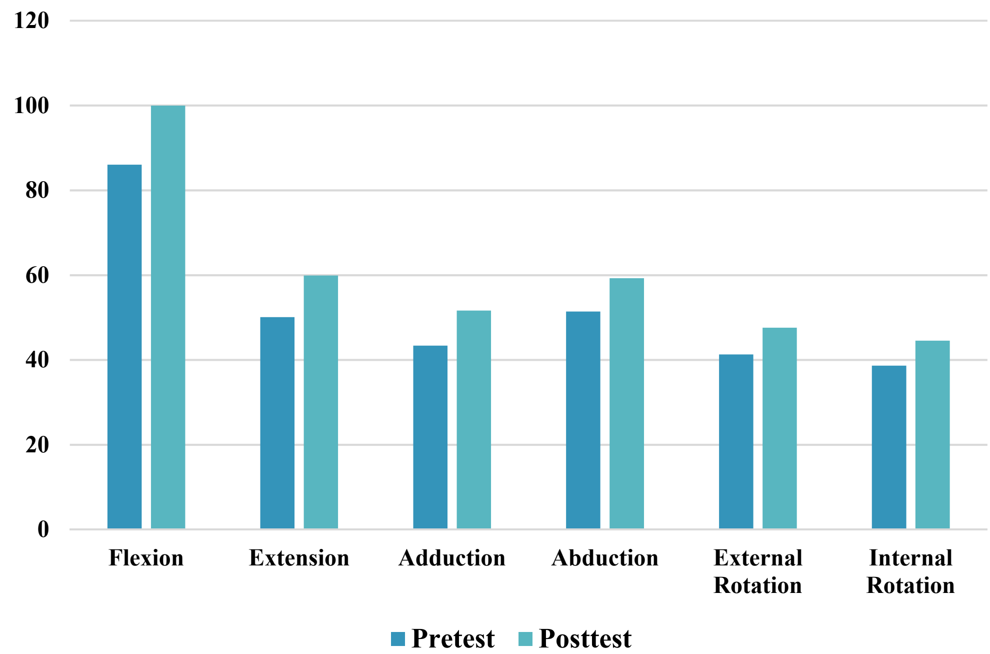

Fig. 6. Histogram of average pretest-posttest ROM

Tepurak manipulation, which is believed to promote muscle relaxation, was evaluated by measuring the range of motion (ROM) at the hip and shoulder joints, focusing on movements such as flexion, extension, abduction, adduction, internal rotation, and external rotation. These movements are commonly associated with the flexibility and mobility of the joints, and the assessment was conducted both before (pretest) and after (posttest) the manipulation. For instance, flexion and extension were measured at both the hip and shoulder joints, with flexion referring to the forward movement of the limb and extension referring to its backward movement. Similarly, abduction and adduction were assessed as the outward and inward movement of the limb, respectively, at these joints. Internal and external rotation were also evaluated at the shoulder and hip, with internal rotation referring to the inward rotation of the limb and external rotation referring to its outward rotation. The data presented in Table 2 show a marked increase in ROM after Tepurak manipulation, indicating the technique's effectiveness in enhancing flexibility and reducing stiffness, particularly through its physiological effect of muscle relaxation. This supports the hypothesis that Tepurak manipulation can improve ROM by facilitating greater joint mobility and muscle flexibility.

Normality Test

Based on the results of data processing using SPSS 25.0 software in Table 3.

Table 3

Normality test results using the Shapiro-Wilk test

Variable	P value (<0.05)	Distribution
Flexion pretest	0.000	Abnormal
Flexion posttest	0.034	Abnormal
Extension pretest	0.000	Abnormal
Extension osttest	0.000	Abnormal
Adduction pretest	0.000	Abnormal
Adduction posttest	0.000	Abnormal
Abduction pretest	0.000	Abnormal
Abduction posttest	0.000	Abnormal
Ex. Rot pretest	0.012	Abnormal
Ex. Rot posttest	0.001	Abnormal
In. Pretest rotation	0.019	Abnormal
In. Posttest rotation	0.000	Abnormal
Painful pretest	0.012	Abnormal
Painful posttest	0.000	Abnormal

The ROM data for flexion, abduction, extension, internal rotation, external rotation, adduction, and pain have an irregular distribution, according to Table 3 test results for the Shapiro-Wilk test. As a result, non-parametric statistical methods, particularly the Wilcoxon signed-rank test, will be utilized for data analysis.

