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A comparative study of veerbhadrasan and trikonasan in managing chronic knee pain clinical evidence and patients outcome

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Abstract
Background: Chronic knee pain is a debilitating condition affecting millions worldwide. While conventional treatments provide symptomatic relief, complementary therapies like yoga are gaining popularity. This study compares the efficacy of two yoga asanas, Veerbhadrasan and Trikonasan, in managing chronic knee pain.
Methods: A randomized controlled trial was conducted with 120 participants having chronic knee pain. They were allocated to Veerbhadrasan (n = 40) Trikonasan (n = 40) and control (n = 40) groups. The intervention groups practiced respective asanas for 12 weeks. Pain, stiffness, physical function (WOMAC scale), quality of life (WHOQOL-BREF), and pain pressure threshold (PPT) were assessed at baseline, 6, and 12 weeks.
Results: *Significant improvements in WOMAC pain ($p < 0.001$) stiffness ($p < 0.01$) physical function ($p < 0.001$) WHOQOL-BREF ($p < 0.01$) and PPT ($p < 0.001$) were observed in both Veerbhadrasan and Trikonasan groups compared to control at 12 weeks. Veerbhadrasan showed superior improvements in pain ($p = 0.032$) and physical function ($p = 0.047$) than Trikonasan. No adverse events were reported.*
Conclusion: Veerbhadrasan and Trikonasan are safe and effective in managing chronic knee pain. with Veerbhadrasan demonstrating better clinical outcomes. Integrating these yoga asanas into conventional care can enhance patient outcomes.
Keywords: *chronic knee pain; yoga; Veerbhadrasan; Trikonasan; pain management; complementary therapy*

I. Introduction

Chronic knee pain, often associated with conditions like osteoarthritis, is a major public health concern affecting over 250 million people globally [1]. It leads to physical disability, reduced quality of life, and substantial healthcare costs [2,3]. Conventional treatments, including analgesics and surgical interventions, often provide inadequate long-term relief and have side effects [4,5]. This has led to an increased interest in complementary and alternative therapies for managing chronic knee pain [6].

Yoga, an ancient mind-body practice, is gaining popularity as a complementary therapy for various musculoskeletal conditions [7]. It combines physical postures (asanas), breathing techniques (pranayama), and meditation to promote physical and mental well-being [8]. Several studies have reported the beneficial effects of yoga in reducing pain, improving function, and enhancing quality of life in individuals with chronic knee pain [9-11].

Among the various yoga asanas, Veerbhadrasan (warrior pose) and Trikonasan (triangle pose) are commonly practiced for their potential benefits in lower limb conditions [12,13]. Veerbhadrasan is a standing pose that strengthens the legs, improves balance, and stretches the hips, groins, and chest [14]. Trikonasan is another standing pose that stretches the legs, opens the hips, and stimulates the abdominal organs [15]. However, there is limited evidence directly comparing the efficacy of these asanas in managing chronic knee pain.

Therefore, this study aimed to compare the effects of Veerbhadrasan and Trikonasan on pain, stiffness, physical function, quality of life, and pain pressure threshold in individuals with chronic knee pain. We hypothesized that both asanas would significantly improve the outcome measures 54 compared to the control group, with Veerbhadrasan demonstrating superior clinical benefits.

II. Materials and Methods

2.1. Study Design and Participants

This randomized controlled trial was conducted at the Department of Yoga and Naturopathy.
National Institute of Naturopathy, Pune, India, from January 2021 to December 2021. The study protocol was approved by the Institutional Ethics Committee (IEC/NIN/2020/14) and registered with the Clinical Trials Registry of India (CTRI/2020/12/029876).
Individuals aged 40-70 years with chronic knee pain for at least 3 months, radiographic evidence of knee osteoarthritis (Kellgren- Lawrence grade II or III), and pain intensity of 24 on a 0-10 numerical rating scale (NRS) were included. Those with secondary knee osteoarthritis, inflammatory arthritis, severe knee deformities. recent knee injuries or surgeries, and contraindications to yoga practice were excluded.
Sample size was calculated using G Power software (version 3.1.9.2) for repeated measures ANOVA with a power of 0.8, a error of 0.05, effect size of 0.25, and correlation among repeated measures of 0.5, resulting in a total of 120 participants.

2.2. Randomization and Blinding

Participants were randomly allocated to Veerbhadrasan, Trikornasan, or control groups in a 1:1:1 ratio using computer-generated random numbers. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes. The outcome assessors were blinded to group allocation, while participants and yoga instructors could not be blinded due to the nature of the intervention.

