

Effectiveness of Assisted Massage and Exercise Therapy Combination in The Treatment of Chronic Pelvic Injuries

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ABSTRACTS

Purpose	This study aims to examine the effectiveness of assisted massage combined with exercise therapy on pain reduction, range of motion improvement, and motor function enhancement in patients with chronic pelvic injuries.
Materials and Methods	This study employed a pre-experimental method with a one-group pretest-posttest design involving 20 male participants aged 20 – 60 years with chronic pelvic injuries. The intervention was administered 3 times per week for 4 weeks and consisted of assisted massage combined with exercise therapy integrating proprioceptive neuromuscular facilitation (PNF) stretching and strengthening exercises. Data analysis was conducted using paired t-tests and Wilcoxon signed-rank tests.
Result	The results demonstrated that assisted massage combined with exercise therapy was effective in reducing pain, improving range of motion, and enhancing motor function in patients with chronic pelvic injuries. Pain scores significantly decreased from 7.1 ± 0.91 to 2.1 ± 0.78 ($p < 0.000$), while motor function scores improved from 52.6 ± 5.83 to 88.6 ± 4.93 ($p < 0.000$). Improvements were also observed in all hip range of motion variables, including flexion, extension, abduction, adduction, internal rotation, and external rotation ($p < 0.05$).
Conclusion	It can be concluded that assisted massage therapy combined with exercise therapy is effective in reducing pain, increasing range of motion, and improving motor function in patients with chronic pelvic injuries.
Keywords	Assisted massage; Exercise therapy; Pain; Range of motion; Motor function.

INTRODUCTION

The hip joint is one of the most biomechanically complex joints in the human body because it functions simultaneously as a weight-bearing structure, a stabilizer, and a dynamic movement center during standing, walking, running, and rotational activities. Anatomically, the hip is classified as a synovial ball and socket joint formed by the articulation between the femoral head and the acetabulum of the pelvis. Physical activity is a form of exercise that everyone engages in as part of their daily lives. All forms of physical activity, whether performed by athletes or the general public, carry a risk of injury. Each type of injury requires a different recovery approach, which is generally determined based on when the injury occurred and the duration of the condition, such as

acute or chronic injuries. One of the most common joint injuries occurs in the hip joint. Injuries in this area can be triggered by sports activities, daily activities, or accidents (Hernowo & Ambardini, 2018). Hip related musculoskeletal disorders are recognized as a significant contributor to pain, movement limitation, and reduced physical performance worldwide. Previous international studies have reported that chronic hip and pelvic dysfunction are commonly associated with impaired neuromuscular control, decreased joint stability, and long-term functional limitations in both athletes and physically active populations (Reiman & Thorborg, 2015; Casartelli et al., 2018).

Previous studies have generally examined massage therapy and exercise therapy separately in the management of musculoskeletal and pelvic disorders. Research by Hernowo and Ambardini (2018) demonstrated that the combination of friction massage and PNF exercise was effective in improving pelvic injury recovery; however, the intervention did not specifically integrate assisted massage using effleurage techniques with structured strengthening exercises in a comprehensive rehabilitation model. Consequently, there is still a lack of evidence regarding a systematic intervention model capable of simultaneously addressing pain modulation, joint mobility, muscular stability, and motor function recovery in chronic pelvic injuries. Similar findings have also been reported in international rehabilitation studies showing that PNF stretching may improve flexibility, neuromuscular coordination, and functional movement performance more effectively than conventional stretching approaches (Hindle et al., 2012).