Inferential Statistical Analysis Test

The study's hypothesis is that massage therapy can effectively lower the degree of discomfort associated with long-term pelvic injuries. If the Asymp value is met, this hypothesis will be accepted. Rejected if the Asymp value is less than 0.05 ($p<0.05$). $p>0.05$ and sign >0.05. The following are the findings from the examination of the research data:

Non-Parametric Statistical Analysis

The outcomes of hypothesis testing conducted with the Wilcoxon signed rank test on pain scale data are as follows (Table 4).

Pain Scale

Based on Table 4, prior to the intervention, subjects' ratings on the movement pain scale ranged from 6 to 9%, with an average of 7.3 and a standard deviation of 0.801 for pain. Following the intervention, posttest movement discomfort ranged from 0 to 2%, with an average of 0.6 and a standard deviation of 0.681. There was a -0.12 difference in the standardized Z-value between pretest and posttest movement pain data. Utilizing a significance level of

0.05, the cumulative probability value of -0.12 is 0.000 (Asymp. Sig 2-tailed). Since 0.000<0.05, the null hypothesis (H0) is rejected, and the alternative hypothesis (H1) is accepted. The movement pain scale decreased in every patient, according to the data, and the hypothesis was confirmed by significance testing. Therefore, it may be said that a significant contrast was observed in the subject data scales between the initial assessment and the follow-up, suggesting that a combination of core stability exercises and massage manipulation is effective in reducing pain associated with chronic pelvic injuries.

Table 4

Results of the Wilcoxon Signed-rank test for pretest and posttest pain scale data

Pain Variables	N	Mean	Standard Deviation	Minimum Value	Maximum Value	Z-value	Asymp Sig. (2tailed)
Pretest	20	7.3	0.801	6.00	9.00	-4.008^{b}	0.000
Posttest	20	0.6	0.681	.00	2.00		

ROM

Table 5 statistical analysis, which employed the Wilcoxon signed-rank test, reveals that the range of flexion ROM values among individuals during the pretest varied from 45 to 100%, averaging 86.050 with a standard deviation of 12.890. Meanwhile, the range of individuals' flexion ROM values on the posttest varied from 68 to 128%, with an average of 99.950 and a standard deviation of 11.306. The difference between the posttest and pretest flexion ROM data yielded a normalized Z-value of -3.928. The cumulative probability value of -3.928 is 0.000 (Asymp. Sig 2-tailed) with a significance threshold of 0.05. Given that 0.000<0.05, H0 is rejected, and H1 is accepted.

Table 5

Wilcoxon signed-rank test results of ROM pretest-posttest data

ROM	Pain Variables	N	Mean	Standard Deviation	Min Value	Max Value	Z-value	Asymp Sig. (2tailed)
Flexion	Pretest	20	86.050	12.890	45.00	120.00	-3.928	0.000
	Posttest	20	99.950	11.306	68.00	128.00		
Extension	Pretest	20	50.100	18.324	35.00	120.00	-3.929	0.000
	Posttest	20	59.900	18.660	45.00	135.00		
Abduction	Pretest	20	51.400	7.549	44.00	80.00	-3.936	0.000
	Posttest	20	59.250	8.564	48.00	90.00		
Adduction	Pretest	20	43.350	12.092	35.00	90.00	-3.833	0.000
	Posttest	20	51.650	13.192	45.00	105.00		
External Rotation	Pretest	20	41.300	3.404	35.00	50.00	-3.840	0.000
	Posttest	20	47.600	5.364	40.00	65.00		
Internal Rotation	Pretest	20	41.300	3.404	35.00	50.00	-3.018	0.003
	Posttest	20	4.550	5.443	40.00	65.00		

The ROM extension pretest scores ranged from 35 to 100%, with a 50.100 average and an 18.324 standard deviation. Meanwhile, the post-test abduction range of motion scores varied from 45 to 135%, with an average of 59.900% and a standard deviation of 18.660. The standardized Z-value for the difference in abduction ROM data between the pretest and posttest is -3.929. With a significance threshold of 0.05, the cumulative probability value of -3.929 is 0.000 (Asymp. Sig 2-tailed). As 0.000 is less than 0.05, the null hypothesis (H0) is rejected, and the alternative hypothesis (H1) is accepted.