2.3. Interventions

2.3.1. Veerbhadrasan Group

Participants in the Veerbhadrasan group practiced the warrior pose . for 30 minutes per day, 5 days a week, for 12 weeks. Each session included 10 minutes of warm-up. 15 minutes of Veerbhadrasan practice (3 sets of 5 repetitions, holding each pose for 30 seconds), and 5 minutes of cool-down. . The pose was performed under the guidance of a certified yoga instructor.

2.3.2. Trikonasan Group

Participants in the Trikonasan group practiced the triangle pose for 30 minutes per day, 5 days a week, for 12 weeks. Each session included 10 minutes of warm-up. 15 minutes of Trikonasan practice (3 sets of 5 repetitions, holding each pose for 30 seconds), and 5 minutes of cool-down. The pose was performed under the guidance of a certified yoga instructor.

2.3.3. Control Group

Participants in the control group received educational leaflets on knee osteoarthritis and were advised to continue their usual care, including medications and exercises prescribed by their physicians.

2.4. Outcome Measures

The primary outcome measure was knee pain assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale [16]. Secondary outcomes included WOMAC stiffness and physical function subscales, quality of life assessed using the World Health Organization Quality of Life-BREF (WHOQOL-BREF) [17], and pain pressure threshold (PPT) measured using a digital algometer [18]. All outcomes were assessed at baseline, 6 weeks, and 12 weeks.

2.5. Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, NY, USA). Normality of data was checked using the Shapiro-Wilk test. Baseline characteristics were compared using one-way ANOVA for continuous variables and chi-square test for categorical variables. The effects of interventions on outcome measures were analyzed using mixed-model repeated measures ANOVA with time as the within-subject factor and group as the between-subject factor. Post-hoc pairwise comparisons were performed using Bonferroni correction. Intention-to-treat analysis was used, with the last observation carried forward for missing data. A p-value <0.05 was considered statistically significant.

III. Results

3.1. Participant Characteristics

A total of 120 participants (mean age 57.4 plus/minus 8.6 years, 70% female) were included and randomly allocated to Veerbhadrasan (n = 40) Trikonasan (n = 40) and control (n = 40) groups. The baseline characteristics were comparable between the groups (Table 1).

Table 1. Baseline characteristics of participants

Characteristic	Veerbhadrasan (n=40)	Trikonasan (n=40)	Contral (n=40)	p-value
Age (years)	56.8 ± 8.2	58.1 ± 9.1	57.3 ± 8.4	0.812
Female.n (%)	28 (70%)	27 (67.5%)	29 (72.5%)	0.886
BMI (kg/m^2)	27.4 ± 3.6	26.9 ± 3.8	27.8 ± 3.5	0.523
Symptom duration (years)	4.2 ± 2.1	4.5 ± 2.3	4.1 ± 1.9	0.675
KL grade II, n (%)	23 (57.5%)	25(62.5%)	24(60%)	0.902
KL grade III, n (%)	17 (42.5%)	15 (37.5%)	16 (40%)	0.902
WOMAC pain (0-20)	12.4 ± 2.6	11.9 ± 2.8	12.2 ± 2.5	0.711
WOMAC stiffness (0-8)	4.7 ± 1.4	4.5 ± 1.2	4.8 ± 1.3	0.593
WOMAC Function (0-68)	42.1 ± 8.3	40.8 ± 7.9	41.6 ± 8.1	0.768
WHOQOL-BREF (0-100)	48.2 ± 6.4	47.5 ± 7.1	49.1 ± 6.8	0.606
PPT (kg/cm^2)	2.6 ± 0.8	2.7 ± 0.9	2.5 ± 0.7	0.544

Data presented as mean ± SD or n (%). BMI: body mass index; KL: Kellgren-Lawrence; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; WHOQOL-BREF: World Health Organization Quality of Life-BREF: PPT: pain pressure threshold.

3.2. Compliance and Adverse Events

The mean compliance to yoga practice was 91.3% in the Veerbhadrasan group and 92.5% in the Trikonasan group. No serious adverse events were reported in any of the groups. Two participants in the Veerbhadrasan group and one in the Trikonasan group reported mild knee pain during practice, which resolved with rest and did not require medical intervention.

3.3. Primary Outcome: WOMAC Pain

Significant group-by-time interaction effects were observed for WOMAC pain scores (F(4,234) 28.52, p<0.001). Both Veerbhadrasan and Trikonasan groups showed significant reductions in pain scores at 6 weeks (p<0.001) and 12 weeks (p<0.001) compared to the control group. The Veerbhadrasan group demonstrated a significantly greater reduction in pain scores than the Trikonasan group at 12 weeks (p=0.032) (Table 2).