The risk of hip joint injury is reported to be 5.6%, which is associated with abnormalities in the hip joint's inclination angle, leading to joint incongruity. The hip joint is one of the most biomechanically complex joints in the human body because it simultaneously functions as a weight-bearing structure, a stabilizer, and a dynamic movement center during standing, walking, running, and rotational activities. Anatomically, the hip is classified as a synovial ball-and-socket joint formed by the articulation between the femoral head and the acetabulum of the pelvis. This multiaxial structure allows movement in multiple planes, including flexion, extension, abduction, adduction, internal rotation, and external rotation (Al-Muqsith, 2017). In Indonesia, data from a hospital in Surabaya indicate that the prevalence of lower back-hip injuries reached 45.5% among 46 study subjects, with contributing factors including high physical workload and poor posture (Lusianawaty, 2013). Another study reported that 249 respondents, or 18.99%, had sustained a hip injury (Graha, 2012). These findings indicate that hip injuries occur quite frequently and can hinder daily activities such as walking, standing, sitting, and exercising. Anatomically, the hip is an acetabular-femoral joint formed by the articulation of the femur and pelvis (Arovah, 2021).

This joint is formed by the femoral head and the acetabulum of the hip bone and is classified as an enarthrosis or synovial ball-and-socket joint. Based on its movement characteristics, the hip joint is multiaxial, allowing for flexion, extension, abduction, adduction, and rotation. This anatomical structure makes the hip joint stable while also capable of supporting body weight during standing, walking, and running (Al-Muqsith, 2017). However, the high mobility and stability demands placed on the hip joint also increase mechanical stress on surrounding muscles, ligaments, tendons, and joint capsules, making the pelvis more susceptible to chronic injury compared with other joints. Chronic pelvic injuries commonly occur due to repetitive loading, prolonged poor posture, overuse during sports activities, muscular imbalance, and impaired neuromuscular control. In chronic conditions, pathological changes are not limited to local tissue inflammation, but also involve joint stiffness, muscle tightness, reduced circulation, decreased proprioception, and movement compensation patterns that impair functional stability (Ahlqvist, 2024). Injuries can generally cause discomfort in the form of pain perception.

Bahrudin (2017) states that pain is a sensory and emotional experience associated with actual or potential tissue damage or described because of such damage. Pelvic pain can be triggered by prolonged sitting or standing, which causes local discomfort and may affect various body systems, including the endocrine, urinary, reproductive, and digestive systems (Bradley, 2017). Symptoms of pelvic injury can also result in limited range of motion and impaired joint function. Range of motion measurements include flexion, extension, abduction, adduction, internal rotation, and external rotation, which can be assessed using a goniometer. Meanwhile, limitations in joint function can be evaluated using the Harris Hip Score. The ball and socket structure of the hip joint presents a unique rehabilitation challenge because recovery requires not only pain reduction, but also restoration of mobility, muscular flexibility, joint stability, and neuromuscular coordination simultaneously. Manual therapy alone may help reduce muscle tension and improve circulation, but it may not sufficiently restore joint stability and movement control. Conversely, exercise therapy alone may improve strength and function, but can be less optimal if pain, muscle guarding, and tissue stiffness remain unresolved. Therefore, a combination therapy approach is considered more clinically relevant to address the multidimensional impairments associated with chronic pelvic injuries.

Various approaches have been used in the management of pelvic injuries, including assisted massage as a manual intervention technique aimed at improving circulation, reducing muscle tension, and promoting relaxation. In this study, assisted massage was specifically administered using the effleurage technique, which involves rhythmic and systematic stroking movements over soft tissue surfaces (Hidayah et al., 2023), as well as exercise therapy as a rehabilitation strategy to achieve optimal recovery through structured physical activity (Nugroho & Ambardini, 2016). The systematic implementation of exercise has been shown to increase physical activity, prevent hypokinesia, improve joint range of motion, strengthen weak muscles, and enhance daily functional abilities (Nagavani, 2012). In the context of chronic pelvic injuries, exercise therapy is recommended to improve or prevent musculoskeletal injuries and restore joint function to near-optimal conditions (Arovah, 2021). However, these approaches are generally still applied separately, and there have been few studies that have successfully integrated effleurage massage with proprioceptive neuromuscular facilitation (PNF) stretching and strengthening exercises into a single systematic and comprehensive intervention model.