The initial scores for abduction range of motion (ROM) ranged from 44 to 80%, with an average of 51.400% and a standard deviation of 7.549. Conversely, individuals' scores on the posttest for internal rotation ROM varied from 48 to 90%, with an average of 59.250% and a standard deviation of 8.564. The difference in internal rotation ROM data between the posttest and pretest is indicated by a standardized Z-value of -3.936. The cumulative probability value associated with -3.936 is 0.000 (Asymp. Sig 2-tailed) with a significance threshold of 0.05. Since 0.000<0.05, the null hypothesis (H0) is rejected, and the alternative hypothesis (H1) is accepted.

Similarly, the pretest scores for adduction range from 35 to 90%, averaging at 43.350 with a standard deviation of 12.092. Post-test scores for adduction, on the other hand, vary from 45 to 105%, with an average of 51.650% and a standard deviation of 13.192. The normalized Z-value for the change in adduction ROM data between posttest and pretest is -3.833. Given a significance threshold of 0.05, the cumulative probability value for -3.833 is 0.000 (Asymp. Sig 2-tailed), leading to the rejection of H0 and acceptance of H1 since 0.000<0.05.

Pretest findings for the range of motion in external rotation showed a spread from 35 to 50%, with a standard deviation of 3.404 and an average of 41.300%. Following the post-test, individual results for external rotation ROM ranged from 40% to 65%, averaging at 47.600% with a standard deviation of 5.364. The normalized Z-value representing the difference in external rotation ROM data between the pretest and posttest is -3.840. Given a significance threshold of 0.05, the cumulative probability value of -3.840 is 0.000 (Asymp. Sig 2-tailed). H0 is rejected in favor of H1 since 0.000 < 0.05.

The internal rotation ROM pretest, on the other hand, had a range of 35 to 50%, with an average score of 41.300 and a 3.404 standard deviation. The individuals' posttest internal rotation ROM scores, on average 44.550% with a standard deviation of 5.443, ranged from 40 to 65%. The standardized Z-value indicating the difference in internal rotation range of motion (ROM) between the pretest and posttest is -3.018. Considering a significance threshold of 0.05, the cumulative probability value associated with -3.018 is 0.003 (Asymp. Sig 2-tailed). As 0.003 is less than 0.05, we reject the null hypothesis (H0) and accept the alternative hypothesis (H1).

These findings showed that the subject's range of motion increased, and the hypothesis was validated by substantial testing. Hence, one can infer that there is either a notable distinction in the subject data scales between the pretest and post-test, or that the combination of massage manipulation and Core Stability Exercise is highly proficient in enhancing the ROM for flexion, abduction, extension, internal rotation, external rotation, and adduction, particularly in cases of long-term pelvic traumas.

Effectiveness

Painful

After massage manipulation and followed by core stability exercises, the percentage effectiveness of reducing the pain scale is calculated using the following formula:

$$\textbf{Effectiveness} = \frac{\boldsymbol{posttest - pretest}}{\boldsymbol{pretest}} \times \mathbf{100\%}$$

By doing this calculation, the difference in score between the posttest and pretest is divided by the pretest score, then the result is multiplied by 100%. From this calculation, the percentage of effectiveness in increasing pain was obtained at 92.28%.

ROM

Based on Table 6 percentage effectiveness of increasing ROM after calculating the effectiveness of mass manipulation as followed by Core Stability exercises is carried out by calculating based on the mean value of the pretest and posttest using the formula:

$$\textbf{Effectiveness} = \frac{\boldsymbol{posttest - pretest}}{\boldsymbol{pretest}} \times \mathbf{100\%}$$

Effectiveness was determined by taking the difference between the pretest and posttest scores, dividing that number by the pretest score, and then multiplying the result by 100%. The results showed that increasing range of motion in flexion movements was 17.26% effective, in extension movements it was 21.63%, in adduction movements it was 19.99%, in abduction motion it was 15.38%, in external rotation motion it was 15.28%, and in internal rotation motion it was 7.94%. The study's average percentage number for how successful it was to increase ROM was 16.24%.

