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The Effect of Physiotherapy Manual Traction Techniques on the Western Ontario and McMaster University OA Index (WOMAC) in Knee Osteoarthritis Patients

Rizka Mutiara[1,2*], Dedi Ardinata[1,3], Ririe Fachrina Malisie[1,4], Sunna Vyatra Hutagalung[1,5], Fitriani Lumongga[1,6]

[1]*Master Program in Biomedical Sciences, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia*
[2] *Institut Kesehatan Medistra Lubuk Pakam, Indonesia*
[3]*Department of Physiology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia*
[4]*Department of Child Health, Faculty of Medicine Universitas Sumatera Utara*
[5]*Department of Parasitology, Faculty of Medicine, Universitas Sumatera Utara*
[6]*Department of Anatomy, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia*
Jalan, Dr. T. Mansur No.9, Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20222.
Email: rizkamutiara1997@gmail.com

Abstract

Age-related physical decline increases the risk of various diseases, including degenerative conditions, such as osteoarthritis (OA). OA is a chronic, progressive, multifactorial joint disorder characterized by cartilage deterioration, leading to chronic pain, stiffness, and impaired joint mobility. Knee OA significantly reduces patients' quality of life owing to functional limitations and pain. Manual traction therapy has shown potential in alleviating secondary inflammation in OA by lowering serum interleukin-1β levels and reducing pro-inflammatory cytokines and subchondral bone changes. This study aimed to assess the effect of manual traction physiotherapy on the Western Ontario and McMaster Universities Arthritis Index (WOMAC) in patients with knee OA. The study utilized a one-group pretest-post-test design, involving 36 participants selected through consecutive sampling from patients at the Sembiring Deli Tua Hospital Physiotherapy Clinic and Universitas Sumatera Utara's medical laboratory. Participants (aged 48–69 years, 80.6% female) underwent manual traction therapy twice a week for four weeks. The WOMAC questionnaire was used to evaluate changes in pain, stiffness, and physical function pre- and post-intervention. Statistical analysis using the Wilcoxon test revealed significant improvements across all WOMAC components, with pain scores decreasing from 14.81 to 7.58, stiffness scores from 4.0 to 2.5, and physical function scores from 30 to 23 ($p < 0.001$). These results demonstrate that manual traction therapy effectively reduces pain and stiffness while enhancing joint function in patients with knee OA.

Keywords**:** *Knee Osteoarthritis (OA); Manual Traction; WOMAC*

1. INTRODUCTION

Health problems in the elderly usually occur frequently because of increasing age and decreasing function and endurance of the body, leading to various diseases. One of them is a type of degenerative disease such as osteoarthritis (OA). OA is a chronic, long-term joint disease that is progressive, multifactorial, and common. This disease begins with damage to the joint cartilage, causing chronic pain, stiffness, and functional disability [1]. OA is a health problem that occurs in many parts of the country and is associated with the incidence of disability [2]. The severity of knee OA correlates with the patient's quality of life, such as emotional status and pain, which can reduce the quality of life [3].

The prevalence of osteoarthritis is projected to significantly increase by 2050, with notable increases in cases of knee (74.9%), hand (48.6%), hip (78.6%), and other types of osteoarthritis (95.1%), highlighting the growing burden of this condition on global health systems due to population growth and aging. [4]. The incidence of knee osteoarthritis was 15.0%. Banda Aceh exhibits the highest frequency of knee osteoarthritis at 70.79%, while Bandung demonstrates the lowest at 4.18%; the likelihood of developing knee osteoarthritis escalates with age.

* Corresponding author: Rizka Mutiara, Universitas Sumatera Utara, Medan, Indonesia
E-mail : rizkamutiara1997@gmail.com
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The adjusted odds ratios (aOR) were 5.01 (95% CI 2.47-10.15, $p < 0.001$) for individuals aged 40-49 years and 72.19 (95% CI 36.32-143.51, $p < 0.001$) for those aged 70 years or older, in comparison to individuals under 40 years [5]. The knee is the joint most commonly affected by OA, accounting for a significant portion of the global OA burden. It is estimated that knee OA contributes to nearly 80% of the total OA burden, with a high prevalence among older adults, particularly women [6].