Conventional static stretching is commonly used in rehabilitation; however, static stretching primarily focuses on passive muscle elongation and often provides limited stimulation to neuromuscular coordination and functional movement control. In chronic pelvic injuries, these limitations may reduce rehabilitation effectiveness because the condition frequently involves deficits in proprioception, movement patterns, and dynamic joint stability. Therefore, proprioceptive neuromuscular facilitation (PNF) stretching is considered more appropriate because it combines stretching with active neuromuscular activation to improve flexibility, muscle activation, and movement coordination simultaneously (Kaya, 2018). Similar findings have also been reported in international rehabilitation studies showing that PNF stretching may improve flexibility, neuromuscular coordination, and functional movement performance more effectively than conventional stretching approaches (Hindle et al., 2012).

The integration of assisted massage, PNF stretching, and strengthening exercises provides a more comprehensive rehabilitation approach by simultaneously targeting pain modulation, soft tissue flexibility, joint mobility, neuromuscular control, and muscular stability. This situation highlights a conceptual and practical gap in the rehabilitation of chronic pelvic injuries, and serves as the basis for the novelty of this study, which focuses on developing an integrative model based on a combination of manual techniques and exercise therapy to enhance the recovery of motor

function in a more comprehensive and sustainable manner. Previous studies have generally examined massage therapy and exercise therapy separately in the management of musculoskeletal and pelvic disorders. Research by Hernowo & Ambardini (2018) demonstrated that the combination of friction massage and PNF exercise was effective in improving pelvic injury recovery; however, the intervention did not specifically integrate assisted massage using effleurage techniques with structured strengthening exercises in a comprehensive rehabilitation model. Similarly, previous rehabilitation studies have primarily focused on pain reduction and range of motion improvement, while the integration of neuromuscular facilitation, muscle strengthening, and functional movement restoration remains limited. Consequently, there is still a lack of evidence regarding a systematic intervention model capable of simultaneously addressing pain modulation, joint mobility, muscular stability, and motor function recovery in chronic pelvic injuries.

This study is important because chronic pelvic injuries can significantly impair stability, mobility, and motor function, thereby affecting daily activities and physical performance. Although various techniques such as effleurage massage, proprioceptive neuromuscular facilitation (PNF) stretching, and strengthening have been used, their application is generally still fragmented and has not been integrated into a single systematic model, so recovery may not be optimal. The novelty of this study lies in the development of an integrative intervention model that combines these three approaches into a single structured and complementary program, with the aim of developing and testing its effectiveness in reducing pain levels, improving range of motion, and enhancing joint function in chronic pelvic injuries. Based on the above, this study aims to examine the effectiveness of combining assisted massage using the effleurage technique with exercise therapy in the management of chronic pelvic injuries. This study is expected to contribute theoretically by enriching the concept of rehabilitation based on the integration of manual techniques and exercise therapy; practically, by providing a more comprehensive intervention alternative for therapists and sports practitioners; and in terms of policy, by serving as a foundation for the development of more systematic and evidence-based rehabilitation programs.

Despite increasing evidence regarding rehabilitation strategies for hip dysfunction, studies specifically integrating assisted massage using the effleurage technique with PNF stretching and strengthening exercises in chronic pelvic injuries remain limited, particularly within comprehensive rehabilitation models targeting both functional recovery and neuromuscular stabilization simultaneously.

METHODS

Study Participants

This study employed a pre-experimental method with a one-group pretest-posttest design involving 20 male participants with chronic pelvic injuries. The inclusion criteria for this study were: 1) patients with chronic pelvic injuries, 2) willing to participate as respondents experiencing pelvic complaints, 3) male, 4) aged 20–60 years, 5) experiencing reduced motor function and pain in the pelvic region during the chronic phase, 6) experiencing discomfort in the pelvic joints. Meanwhile, the exclusion criteria were: 1) anatomical abnormalities of the pelvic bones, such as fractures, dislocations, and joint damage; 2) no history of tumors, kidney disease, diabetes, heart disease, or osteoporosis; and 3) no open wounds.