This study is significant due to the increasing prevalence of chronic pelvic injuries, particularly among individuals who engage in high levels of physical activity, such as athletes, students, and workers with repetitive or strenuous tasks. Chronic pelvic pain, often associated with musculoskeletal dysfunction, can severely impact mobility, productivity, and overall quality of life. Yet, it is frequently neglected or treated symptomatically through pharmacological approaches, which carry potential side effects. Therefore, exploring non-pharmacological treatment methods, such as the combination of Tepurak massage and core stability exercises, provides a safer and potentially more effective alternative for managing and rehabilitating chronic pelvic conditions. The integration of massage techniques targeting muscle tension and joint alignment with exercises aimed at strengthening the pelvic and core muscles may offer synergistic benefits in pain reduction and functional recovery.

Table 6

Painful and ROM effectiveness

Variable	Pretest	Posttest	Effectiveness
Painful	7.3	0.6	92.28%
Flexion	86.05	99.95	17.26%
Extension	50.1	59.9	21.63%
Abduction	51.4	59.25	15.38%
Adduction	43.3	51.65	19.99%
Internal Rotation	41.3	44.55	7.94%
External Rotation	41.3	47.6	15.28%

The findings of this study are supported by several previous studies. It was found that traditional massage therapy significantly increased joint flexibility and reduced muscle stiffness, aligning with the present study's results where participants experienced an average ROM improvement and pain reduction [16]. Similarly, it was emphasized that core stability training enhances spinal alignment and pelvic control, reducing the incidence of low back and pelvic injuries – an outcome echoed in this study [17]. Furthermore, research has noted that massage can improve blood circulation and reduce inflammation in soft tissues, which explains the significant post-intervention improvements in both pain and ROM observed in this study [18].

The implications of this research are noteworthy for physical therapists, sports trainers, and healthcare providers. The demonstrated effectiveness of combining Tepurak massage with core stability exercises suggests that this approach could be implemented as a standard non-pharmacological treatment protocol for patients suffering from chronic pelvic injuries. It also encourages the integration of traditional therapeutic techniques with modern rehabilitation exercises, potentially improving patient compliance and outcomes. However, the study has several limitations. The sample size was relatively small (n=20) and obtained through incidental sampling, which may limit the generalizability of the findings. The absence of a control group also restricts the ability to attribute the results solely to the intervention. Furthermore, the study relied on subjective pain scales and basic ROM measurements, which may lack the precision of more advanced diagnostic tools.

Core Stability exercises contributed to pain reduction and ROM improvement by enhancing neuromuscular control, pelvic stability, and activation of the deep trunk muscles that support the lumbopelvic region. Improved stabilization may reduce excessive mechanical stress on the hip and pelvic structures, thereby decreasing pain and facilitating more efficient movement patterns during functional activities. These mechanisms may explain the significant improvements observed in pain intensity and joint ROM following the combined intervention.

For future research, it is recommended to conduct randomized controlled trials with larger sample sizes to validate these findings. Incorporating objective assessments such as electromyography or motion analysis systems could also provide more comprehensive data. Additionally, long-term follow-up studies would help determine the sustainability of the treatment's effects and its potential role in preventive care for individuals at high risk of pelvic injury.

CONCLUSION

1. This study demonstrated that the combination of Tepurak massage therapy and Core Stability exercises was effective in reducing pain and impro-

ving hip joint range of motion in individuals with chronic pelvic injuries.

2. The intervention resulted in a 92.28% reduction in pain intensity and an average range of motion improvement of 16.24% across all measured movements.

3. The combined intervention contributed to improved musculoskeletal function by enhancing joint mobility, reducing muscle stiffness, improving pelvic stability, and supporting functional movement during daily activities.

4. The sequential application of massage therapy followed by core stability exercises facilitated muscular relaxation and neuromuscular activation, which may accelerate the recovery process in chronic pelvic injury rehabilitation.

5. Tepurak massage helps reduce muscle stiffness and improve joint mobility, while core stability exercises support pelvic stability and functional movement control during rehabilitation.

6. This non-pharmacological approach provides a safe and effective rehabilitation strategy that may improve functional recovery and quality of life while minimizing dependence on medication and its potential side effects.

7. Further randomized controlled trials with larger sample sizes and long-term follow-up are recommended to validate the effectiveness and sustainability of this intervention.

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