Therapy for knee OA includes pharmacological treatment, non-pharmacological interventions, and surgery. Medications such as analgesics, corticosteroids, opioids, glucosamine sulfate, and nonsteroidal anti-inflammatory drugs (NSAIDs) usually have limits and side effects. For example, NSAIDs and opioids can cause problems in the heart and digestive systems [7], [8], [9], [10]. Non-pharmacological treatments, such as physiotherapy measures, should be recommended to improve OA symptoms, especially knee OA. Physiotherapy actions such as mobilization techniques are believed to be able to treat the symptoms of knee OA through modalities and interventions such as exercise, massage, taping, and mobilization (traction), so that they can improve joint mobility, reduce pain, and improve physical function. Manual traction in OA affects various physiologies including decreased pressure in the joint, increased nutrient supply, pain inhibition, and improved flexibility and joint function. This therapeutic approach has been shown to relieve pain and improve quality of life in OA patients. [11], [12], [13], [14], [15].

Knee joint traction can combat secondary inflammation in OA, by reducing serum levels of interleukin-1β, a pro-inflammatory cytokine, which is involved in cartilage degeneration and pathological changes in subchondral bone [16]. Some complaints experienced by patients with OA include pain, stiffness, and functional limitations in activities.

The WOMAC index (Western Ontario and McMaster University) can be used to measure the severity of knee OA. The WOMAC is an assessment instrument in the form of a questionnaire used to evaluate the condition of patients with knee OA that focuses on assessing pain, stiffness, and limitations of patient activity. The WOMAC is the most frequently used and recommended measure, with good validity and reliability [17].

The provision of this Manual Traction technique is expected to relieve the pain, stiffness, and limitations felt by patients with OA. The WOMAC instrument will also be the correct parameter for analyzing the development of knee OA felt by patients. This is what underlies patients to conduct research on the effect of Physiotherapy Manual Traction Techniques on the Western Ontario and McMaster University OA Index (WOMAC) in knee OA patients.

2. METHODS

2.1 Design of Research

The study is an experimental type using a one-group pretest-posttest research design. This study was conducted at the Sembiring Deli Tua Hospital Physiotherapy Clinic and Universitas Sumatera Utara's medical laboratory, from August to November 2024.

2.2 Population and Sample

The population of this study was all patients with Knee OA Sembiring Deli Tua Hospital Physiotherapy Clinic, Deli Serdang. The sample was determined using the consecutive sampling method, which must refer to the inclusion criteria, namely, the sample must be men and women over 40 years old who suffer from grade 3 knee OA, have never received physiotherapy treatment, and do not experience musculoskeletal or cognitive disorders. The sample size was determined using G * Power software, which obtained a sample of 36 participants.

2.3 Instrument and Procedure

The instruments used in this research included the Standard Operating Procedure (SOP) for Manual Traction Implementation and WOMAC Questionnaire. The procedure for implementing Manual Traction is as follows:
The patient was positioned face down, the knee joint was at 45°, and a belt was attached.
Perform fixation using a lumbrical grip or hold the foot in a position slightly above the ankle.
Suggesting the patient to relax and pull the patient's leg straight. Manual traction was performed 3 times with a duration of 8-10 seconds 2 times a week for 4 weeks.

This research was approved by Komite Etik Penelitian Kesehatan Universitas Sumatera Utara (Number: 621/KEPK/USU/2024) so that the safety, security, and privacy of all samples can be guaranteed.

2.4 Data Analysis

Univariate analysis began by measuring the normality of WOMAC data using the Shapiro-Wilk test. Then, we conducted a characteristic test on the subjects (Demographics and WOMAC Score). Pre- and post-test data were analyzed to examine the differences and relationships in bivariate analysis using the Wilcoxon test.

3. RESULT

3.1 Subject Characteristics

Table 1. Subject Characteristics

Characteristics	Result
Demographic Characteristics	
Age (years old)	58 (48 - 69)*
Sex, n (%)	
Male	7 (19.4)**
Female	29 (80.6)**
WOMAC Score	
Before Intervention	49 (31.0 – 73.0)*
After Intervention	34.5 (22 - 48)*
WOMAC components	
Before Intervention	
Pain	14.806 ± 2.364***
Stiffness	4 (2 – 6)*
Physical Function	30 (21 – 48)*
After Intervention	
Pain	7.583 ± 2.005***
Stiffness	2.5 (2 - 4)*
Physical Function	23 (13-35)*

*Median (minimum-maximum), **Total (%), ***Average (standard deviation)

Table 1 shows that the median age was 58 years (range 48-69 years). The majority of the subjects were women (n = 29, 80.6%). Table 3 demonstrates statistically significant improvements in all WOMAC components. Pain levels significantly decreased from 14.806 ± 2.364 to 7.583 ± 2.005, stiffness reduced from 4 (2-6) to 2.5 (2-4), and physical function improved from 30 (21-48) to 23 (13-35). These changes were determined using the Wilcoxon Test, with each WOMAC component showing a p-value less than 0.001, indicating a highly significant reduction in pain, stiffness, and improvement in physical function.