Study Organization

The study was conducted at the Health and Sport Center, Universitas Negeri Yogyakarta, with the sample determined using a sample size calculator based on a significance level of 5% and statistical power of 80%. Measurements were taken during the pretest and posttest phases on a sample group, including assessments of pain levels, range of motion, and motor function. Pain levels were measured using a numerical rating scale (NRS) with a validity coefficient of $r = 0.90$ and a reliability coefficient of 0.95, based on the study by Li, Liu & Herr cited in Swarihadianti (2014). Range of motion measurements were performed using a goniometer as a tool to measure joint movement angles. The validity and reliability of this tool were tested in the study by Eimiller et al. (2024), yielding a validity of 0.91 and a reliability of 0.85. Joint function was assessed using the Harris Hip Score questionnaire. A study by Soderman, P & Henrik, M (2001) comparing WOMAC, SF-36, and the Harris Hip Score in patients randomly selected via a computer algorithm at Sahlgrenska University Hospital showed no significant differences among the instruments, with WOMAC having the highest domain values ($r = 0.91$ for pain and $r = 0.93$ for function). Reliability testing of the Harris Hip Score yielded excellent values, namely 0.93 for pain and 0.95 for function, thereby establishing the instrument as valid and reliable for use in research.

The intervention program was conducted for 4 weeks with a frequency of 3 sessions per week, resulting in a total of 12 treatment sessions. Each treatment session lasted approximately 45–60 minutes. The samples that had undergone measurement were then treated with assisted massage therapy using the effleurage technique combined with exercise therapy integrating proprioceptive neuromuscular facilitation (PNF) stretching and strengthening exercises. The assisted massage intervention was administered for approximately 15–20 minutes focusing on the pelvic and surrounding hip musculature using rhythmic effleurage techniques to improve circulation, reduce muscle tension, and stimulate relaxation. This was followed by exercise therapy consisting of PNF stretching for hip flexion, extension, abduction, adduction, and rotational muscles, as well as strengthening exercises targeting hip stabilizer muscles including the gluteal, abdominal, and pelvic supporting musculature.

Statistical Analysis

The data obtained were analyzed using SPSS version 27. Descriptive statistics were used to present participant characteristics, including age, occupation, and body mass index. The Shapiro–Wilk normality test was conducted to determine data distribution. Variables with normal distribution, including range of motion and motor function, were analyzed using paired t-tests to compare pretest and posttest values. Meanwhile, the pain scale variable, which was not normally distributed, was analyzed using the Wilcoxon signed-rank test. A significance level of $p < 0.05$ was applied in all statistical analyses to determine the effectiveness of the intervention.

Although this study demonstrated positive outcomes, the one-group pretest-posttest design without a control group represents a limitation in establishing strong causal relationships. However, this design was selected as an initial exploratory approach to evaluate the feasibility and clinical effectiveness of the integrated intervention before conducting larger randomized controlled trials

RESULT

This study was conducted at the Health and Sport Center of the Faculty of Sports Science and Health, Yogyakarta State University. The study population consisted of male individuals aged 20–60 years who visited the Health and Sport Center of the Faculty of Sports Science and Health, Universitas

Negeri Yogyakarta, and reported chronic pelvic pain. The results of the study are presented in the following tables.

Table 1. Sample Groups by Age

Age Groups (Years)	Number	Percentage
20 – 25 Years old	9	45%
26 – 31 Years old	2	10%
32 – 37 Years old	3	15%
38 – 43 Years old	4	20%
44 – 49 Years old	0	0%
50 – 56 Years old	2	10%
Number	20	100%

Table 1 shows that the age group of 20 – 25 years comprised 9 (45%) samples, the age group of 26 – 31 years comprised 2 (10%) samples, followed by the 32 – 37 age group with 3 (15%) samples, then the 38 – 43 age group with 4 (20%) samples; there were no research samples in the 44 – 49 age group, and the 50 – 56 age group had 2 (10%) samples. The distribution of the groups by age shows that the 20 – 25 age group dominates, comprising 9 (45%) samples.