Table 2. Changes in WOMAC pain scores

Group	Baseline	6 weeks	12 weeks	p-value (group x time)
Veerbhadrasan	12.4 ± 2.6	8.2 ± 2.1*	5.6 ± 1.8**	<0.001
Trikonasan	11.9 ± 2.8	8.8 ± 2.3*	6.7 ± 2.1*	
Control	12.2 ± 2.5	11.6 ± 2.4	11.3 ± 2.6	

Data presented as mean ± SD. * p < 0.001 vs. control; *p < 0.001 vs. baseline: *p = 0.032 vs.Trikonasan.

3.4. Secondary Outcomes

3.4.1. WOMAC Stiffness and Physical Function

Significant group-by-time interaction effects were observed for WOMAC stiffness (F(4.234) = 15.68 . p<0.001) and physical function (F(4.234) = 32.14 p < 0.001) scores. Both Veerbhadrasan and Trikonasan groups showed significant improvements in stiffness and physical function at 6 weeks (p < 0.01) and 12 weeks (p < 0.001) compared to the control group. The Veerbhadrasan group demonstrated a significantly greater improvement in physical function than the Trikonasan group at 12 weeks (p = 0.047) (Table 3).

Table 3. Changes in WOMAC stiffness and physical function scores

Group	Stiffness			Function		
	Baseline	6weeks	12weeks	Baseline	6weeks	12weeks
Veerbhadrasan	4.7 ±1.4	3.1 ± 1.1*	2.2 ± 0.9*	42.1±8.3	30.6 ± 6.9*	22.4 ± 5.7*
Trokonasan	4.5± 1.2	3.4 ± 1.2*	2.6 ± 1.1*	40.8 ± 7.9	32.1 ± 7.2*	25.3 ± 6.4*
Control	4.8 ±1.3	4.6±1.4	4.4 ±1.5	41.6±8.1	40.2 ± 7.8	39.1 ± 8.2
p-value (group x time)	<0.001			<0.001		

Data presented as mean ± SD. * p < 0.01 vs. control; tp < 0.001 vs. baseline; 4p = 0.047 vs. Trikonasan.

3.4.2. Quality of Life

Significant group-by-time interaction effects were observed for WHOQOL-BREF scores (F(4.234) = 11.26 p < 0.001). Both Veerbhadrasan and Trikonasan groups showed significant improvements in quality of life at 6 weeks (p < 0.05) and 12 weeks (p < 0.01) compared to the control group. There was no significant difference between the Veerbhadrasan and Trikonasan groups at any time point (Table 4).

Table 4. Changes in WHOQOL-BREF scores

Group	Baseline	6 weeks	12 weeks	p-value (group x time)
Veerbhadrasan	48.2 ± 6.4	56.7 ± 7.1*	64.5 ± 7.8*	<0.001
Trikonasan	47.5 ± 7.1	54.9 ± 6.8*	62.1 ± 7.4*	
Control	49.1 ± 6.8	50.3 ± 7.2	51.6 ± 7.5	

Data presented as mean plus/minus S * D * $p < 0.05$ vs. control; t_{p} < 0.01 vs. baseline.

3.4.3. Pain Pressure Threshold

Significant group-by-time interaction effects were observed for PPT ($F(4.234) = 19.83$ $p<0.001$).Both Veerbhadrasan and Trikonasan groups showed significant increases in PPT at 6 weeks ($p < 0.01$) and 12 weeks ($p < 0!$) compared to the control group. There was no significant difference between the Veerbhadrasan and Trikonasan groups at any time point (Table 5).

Table 5. Changes in pain pressure threshold

Group	Baseline	6 weeks	12 weeks	p-value (group x time)
Veerbhadrasan	2.6 ± 0.8	3.5 ± 0.9*	4.3 ± 1.1*	<0.001
Trikonasan	2.7 ± 0.9	3.3 ± 0.8*	4.1 ± 1.0*	
Control	2.5 ± 0.7	2.6 ± 0.8	2.7 ± 0.9	

Data presented as mean ± SD. ^ * $p = 0.01$ vs. control; tp < 0.001 vs. baseline.

IV. Discussion

This study compared the effects of two yoga asanas. Veerbhadrasan and Trikonasan, on clinical 2 outcomes in individuals with chronic knee pain. Both asanas significantly reduced pain and stiffness, improved physical function and quality of life, and increased pain pressure threshold compared to the control group. Notably. Veerbhadrasan demonstrated superior improvements in pain and physical function compared to Trikonasan at 12 weeks.

The beneficial effects of yoga on chronic knee pain have been attributed to various mechanisms. The physical postures improve flexibility, strength, and joint stability, reducing pain and stiffness [19]. The slow, controlled movements and deep breathing practiced in yoga promote relaxation and reduce stress, which may modulate pain perception [20]. Additionally, yoga has been shown to decrease inflammation and oxidative stress, which are implicated in the pathogenesis of knee osteoarthritis [21].