3.2 Bivariate Analysis

Analysis was conducted on the WOMAC components consisting of Pain, Stiffness, and Physical Function before and after the intervention in the form of Manual Traction. The mean and median values before and after the intervention will be compared against the significance value, which must be less than 0.001 (Table 2).

Table 2. Comparison of WOMAC components

WOMAC Components	Before	After	Value*
Pain	14.806 ± 2.364**	7.583 ± 2.005**	<0.001
Stiffness	4 (2-6)***	2.5 (2-4)***	<0.001
Physical Function	30 (21-48)***	23 (13-35)***	<0.001

*Wilcoxon Test, **Average (± SD), ***median (min-max)

Table 2 shows the comparison of WOMAC component scores, namely Pain, Stiffness, and Physical Function, between the pre- and post-conditions. All components showed a p-value <0.001, which was calculated using the Wilcoxon test, proving a statistically significant difference between pre- and post-scores on each component.

4. DISCUSSION

The average age of the participants in this study was 58 years, ranging from 48 to 69 years, indicating a mid-to-late adult population typically affected by knee osteoarthritis. This age range aligns with previous studies suggesting that knee OA prevalence increases with age owing to cumulative joint wear and decreased cartilage repair capacity. Age is a significant risk factor for knee OA. The prevalence increases substantially with age, with studies showing rates of 3.1% in the 45-54 age group, rising to 15.0% in people aged 85 years and older [18]. The incidence of knee OA also rises with age, with a substantial increase observed after the age 50 years [19].

In terms of sex distribution, the majority of the study population was women. Therefore, the predominance of female participants in this study aligns with the epidemiological patterns in OA studies [20], [21]. This disproportionate ratio reflects the well-documented higher incidence of OA in women, particularly postmenopausal women, owing to hormonal changes and differences in joint biomechanics. Estrogen influences cartilage health and bone density. Its receptors are present in joint tissues, indicating its direct involvement in joint maintenance. The decline in estrogen levels during menopause leads to increased cartilage degradation and subchondral bone loss, contributing to OA progression [22], [23].

This study revealed notable improvements in pain, stiffness, and physical function in subjects with knee osteoarthritis following manual traction therapy. Each component of the WOMAC score demonstrated significant symptom reduction, indicating the effectiveness of this physiotherapy intervention.

Prior to the intervention, the subjects indicated substantial pain, affecting their daily activities and general health. Following manual traction therapy, pain levels significantly decreased. This result, in line with a systematic review and meta-analysis, indicates that manual therapy, which may include manual traction, has statistically significant effects on reducing pain in patients with knee osteoarthritis [24]. This improvement suggests that manual traction can decrease the compressive forces acting on the knee joint by creating a separation between the joint surfaces. This separation can alleviate pressure on the cartilage and subchondral bone, which are often sources of pain in osteoarthritis [25], [26], and also realign the joint structure and reduce mechanical stress on the knee, thereby decreasing the intensity of pain [27].

Stiffness, often described as difficulty in moving the joint after prolonged inactivity, was also significantly reduced. Before treatment, patients experienced moderate to severe stiffness, limiting their ability to move comfortably. Post-intervention, reduced stiffness suggests improved joint flexibility and mobility. Manual therapy may help modulate the inflammatory response by affecting the production of cytokines and other inflammatory mediators, thereby reducing joint inflammation and stiffness [28], [29].

The subjects reported noticeable challenges in performing physical tasks before the intervention, including difficulties with walking, climbing stairs, and other functional activities. Following the intervention, improvements in physical function were evident. The underlying mechanism of the effectiveness of manual therapy involves a combination of biomechanical and neurophysiological factors that work synergistically to reduce pain and improve joint function. Manual therapy techniques can improve hamstring muscle flexibility, which plays a key role in reducing knee joint tension and improving overall joint function [30].

5. CONCLUSIONS

This study confirms that manual traction therapy leads to significant improvements in pain reduction, decreased stiffness, and enhanced physical function in patients with knee osteoarthritis, as reflected in the pre- and post-intervention WOMAC scores. While these findings are encouraging, the small sample size, lack of a control group, and short intervention period limit the generalizability and robustness of the conclusions. Future research should incorporate longer follow-up periods, randomized controlled trials, and a larger, more gender-balanced participant pool to comprehensively validate these outcomes.

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