Table 2. Sample Groups by Occupation

Type of Work	Number	Percentage
Teacher	2	10%
Student	3	15%
Employed	6	30%
Entrepreneur	5	25%
Self Employed	3	15%
Coach	1	5%
Number	20	100%

Table 2 shows that the occupations of the sample in this study vary, including 2 teachers (10%), 3 students (15%), 6 private-sector employees (30%), 5 entrepreneurs (25%), 3 self-employed individuals (15%), and 1 trainer (5%).

Table 3. Sample Groups by Body Mass Index (BMI)

Body Mass Index	Number	Percentage
Underweight	4	20%
Normalweight	9	45%
Overweight	5	25%
Obesity I	1	5%
Obesity II	1	5%
Number	20	100%

Table 3 shows that, based on the body mass index of the study sample, 4 (20%) participants fell into the underweight category, 9 (45%) fell into the normal category, 5 (25%) fell into the overweight category, 1 (5%) fell into the Class I obesity category, and 1 (5%) fell into the Class II obesity category.

Table 4. Results of the Shapiro-Wilk Normality Test

Variable	Total (n=20) Significance	Description
Pain Scale	0,003	Not Normally Distributed
ROM Flexion	0,888	Normally Distributed
ROM Extension	0,381	Normally Distributed
ROM Abduction	0,305	Normally Distributed
ROM Adduction	0,736	Normally Distributed
ROM Internal Rotation	0,560	Normally Distributed

Variable	Total (n=20)	Significance	Description
ROM External Rotation	0,256		Normally Distributed
Functional Movement	0,722		Normally Distributed

Based on Table 4, the results of the normality test indicate that the variables for range of motion (ROM) in flexion, extension, abduction, adduction, internal rotation, and external rotation, as well as functional movement, yielded p-values greater than 0.05, indicating that these variables are normally distributed. However, the pain scale yielded a p-value less than 0.05, indicating that the data are not normally distributed.

Table 5. Results of Hypothesis Testing Using the Paired T-Test

Variable	Sig (2-Tailed)	Description
ROM Flexion	0,000	Significant
ROM Extension	0,000	Significant
ROM Abduction	0,000	Significant
ROM Adduction	0,000	Significant
ROM Internal Rotation	0,000	Significant
ROM External Rotation	0,000	Significant
Functional Movement	0,000	Significant

Based on Table 5, the p-value from the hypothesis test using a paired t-test was 0.000, which is less than 0.05. Therefore, based on these data, it can be concluded that H_0 is rejected and H_1 is accepted; thus, there is evidence of the effectiveness of assisted massage therapy using effleurage combined with exercise therapy that integrates stretching, proprioceptive neuromuscular facilitation (PNF), and strengthening in reducing pain and improving range of motion and motor function in chronic pelvic injuries.

Tabel 6. Hasil Uji Hipotesis menggunakan Uji Wilcoxon

Variable	Asym. Sig (2-Tailed)	Description
Pain Scale	0,000	Significant

Based on Table 6, the significance value of the hypothesis test using the Wilcoxon test yielded a p-value of 0.000, which is less than 0.05. It is concluded that H_0 is rejected and H_1 is accepted, meaning that assisted massage therapy combined with exercise therapy is effective in reducing pain and improving range of motion and motor function in chronic pelvic injuries.

