



## Comparison of Pilates exercises and conventional treatment in people with knee osteoarthritis: A pilot study

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### Abstract

Osteoarthritis is a frequently slowly progressive joint disease typically seen in middle aged to elderly people. The knee joint is a common site of OA and subjects with knee osteoarthritis exhibit a characteristic pattern of decrements in function, generally concerning mobility, transfer from seated or supine positions to standing and activities of daily living involving the lower extremities.

The aim of this research is to compare the effect of Pilates exercises and conventional treatment in people with knee osteoarthritis. Following outcome measures: a numeric pain rating scale; the WOMAC lower limb function score; and the Hospital Anxiety and Depression scale (HAD) were used for subjects who fulfilled the inclusion and exclusion criteria.

Pilates can have immense strengthening and toning benefits, even with a moderate program. The use of controlled, progressive resistance allows for an incredibly tailored program, giving the OA clients exactly the amount of challenge appropriate. These low impact motions will optimize joint range of motion, while still building strength and coordination.

**Keywords:** knee osteoarthritis, pilates exercises, conventional treatment

### 1. Introduction

Osteoarthritis (OA) is the most common type of arthritis [1]. It is estimated that approximately four percent of world's current population is affected by osteoarthritis. It is the fourth leading cause of year lived with disability. It affects the cartilage surrounding the articulating bones of a joint. As the cartilage breaks down the joint loses its elastic strength and becomes stiff, inflamed and painful.

Articular cartilage destruction typically is more apparent on the medial than the lateral aspect of the knee. As the condition worsens the joint can deform and parts of bone or cartilage can break off and float in the joint capsule, causing further pain and discomfort. One third of individuals older than age 65 have radiographic evidence of OA. Pain, muscle weakness, medial joint laxity and limitation of joint motion affect function and lead to disability. Deformity such as genu varum commonly develops in the knees. Knee instability is frequently reported by individuals with knee OA and significantly contributes to impaired physical function. [2]

Pilates teachings were defined by six fundamental principles: concentration, control, centering, flowing movement, precision, and breathing [3]. There is an emphasis on stretching, maintaining a neutral spine during movements, and performing quality movements [4, 5]. The concept of centering is fundamental to the Pilates method and refers to the emphasis of strengthening and stretching the core of the body. Pilates referred to this region as the "powerhouse," which has

been broadly interpreted to anatomically include an area from the pelvic floor, inferiorly, to the rib cage, superiorly.

This concept of strengthening the core was recently reviewed by Willson and associates. They found that decreased core stability may predispose one to injury of the lower extremities and suggested that stability of the core is crucial to the ability to establish a stable base for movement of the extremities [6].

Recent studies indicate that Pilates is a useful tool in rehabilitation and can improve: overall health, sports performance [7], proprioception, [8] the level of pain [8], flexibility [9], the degree of depression, strength, muscular endurance [10] and the control of the mobility of the trunk and pelvic segments, as well as help in prevention and mitigation of injuries and dysfunctions of the musculoskeletal system [11]

In the case study conducted by *Rothenmaier on Pilates and Osteoarthritis of the Knee* stated that Pilates has so many benefits for an osteoarthritic client. The key take home point here should be to focus on range of motion and low impact strengthening for the area affected while working the body as a whole. Potentially the greatest benefit that Pilates can offer the OA client is to help them feel successful and confident in their ability to stay active, even with their limitations. [1]

### 2. Methodology

Total 20 patients diagnosed with OA participated in the study of age group ranged between 30-60 years, who are referred for physiotherapy treatment in HAHC hospital for OA knee.

Sample of convenience are selected.

Inclusion criteria for the study were, patients who experienced knee pain on most days of previous month and average NPRS pain score was more than 3, patients who have MMT score more than 3 for back extensors, abdominals, hip flexors, hip extensors, hip abductors and adductors.

Exclusion criteria for the study were, patients who have undergone any knee surgery or lower limb joint replacement surgeries, who were administered intra-articular steroid injection (previous 6 months) and patients with systemic arthritic conditions as per signs and symptoms.

**2.1 Procedure**

All subjects were assessed prior treatment. An assessment sheet was prepared which had details required for research i.e. name, age, sex, occupation, address, present history, past history, medical history, surgical history, observational findings, palpation findings, examination findings, radiological findings, provisional diagnosis etc. All subjects were from similar socio economic background and nutritional status. Subjects who fulfilled the exclusion and inclusion criteria were included in the study. The entire study was performed with the permission of the individuals and all the objectives and probable impact was explained to subjects. Only after they agreed to volunteer for the study, they were included in it after taking an informed consent.

These 20 subjects with osteoarthritis knee pain were randomly allocated to one of two treatment groups: (1) Pilates exercises and education; and (2) Conventional exercises and education. Each group received physiotherapist-led treatments over two weeks. Follow up took place after two weeks using the following outcome measures: a numeric pain rating scale (NPRS); the WOMAC lower limb function score; and the Hospital Anxiety and Depression scale (HAD).

**2.2 Experimental group**

The experimental group received a treatment protocol consisting Pilates exercises for knee pain and education for two weeks. It included following:

**Session 1-5**

- Hundreds (5 repetitions)
- One leg stretch (3 repetitions)
- Double leg stretch (3 repetitions)

**Session 6-10**

- Hundreds (5 repetitions)
- One leg stretch (3 repetitions)
- Double leg stretch (3 repetitions)
- Clams (7 repetitions)
- One leg kick (7 repetitions)

**Session 11-14**

- Hundreds (5 repetitions)
- One leg stretch (3 repetitions)
- Double leg stretch (3 repetitions)
- