



Comparison between the effectiveness of ultrasound therapy and cupping therapy in knee osteoarthritis

Dr. Pooja Katiyar (PT), Ph.D. scholar

Teerthanker Mahaveer University, Moradabad, Uttar Pradesh 244001, India

Assistant Professor (Faculty of Paramedical sciences, Bareilly)

Dr. Naveen Kumar Singh

TMMC&RC, professor & HOD General Surgery,

Teerthanker Mahaveer University, Moradabad, Uttar Pradesh 244001, India

INTRODUCTION

Knee osteoarthritis (OA) is characterized by pain, articular cartilage deterioration, and joint space narrowing and reduced muscle strength. Loss of leg muscular strength is associated with increased pain and disability, as well as a more rapid progression of knee OA. Aberrant biomechanics and abnormal joint forces have also been identified as potential culprits underlying OA onset and progression. Some evidence indicates that abnormal motion at the knee often precedes degenerative changes with decreased tibiofemoral rotation as a mechanism contributing to the development of cartilage degradation. Increased ligament stiffness, decreased muscle strength, and alterations in muscle activation patterns are associated with aging and can adversely affect joint kinetics.

APTA's Guide to Physical Therapist Practice has defined mobilization/manipulation as "a manual therapy technique comprised of a continuum of skilled passive movements that are applied at varying speeds and amplitudes, including a small amplitude/ high velocity therapeutic movement".

The intensity of mobilization is commonly categorized based on a 5-grade classification system defined by Maitland. According to Maitland's classification, Grade I and Grade II joint mobilizations are performed primarily to decrease joint pain and Grade III and Grade IV joint mobilizations are performed to increase joint ROM. Joint mobilization which involves low-velocity passive movements within or at the limit of joint range of motion reduces pain by modulating the nervous tissues and increases joint motion. Restricted joint mobility, especially in terms of knee flexion, appears to be an important determinant of disability in patients with osteoarthritis. Maitland

mobilization has been found to be effective in reducing pain and improving ROM in knee OA subjects. Proprioception is the perception issued from the central processing of information coming from Proprioceptive receptors and motor cortical areas. Deformation or stimulation of the tissues in which the mechanoreceptors lie produces gated release of sodium, which elicits an action potential. One of the common symptoms and signs of knee OA is impaired proprioception.

Knee proprioception derives from the integration of afferent signals from Proprioceptive receptors in different structures of the knee and is also influenced by signals from outside the knee (e.g., from the vestibular organs, visual system, and cutaneous and Proprioceptive receptors from other body parts). Muscle spindles are thought to be the most important Proprioceptive receptors of the knee. Knee proprioception serves to protect against injurious movement and it is critical to the maintenance of joint stability. It is also important for normal joint coordination during movement. This exercise is based on the notion that when a patient performs balancekeeping exercises on unstable surfaces, proprioception responses occur first among those generated by the somatic senses. These responses allow compensatory adjustments in the lengths of various muscles, their tension levels, and the position of the joints to facilitate joint movements. Proprioceptive training improves knee functions in OA patients, and quadriceps muscle strengthening is known to mitigate the symptoms of knee OA and improve knee function.

Ultrasound (US) treatment has been used as a non-invasive modality for the management of OA for more than 60 years because of its reputed ability to relieve pain, reduce edema, increase the range of motion, and accelerate tissue repair via thermal and non-thermal mechanisms (mechanical effects). US can be administered in either a continuous or a pulsed mode. Pulsed US produces non-thermal effects and is beneficial for cartilage health, whereas continuous US aims to generate thermal effects that could enhance fibrous tissue extensibility, increase tissue metabolism, promote capillary permeability, and elevate the pain threshold. A recent systematic review and meta-analysis suggested that pulsed US is the preferred treatment mode both in terms of more effective pain relief and improved function without significant adverse effects in clinical trials. In addition, US can be administered in either an unfocused or a focused mode. The basic differences between FLIPUS and traditional US are that the main biological effect of FLIPUS is a mechanical effect and the targeted tissue is cartilage, while the biological effect of traditional US is a thermal effect and the targeted tissues are per articular soft tissue lesions. The results of a number of studies have suggested that unfocused therapeutic US may be useful for reducing the pain and disability associated with knee OA. However, few studies of focused low-intensity pulsed US (FLIPUS) have been published that describe knee OA rehabilitation.

Cupping is a long-used therapy applied worldwide to treat chronic pain. Among the different application methods, dry cupping is the most commonly used in clinical practice, primarily because no scarification is involved. The technique consists of placing a plastic, glass or silicone cup on the skin, normally in painful areas or at acupuncture points, using a suction pump to generate negative pressure in the region, creating a vacuum in subcutaneous tissues. Cupping application time in KOA varies between 5 and 10 min, and may extend up to 20 min, associated with the force of two suctions. Bruising may appear after applications, but usually disappears in a few days, requiring a time period between sessions for tissue recovery. Despite being a complementary resource in the treatment of individuals with KOA, the mechanisms of action and clinical effects of cupping therapy are poorly understood. In addition, there are no literature protocols of well-designed standardized interventions in this population.

There are currently two systematic reviews on cupping therapy in KOA that reported significant heterogeneity between studies, with a high risk of bias. In the vast majority, the assessor and participants were not blinded, exhibited inadequate randomization, did not involve a follow-up, limited interventions to 1 month and did not use a sham dry cupping group for comparison purposes. Thus, well-designed trials are needed before any conclusions can be drawn about the efficacy of cupping therapy in KOA.

As such, the aim of this study will be to assess the effects of dry cupping on pain, function and quality of life in individuals with KOA. Based on unpublished data from our recent protocol performed in people with chronic pain, the scientific hypothesis of this study will be that both the dry and sham cupping interventions will improve pain, function and quality of life in this population.

HYPOTHESIS OF THE STUDY

Null Hypothesis

In comparison with ultrasound therapy and cupping therapy in knee osteoarthritis Cupping therapy will more be effective.

Alternate Hypothesis

In comparison with ultrasound therapy and cupping therapy in knee osteoarthritis Ultrasound therapy will be more effective.

PROBLEM OF THE STATEMENT

Comparison between the effectiveness of ultrasound therapy and cupping therapy in knee osteoarthritis.

OPERATIONAL DEFINITIONS USED

Comparison

It refers to the act of comparing.

Between

It refers to the distinguishing one from the other.

Effectiveness

It refers to the capability of producing a desired result or the ability to produce desired output.

Ultrasound therapy

Ultrasound therapy is a non-invasive treatment in which sound waves are used to penetrate soft tissue, increasing blood flow. Ultrasound therapy uses sound vibrations above 20,000 Hz to treat soft tissue injuries and chronic pain. It's a non-invasive procedure that's often used by physical and occupational therapists.

Cupping therapy

Cupping therapy is an ancient healing method that may ease back pain, neck pain, headaches and other issues. It uses suction to pull on your skin and increase blood flow to the affected area. Cupping causes bruising and can lead to skin infection. There's mixed evidence on the benefits of cupping, but the treatment risks are generally low.

Knee Osteoarthritis

Knee osteoarthritis also known as degenerative disease, is typically the result of wear and tear and progressive loss of articular cartilage.

AIM AND OBJECTIVES

AIM

The aim of the study is to evaluate the efficacy of ultrasound therapy and cupping therapy in knee osteoarthritis.

OBJECTIVES OF THE STUDY

1. To find out effect of mulligan's MWM along with conventional treatment.
2. To compare effect of MWM and conventional treatment on pain in knee osteoarthritis.
3. To check the effectiveness of ultrasound therapy.

REVIEW OF LITERATURE

Sara Abolahrari-Shirazi. et.al., (2023) investigated on Cupping Therapy in Combination with Routine Physical Therapy Effective in the Management of Knee Osteoarthritis? A Randomized Controlled Trial. He concluded that at follow-up, both groups had significantly lower pain intensity and functional disability, and higher knee passive ROM compared to their respective pre-intervention values ($P < 0.05$). Differences in total WOMAC scores between pre and post-intervention were significantly greater in the control group than in the intervention group ($P < 0.05$). Based on the results, both interventions can be effective in relieving symptoms in patients with knee OA.

Changjie Zhang et.al., (2021) conducted a study on Effect of ultrasound therapy for knee osteoarthritis: a meta-analysis of randomized, double-blind, placebo-controlled clinical trials. Study concluded that demonstrated that both continuous and pulsed Ultrasound therapy could efficiently reduce pain and improve physical function in people diagnosed with knee osteoarthritis. The pulsed US seemed more effective in these aspect to improve patients' life quality.

Gidey Gomera Weleslassie et.al., (2021) this study demonstrate that MWM was effective to improve pain, range of motion, and functional activities in subjects with knee osteoarthritis.

Patrcia Pereira Alfredo et.al., (2020) this study conclude prolonged application of continuous ultrasound combined with exercise are effective in providing pain, mobility, functionally and activity in subjects with knee osteoarthritis.

Yu Wu, Shibo Zhu, Zenghui Lv et.al., (2019) Therapeutic ultrasound is safe treatment to relieve pain and improve physical function in patients with knee osteoarthritis.

Regina Wing Shan Sit et.al., (2018) Patellar mobilization therapy has the potential to reduce pain and improve function and quality of life patients with knee osteoarthritis.

Anjali Vyankatesh Kulkarni, Manasi Madhav Kamat et.al., (2017) the Study concluded that Mulligan's Mobilization with Movement(MWM) technique is effective in reducing pain in patient with knee osteoarthritis.

Vaishnavi KS et.al., (2017) studied on A comparative study of Maitland's mobilization along with ultrasound versus proprioceptive exercises along with ultrasound in stage ii and iii osteoarthritis of knee joint. They concluded that following the intervention, at the end of 2nd week result showed clinically and statistically improvement in the VAS and WOMAC scores in Group A compared to Group B. Therefore, it signifies that the subject can be improve after combined treatment of Maitland's mobilization with ultrasound.

Ahmad A et.al., (2016) conducted a comparative study in 50 osteoarthritis knee patients. Patients were grouped into control who received only conventional physical therapy interventions and experimental group who received only joint mobilization. Authors concluded that Manual joint mobilization improves the effectiveness of the treatment program in treating symptoms of knee OA and improves function in elderly people with knee OA.

Park SJ et.al., (2016) investigated the effects of joint mobilization and kinesio taping on pain, range of motion and knee function in 30 patients with knee osteoarthritis. Authors found that joint mobilization and kinesio taping effectively improved pain, range of motion and knee function in patients with knee osteoarthritis, but that application of joint mobilization with kinesio taping was most effective.

Courtney CA et.al., (2016) examined the effect of joint mobilization in 40 patients with mild to moderate osteoarthritis. They concluded that Joint mobilization may act via enhancement of descending pain mechanisms, in patients with painful knee OA.

Gaurav C Mhaske et.al., (2016) Effect of wobble board exercise with mirror feedback on balance and gait training in geriatric population: An experimental study aimed to study the effect of wobble board exercises with mirror feedback on balance and gait in the geriatric population and concluded that it enhanced balance and gait in geriatric population.

MATERIALS AND METHODS

STUDY DESIGN

COMPARATIVE STUDY

POPULATION OF THE STUDY

45-75 age of female patients

SAMPLE SIZE

30 patients of Bareilly who have knee pain due to overweight.

PARTICIPANTS

A total of 30 eligible participants were recruited for participation in the study. After getting an informed consent all of them were initially screened for inclusion criteria. All 30 (15 in each group) were randomly assigned into either of 2 treatment groups namely GROUP A: Treated with ultrasound therapy. GROUP B: Treated with Maitland's mobilization.

SAMPLE COLLECTION

Random collection method.

POPULATION AREA

The subject taken from Bareilly and Pilibhit, UP, India.

SOURCE OF SUBJECT

The subject will be taken from Bareilly and Pilibhit. All the participants are over weighted women.

INCLUSIVE CRITERIA

- **Age group:** 45 to 75 years old
- **Gender:** Females
- **Area of study:** Bareilly and Pilibhit
- Over weighted female

Exclusive criteria

- Female less than 45 and greater than 75 years of age
- Fracture
- Drug abuse
- Tuberculosis
- Male

PROTOCOL

The subjects were introduced to the study, followed by signing of the consent form. The Subjects were measured for their pain assessment (VAS) and then asked to the patient to rate their current level of pain by placing the mark on the line, that score 1 to 10 represents pain mild to moderate and checked the improvement in posture by posture and postural ability scale and knee disability index.

SUBJECT SELECTED FOR STUDY (n = 30)

PRE TEST (VAS AND WOMAC)

INTERVENTION (4 WEEK)

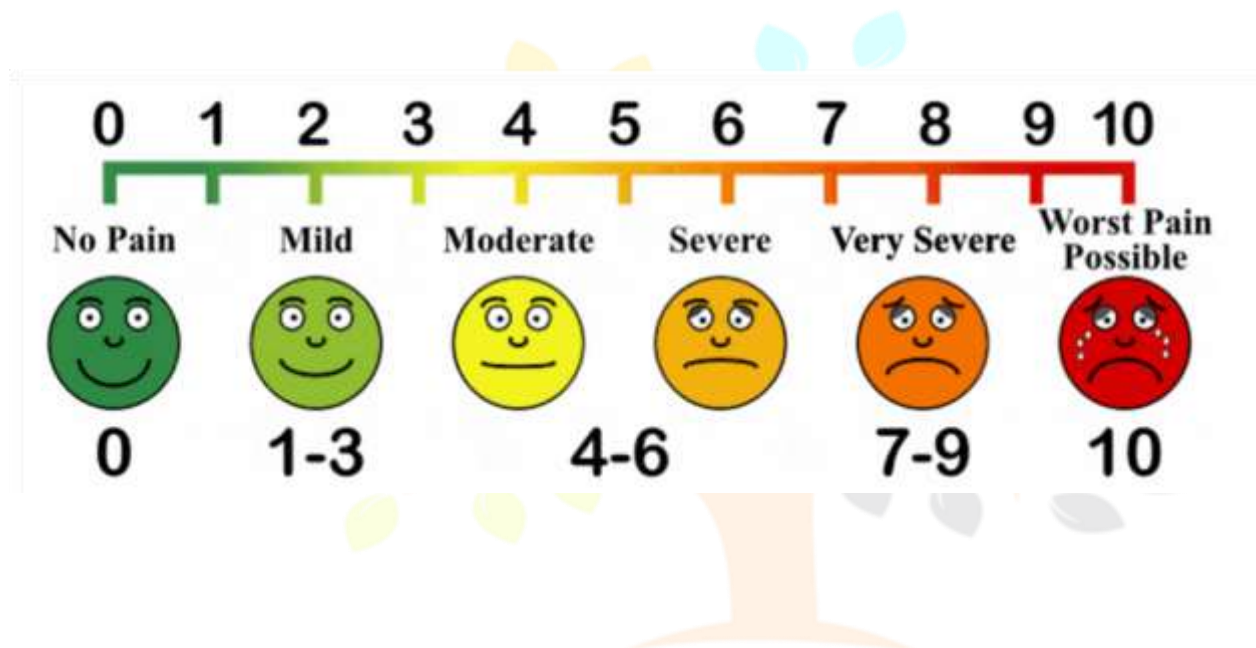
POST TEST (VAS AND WOMAC)

STATISTICAL ANALYSIS

VARIABLES

Visual Analogue Scale

VAS is a 10 cm (100-mm) long line which ranged from “0 = no pain” to “10 = most pain” It is a valid, reliable, sensitive, and most strong statistically strong scale with a very high test-retest reliability for acute pain. All patients were asked to rate the pain intensity in the involved elbow on this scale.



PROCEDURE

Participation was recruited from Bareilly and Badaun or on the basis of inclusive and exclusive criteria. Potential participations were verbally given the criteria for inclusion in study and checked whether met the criteria those who met the criteria were included in the study, after the selection of the subject the purpose and method of the study were explained and a consent sheet was provided to all participants outlining the purpose of study alongside the benefits and risk of study of participating. Who voluntarily participated in study was included in the study participants were provided both the study information sheet (consent) and questionnaire sheet. The pre-assessment grades and score given to patient using the outcome measure. The treatment was given for two month to the participants. All the grades and score were measured the treatment time the comparison of pre and post grade and score were performed.

WOMAC Scale

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is a widely used, proprietary set of standardized questionnaires used by health professionals to evaluate the condition of patients with osteoarthritis of the knee and hip, including pain, stiffness, and physical functioning of the joints. The WOMAC has also been used to assess back pain, rheumatoid arthritis, juvenile rheumatoid arthritis, systemic lupus erythematosus, and fibromyalgia. It can be self-administered and was developed at Western Ontario and McMaster Universities in 1982. Higher scores indicate worse pain, stiffness, and functional limitations. The WOMAC measures five items

for pain (score range 0–20), two for stiffness (score range 0–8), and 17 for functional limitation (score range 0–68). Physical functioning questions cover everyday activities such as stair use, standing up from a sitting or lying position, standing, bending, walking, getting in and out of a car, shopping, putting on or taking off socks, lying in bed, getting in or out of a bath, sitting, and heavy and light household duties. The questions on the WOMAC are a subset of the questions of the Hip disability and osteoarthritis outcome score (HOOS). Thus, a HOOS survey may also be used to determine a WOMAC score.

PROCEDURE

The test questions are scored on a scale of 0-4, which correspond to: None (0), Mild (1), Moderate (2), Severe (3), and Extreme (4). The scores for each subscale are summed up, with a possible score range of 0-20 for Pain, 0-8 for Stiffness, and 0-68 for Physical Function.

WOMAC (pain subscale) mean $\pm$ SD (range)	KOA patients (n = 80)		
Pain (on/at):			
Using stairs	2.8	± 0.8	(1–4)
Going downstairs	2.5	± 1	(0–4)
Weight bearing	2.5	± 1	(0–4)
Going upstairs	2.4	± 1	(1–4)
Standing	2.1	± 1	(0–4)
Using cars	2.1	± 0.9	(0–4)
Bending	2.0	± 0.98	(0–4)
Bathing	1.9	± 0.97	(0–4)
Using toilet	1.9	± 0.97	(0–4)
Bending put socks on	1.8	± 1.2	(0–4)
Bending put socks off	1.6	± 1.2	(0–4)
Shopping	1.6	± 1	(0–4)
Rising from bed	1.4	± 0.8	(0–3)

Research Through Innovation

TECHNIQUE AND PROCEDURE

During first week the consent form was given to the patient. Patient will receive the treatment by ultrasound therapy. Before start of treatment take proper assessment and check intensity of pain.

In this treatment method the patient should be comfortable and the skin over the treatment area should be exposed. A hypoallergenic gel is applied to the skin or the head of the ultrasound probe to help the sound waves penetrate the skin. The technician moves the ultrasound transducer over the skin in a stroking motion for about 5–10 minutes. The intensity and frequency of the ultrasound can be adjusted depending on the injury and the desired

effect. After the treatment, the skin is wiped clean of the gel. The same technique is applied on the subject for 15 days.

MEASURING TOOLS

There were two measuring tools used in the present study:

1. Visual analog scale (VAS)
2. Western Ontario and McMaster Universities Osteoarthritis (WOMAC)

STATISTICAL ANALYSIS

The Data was statistical analyzed by statistical package for the study by SPSS software (version 26.0) and descriptive statistics was used to analyze mean age and gender. Baseline character of the study participants were described in mean and standard deviation (SD). The difference in outcome measure at pre and post score measured in 2 months following the intervention. The significant level was set at $p < 0.05$.

RESULT

After the 2 month, all the outcome measure were measured and recorded then. The till date record of the group has been compared and on the basis of all the comparison and the study of data literature review one can say that the treatment was effective. It can reduce pain in obtaining desired reduce pain as well as eliminating the pain in the subjects of the knee pain. Data collected was been analyzed by using SPSS version 26.0. Baseline data of study sample was shown in table & pie chart shown below.

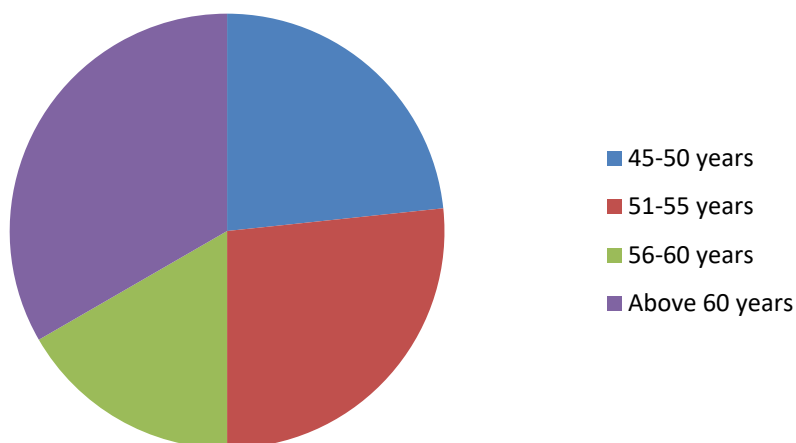
Age distribution of study participants

Out of 30 participants 33.33% participants belonged to an age group of above 60 years, 26.66% belonged to an age group of 51-55 years of age, 23.33% belonged to an age group of 45-50 years of age and 16.66 % participants belonged to 56-60 years of age. Mean age of participants – 18.14

Table 1: Age

Age	Frequency	Percentage
45-50 years	7	23.33
51-55 years	8	26.66
56-60 years	5	16.66
Above 60 years	10	33.33

Frequency



Dietary distribution of study participants

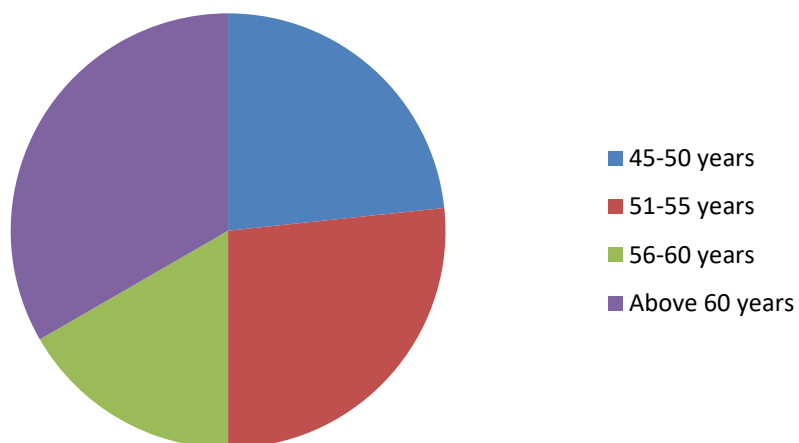
Out of 30 participants 40.00% participants have vegetarian dietary plan while 60.00% participants have non-vegetarian dietary plan.

Mean age of participants – 19.89

Table 2: Dietary plan

Diet	Frequency	Percentage
Vegetarian	12	40.00
Non- vegetarian	18	60.00

Frequency



VAS score in ultrasound Therapy with Cupping Therapy in Knee Osteoarthritis

Participants who treated by ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis VAS scale on a range 1-10.

Pre-mean value: 6.32

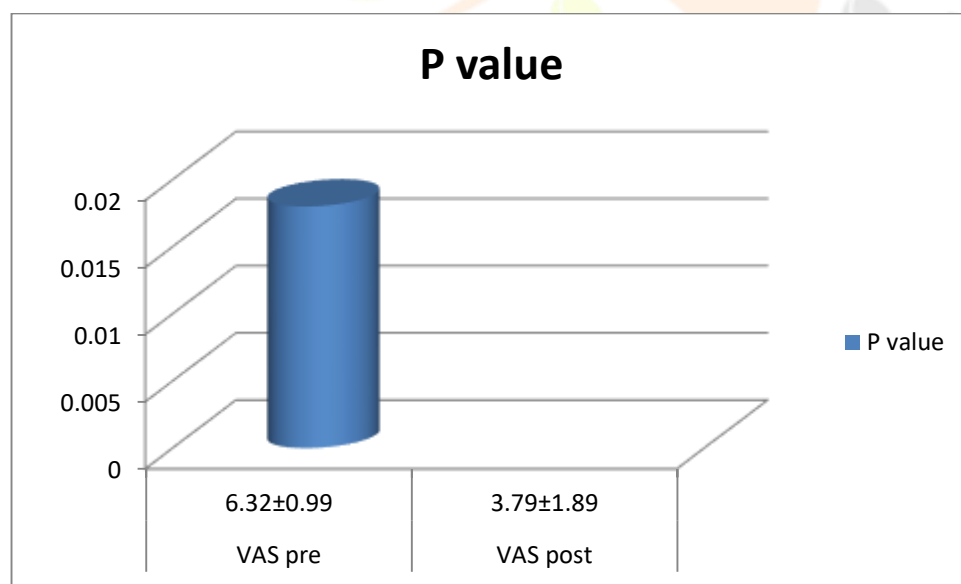
Pre SD: 0.99

Post mean value: 3.79

Post SD: 1.89

Table 3: Descriptive statistics of VAS score in ultrasound Therapy with Cupping Therapy in Knee Osteoarthritis

Variable	Mean±SD	P value
VAS pre	6.32±0.99	0.018
VAS post	3.79±1.89	

**WOMAC score in ultrasound Therapy with Cupping Therapy in Knee Osteoarthritis**

Participants who treated by ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis WOMAC scale on a range 1-20.

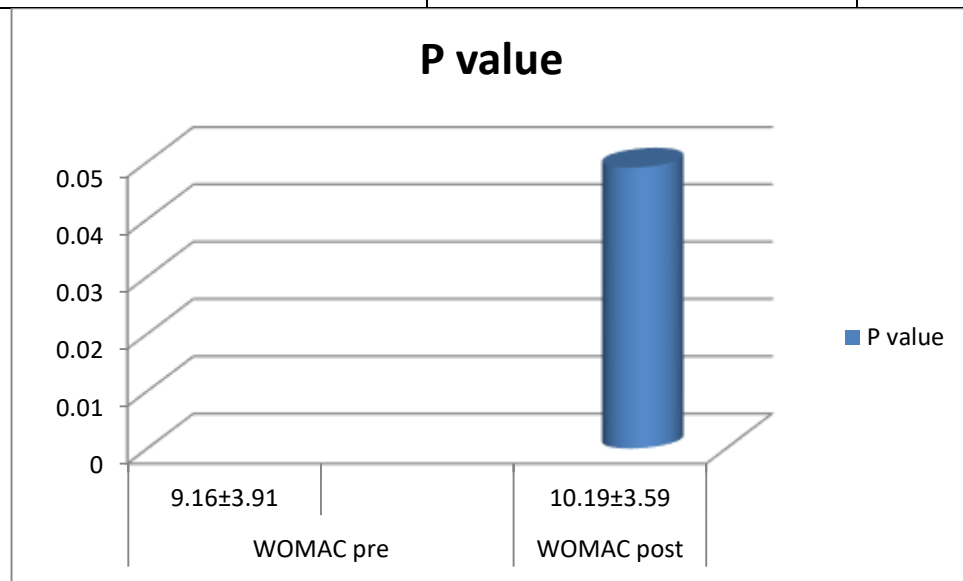
Pre-mean value: 9.16

Pre SD: 3.91

Post mean value: 10.19

Table 4: Descriptive statistics of WOMAC score in ultrasound Therapy with Cupping Therapy in Knee Osteoarthritis.

Variable	Mean±SD	P value
WOMAC pre	9.16±3.91	0.049
WOMAC post	10.19±3.59	



VAS score in ultrasound Therapy without Cupping Therapy in Knee Osteoarthritis

Participants who treated by ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis VAS scale on a range 1-10.

Pre-mean value : 9.41

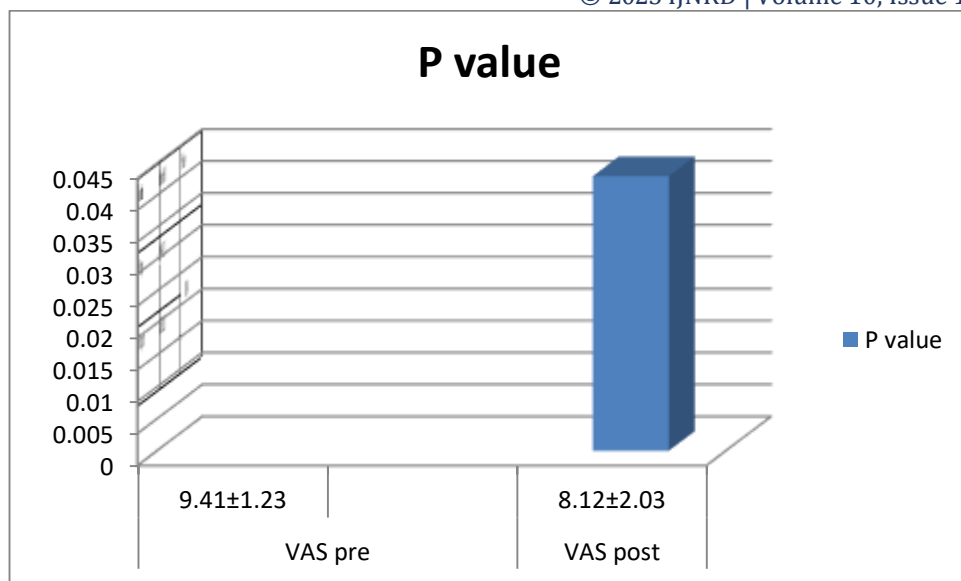
Pre SD : 1.23

Post mean value : 8.12

Post SD : 2.03

Table 5: Descriptive statistics of VAS score in ultrasound Therapy Without Cupping Therapy in Knee Osteoarthritis

Variable	Mean±SD	P value
VAS pre	9.41±1.23	0.043
VAS post	8.12±2.03	



WOMAC score in ultrasound Therapy without Cupping Therapy in Knee Osteoarthritis

Participants who treated by ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis WOMAC scale on a range 1-20.

Pre-mean value : 11.16

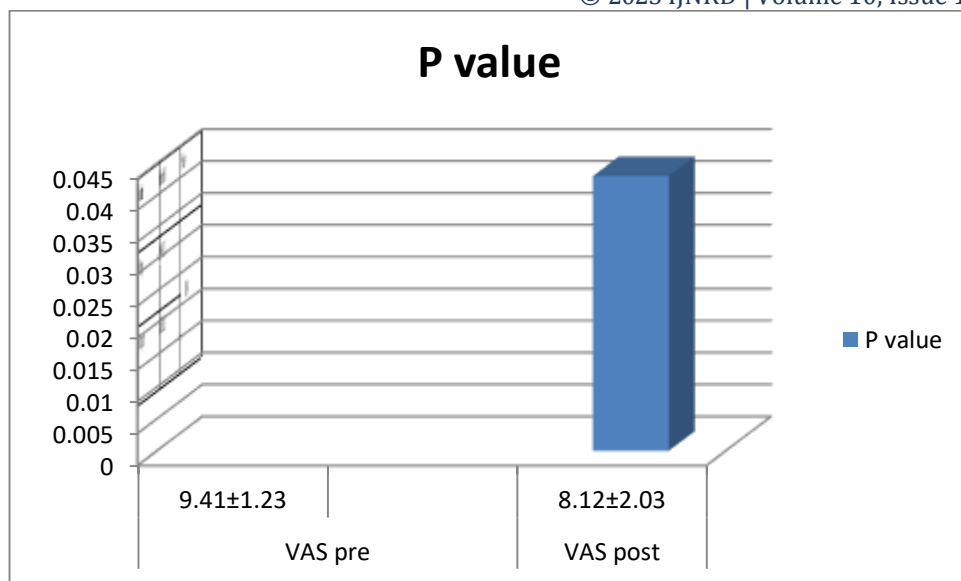
Pre SD : 2.25

Post mean value : 10.93

Post SD : 2.10

Table 6: Descriptive statistics of WOMAC score in ultrasound Therapy without Cupping Therapy in Knee Osteoarthritis

Variable	Mean±SD	P value
WOMAC pre	11.16±2.25	0.070
WOMAC post	10.93±2.10	

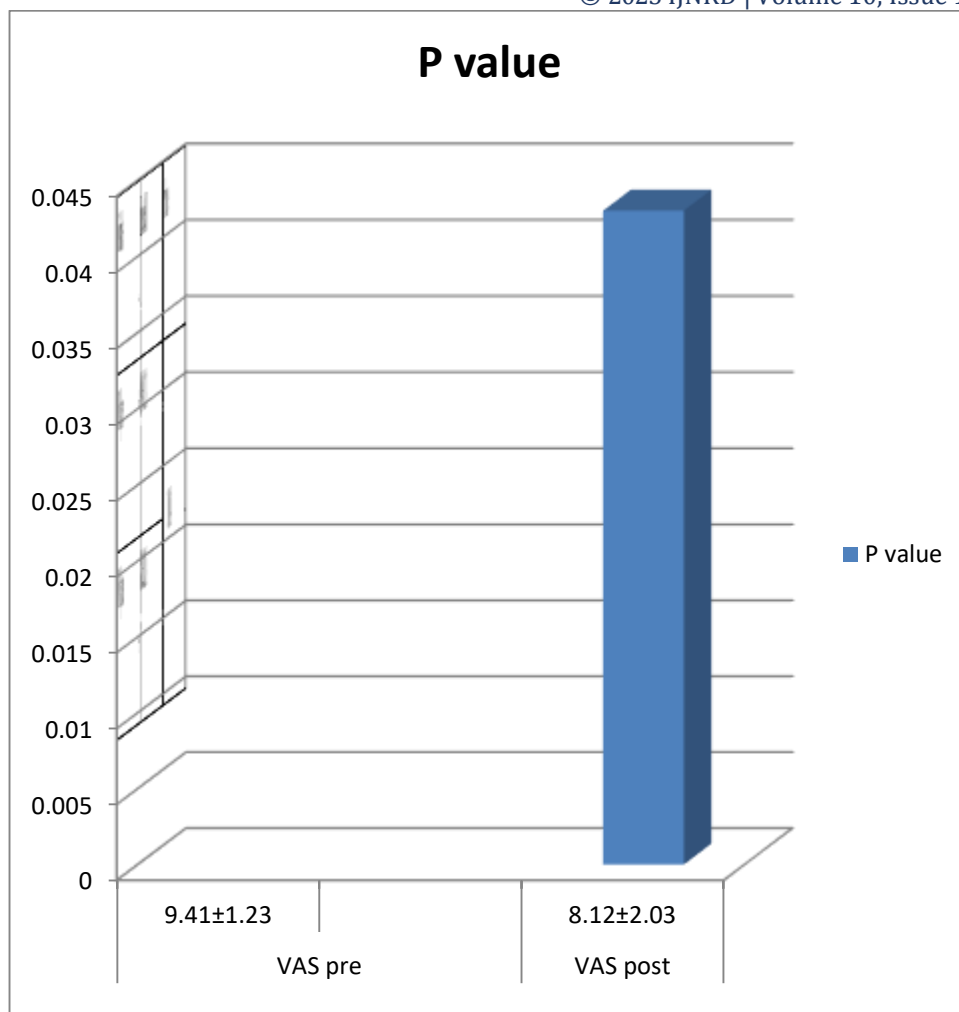


Comparison of both the groups

On comparison of the mean, scores of both the groups we can clearly see that the group A i.e. ultrasound therapy with cupping therapy, group is showing larger mean with depicts that there was more pain intensity in that group while on the other hand we can see that the ultrasound therapy without cupping therapy show less mean values that mean in comparison ultrasound therapy with cupping therapy, ultrasound therapy with cupping therapy is more effective in both VAS and WOMAC scale.

Table 7: Comparison of both the groups

Group	VAS	WOMAC
Ultrasound therapy with cupping therapy	Mean : 7.11 S.D. : 1.46	Mean : 8.02 S.D. : 1.75
Ultrasound therapy without cupping therapy	Mean : 9.15 S.D. : 2.10	Mean : 9.63 S.D. : 2.43



DISCUSSION

The study synthesized the relationship between pain and disability and activity limitation with effectiveness of ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis, there is a significant difference for variables (VAS and WOMAC) in both groups. In this study, conducted a large sample size, and covered a wide age range (Above 60 years), in which the larger disability and activity limitation among the population is found and (Non-vegetarian) also. In this study, there was a sizable majority of patients aged (Above 60 years) reported in this study than other age group, which indicates that effectiveness of ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis is more likely common in patients of this age group rather than other age group and most of the patients were non-vegetarian. In this study, we have seen that severe VAS and WOMAC scores were reported in the pre testing of both groups, and different groups showed significantly different outcomes in the post outcomes, the group A ie, the group treated with the ultrasound therapy with cupping therapy both showed positive outcomes in the study in which VAS and WOMAC scores shows good response, the pre mean values of VAS and WOMAC are (5.75±1.9) and (8.9±9.53) respectively which changes to the post mean values of VAS and WOMAC which are (0.81±1.64) and (2.81±2.40) respectively. Hence, the results clearly show that ultrasound therapy with mobilization helps to reduce the pain as well as improve the functional abilities of the patient. Whereas in group B ie, the group treated with ultrasound therapy without mobilization shows less to no impact in improving the functional abilities of the patients but helps to reduce the pain, the pre mean values of VAS and WOMAC are (9.41±8.12) and (11.16±10.93) respectively which changes to post mean values of VAS and WOMAC which are (1.23±2.03) and (2.25±2.10) respectively. The statistical analysis of the VAS showed that there was a significant effect for both groups for group A ($p < 0.05$) proving alternative hypothesis to be TRUE and group B ($p > 0.05$) proving null hypothesis to be TRUE which means that both the treatment groups were effective.

in reducing the pain but the statistical analysis of the WOMAC showed significantly different effects for both groups ($p < 0.05$) which means that the alternative Hypothesis is TRUE where the group A showed positive impact in WOMAC whereas group B showed little to no impact on WOMAC.

LIMITATIONS

The study presents some limitations, firstly the subjective method of measurement used in data collection and secondly the small sample size with narrow age range covered only Bareilly and Pilibhit.

FUTURE STUDY

The same study will be conducted with some objective variable and in large sample size of patient.

CONCLUSION

The comparative study demonstrate that combining effectiveness of ultrasound Therapy and Cupping Therapy in Knee Osteoarthritis is more effective approach for alleviating Knee Osteoarthritis. Notably, the age group of above 60 years (33.33%) was found to be more commonly affected.

Both the groups shows significant decrease in reducing pain of Knee Osteoarthritis but found that group A participants shows better results in functional ability than group B.

Hence, we can conclude that ultrasound Therapy with Cupping Therapy is better technique for treating in Knee Osteoarthritis.

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