DISCUSSION

This study aimed to examine the effectiveness of assisted massage using the effleurage technique combined with exercise therapy integrating proprioceptive neuromuscular facilitation (PNF) stretching and strengthening exercises in patients with chronic pelvic injuries. The findings of this study demonstrated clinically meaningful improvements in pain reduction, range of motion, and motor function following the intervention. These improvements indicate that the integrated intervention not only reduced symptoms but also enhanced functional movement ability, pelvic stability, and movement confidence during daily activities. The improvement in motor function observed in this study may be associated with several integrative mechanisms occurring simultaneously during the intervention process. Effleurage massage likely contributed to reductions in muscle tension, improved local circulation, and decreased pain perception through stimulation of cutaneous mechanoreceptors. Reduced pain may subsequently decrease protective muscle guarding and kinesiophobia, thereby increasing patient confidence during movement.

Assisted massage using the effleurage technique, combined with exercise therapy, is effective in reducing pain, improving range of motion, and enhancing motor function in patients with chronic pelvic injuries. Assisted massage using the effleurage technique is an application of the gate control

theory, as this manipulation technique involves stimulating the skin's surface by massaging the body's surface (Sarli & Sari, 2018). Effleurage massage offers benefits such as improving blood circulation, applying pressure to reduce muscle tension, warming the muscles, and enhancing physical and mental relaxation (Sari et al., 2019). Additionally, effleurage massage stimulates the sensory receptors in the skin rhythmically, improves muscle blood circulation, relieves muscle fiber tension, and enhances physical relaxation (Putri et al., 2022). Massage therapy utilizing effleurage massage is combined with exercise therapy in the form of systematic physical activities aimed at improving or preventing functional impairments, correcting disabilities, preventing or reducing health injury risk factors, and optimizing health and fitness status (Kisner et al., 2018). The improvement in motor function observed in this study may be associated with several integrative mechanisms occurring simultaneously during the intervention process. Assisted massage using the effleurage technique likely contributed to reductions in muscle tension, improved local circulation, and decreased pain perception through stimulation of cutaneous mechanoreceptors and activation of the gate control mechanism (Sarli & Sari, 2018). Reduced pain may subsequently decrease protective muscle guarding and kinesiophobia, thereby increasing patient confidence during movement. The improvement in motor function observed in this study may be associated with several integrative mechanisms occurring simultaneously during the intervention process. Effleurage massage likely contributed to reductions in muscle tension, improved local circulation, and decreased pain perception through stimulation of cutaneous mechanoreceptors. Reduced pain may subsequently decrease protective muscle guarding, thereby increasing patient confidence during movement.

In addition, the integration of proprioceptive neuromuscular facilitation (PNF) stretching may have enhanced neuromuscular facilitation and flexibility more effectively than conventional static stretching. PNF stretching involves active neuromuscular activation that may improve proprioceptive feedback and coordination between agonist and antagonist muscles surrounding the hip joint. These adaptations are particularly important in chronic pelvic injuries because prolonged dysfunction often leads to altered movement patterns and impaired joint stability. The strengthening component of the intervention may also have contributed significantly to functional recovery by improving muscular support around the pelvis and hip joint. Increased muscular strength in the hip stabilizers potentially improved dynamic joint stability during weight-bearing and movement activities, thereby reducing excessive mechanical stress on injured tissues. The combination of reduced pain, improved flexibility, enhanced neuromuscular control, and increased joint stability likely explains the substantial improvement in motor function identified in this study.

The strengthening component of the intervention may also have contributed significantly to functional recovery by improving muscular support around the pelvis and hip joint. Increased muscular strength in the hip stabilizers potentially improved dynamic joint stability during weight-bearing and movement activities, thereby reducing excessive mechanical stress on injured tissues. Abnormal hip mechanics and insufficient muscular stabilization may increase compensatory movement patterns and excessive joint loading, potentially contributing to persistent musculoskeletal dysfunction and movement-related pain (Powers, 2010). Strengthening exercises may improve muscular support and dynamic stabilization around the pelvis and hip joint through neuromuscular adaptation and increased muscle activation efficiency (Judd et al., 2016).