The superiority of Veerbhadrasan over Trikonasan in improving pain and physical function could be attributed to the unique biomechanical effects of the warrior pose. Veerbhadrasan involves a deeper knee bend and greater hip flexion compared to Trikonasan, which may lead to better strengthening of the quadriceps and hip muscles [22]. Strong quadriceps are essential for knee stability and function in individuals with knee osteoarthritis [23]. Furthermore, the warrior pose challenges balance and proprioception, which are often impaired in chronic knee pain [24].

The safety and high compliance observed in this study suggest that Veerbhadrasan and Trikonasan are feasible and well-tolerated by individuals with chronic knee pain. The integration of these yoga asanas into conventional care may provide additional benefits and improve patient outcomes. Healthcare professionals can recommend these asanas as a complementary therapy for managing chronic knee pain, with proper guidance from trained yoga instructors.

This study has several strengths, including a randomized controlled design, blinded outcome assessment, and a large sample size. However, the lack of long-term follow-up limits the understanding of the sustained effects of the interventions. Future studies should investigate the long-term efficacy and cost-effectiveness of yoga asanas in managing chronic knee pain.

V. Conclusion

The present randomized controlled trial provides compelling evidence for the efficacy of Veerbhadrasan and Trikonasan yoga asanas in managing chronic knee pain. Both poses . demonstrated significant improvements in pain, stiffness, physical function, quality of life, and pain pressure threshold compared to the control group at 6 and 12 weeks. Notably, Veerbhadrasan exhibited superior outcomes in reducing pain and enhancing physical function compared to Trikonasan at the end of the 12-week intervention period.

The findings of this study have important implications for the management of chronic knee pain, a debilitating condition that affects millions of people worldwide. Current conventional treatments. such as analgesics and surgical interventions, often provide inadequate relief and are associated with adverse effects. The integration of yoga asanas into the treatment paradigm for chronic knee pain offers a safe, effective, and holistic approach to managing this condition.

The superior effects of Veerbhadrasan over Trikonasan may be attributed to its unique biomechanical and physiological effects. The deeper knee flexion and greater hip flexion involved in the warrior pose may lead to better strengthening of the quadriceps and hip muscles, which are crucial for maintaining knee stability and function. Additionally, the challenging balance and proprioceptive demands of Veerbhadrasan may help improve overall leg alignment and neuromuscular control, further contributing to its therapeutic effects.

The high compliance and absence of serious adverse events observed in this study underscore the feasibility and safety of incorporating Veerbhadrasan and Trikonasan into the management of chronic knee pain. Yoga is a low-cost, non-pharmacological intervention that can be easily adapted to various settings and can be practiced by individuals of different ages and fitness levels. The integration of these yoga asanas into conventional care may not only improve patient outcomes but also reduce healthcare costs associated with chronic knee pain.

However, it is important to acknowledge the limitations of this study. The lack of long-term follow-up data limits our understanding of the sustained effects of Veerbhadrasan and Trikonasan on chronic knee pain. Future studies should investigate the long-term efficacy and cost- effectiveness of these yoga asanas to provide a more comprehensive understanding of their therapeutic potential.

Furthermore, the mechanisms underlying the beneficial effects of Veerbhadrasan and Trikonasan on chronic knee pain require further elucidation. While this study postulates potential biomechanical and physiological mechanisms, more research is needed to confirm these hypotheses and explore additional pathways through which these yoga asanas exert their therapeutic effects.

In conclusion, this study provides strong evidence for the efficacy and safety of Veerbhadrasan and Trikonasan yoga asanas in managing chronic knee pain. The superior effects of Veerbhadrasan on pain and physical function highlight its potential as a particularly beneficial yoga pose for this condition. Healthcare professionals should consider recommending these yoga asanas as a complementary therapy for individuals with chronic knee pain, with proper guidance from trained yoga instructors.

The integration of yoga into the management of chronic knee pain represents a paradigm shift towards a more holistic, patient-centered approach to care. By addressing not only the physical aspects of the condition but also the psychological and emotional dimensions, yoga offers a comprehensive therapeutic solution that can enhance patient outcomes and improve overall quality of life.

As the prevalence of chronic knee pain continues to rise, driven by factors such as an aging population and increasing rates of obesity, the need for safe, effective, and accessible interventions becomes increasingly pressing. The findings of this study offer hope for the millions of individuals affected by this condition, providing them with a evidence-based, non-pharmacological option for managing their symptoms and improving their functional abilities.

In the face of the growing global burden of chronic knee pain, the integration of yoga asanas into the treatment paradigm represents a promising step towards a more sustainable, patient-centered approach to care. By embracing the therapeutic potential of yoga and other complementary therapies, healthcare systems can more effectively address the complex challenges posed by chronic knee pain and improve the lives of those affected by this condition.

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