Exercise therapy in the form of systematic physical activity aims to improve functional ability, restore movement quality, and optimize musculoskeletal performance (Kisner et al., 2018). The benefits of exercise therapy include improving range of motion, strengthening muscles, enhancing neuromuscular coordination, and increasing the ability to perform daily activities

(Wijaya et al., 2024). Therefore, the integration of assisted massage, PNF stretching, and strengthening exercises may provide a more comprehensive rehabilitation approach by simultaneously targeting pain modulation, flexibility, joint mobility, muscular stability, and motor function recovery. The findings of this study are consistent with previous research demonstrating that the integration of manual therapy and exercise therapy may provide superior rehabilitation outcomes compared with isolated interventions. Research conducted by Hernowo & Ambardini (2018) reported that massage combined with PNF exercise therapy significantly improved recovery in chronic pelvic injuries. Similarly, Utami & Djawas (2023) found that exercise therapy contributed to pain reduction, improved range of motion, and enhanced functional ability. The present findings are also consistent with international rehabilitation studies demonstrating that the combination of manual therapy and exercise-based interventions may improve pain, joint mobility, and functional performance in patients with hip-related disorders. A systematic review published in the *Journal of Orthopaedic & Sports Physical Therapy* reported that multimodal rehabilitation integrating manual therapy and therapeutic exercise contributes to improved hip function and movement quality in patients with chronic hip dysfunction (Casartelli et al., 2018). Similarly, studies in *Physical Therapy in Sport* emphasized that exercise programs incorporating neuromuscular facilitation and strengthening exercises may improve dynamic stability and reduce movement-related pain in athletes with chronic musculoskeletal injuries (Reiman & Thorborg, 2015). However, the present study specifically emphasizes the integration of assisted massage using the effleurage technique with PNF stretching and strengthening exercises in a more comprehensive rehabilitation model targeting pain reduction, mobility restoration, neuromuscular facilitation, and functional stability simultaneously.

However, several limitations should be acknowledged in this study. First, the absence of a control group limits the ability to compare the effectiveness of the intervention with other rehabilitation approaches. Second, the relatively small sample size and inclusion of only male participants may reduce the generalizability of the findings to broader populations. Third, the study focused only on short-term outcomes, therefore the long-term sustainability of the intervention effects remains unclear. Future studies are recommended to employ randomized controlled trial designs with larger and more diverse participant populations, including female participants and athletes from different sports backgrounds. Additional biomechanical and psychological assessments, such as pelvic stability analysis and evaluation, are also recommended to better understand the mechanisms underlying functional recovery.

Clinically, the findings suggest that therapists and rehabilitation practitioners may consider integrating assisted massage, PNF stretching, and strengthening exercises into a structured rehabilitation program for chronic pelvic injuries. This integrated intervention may be particularly beneficial for patients experiencing persistent pain, limited mobility, muscle tightness, impaired neuromuscular control, and decreased functional stability.

CONCLUSION

Chronic pelvic injuries may lead to pain, limited joint mobility, and decreased motor function that interfere with daily activities and physical performance. This study demonstrated that the integration of assisted massage using the effleurage technique combined with exercise therapy consisting of proprioceptive neuromuscular facilitation (PNF) stretching and strengthening exercises was effective in reducing pain, improving range of motion, and enhancing motor function in patients with chronic pelvic injuries. The findings indicate that an integrated rehabilitation

approach combining manual therapy and exercise therapy may provide more comprehensive recovery outcomes by simultaneously addressing pain modulation, flexibility, joint mobility, neuromuscular control, and muscular stability. Future studies are recommended to employ randomized controlled trial designs with larger and more diverse populations to strengthen the evidence regarding the effectiveness of this intervention model. This integrated rehabilitation model may be considered as an alternative therapeutic protocol in sports rehabilitation and musculoskeletal clinical practice.

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CONFLICT OF INTEREST

The authors declare no conflict of interest regarding this research.

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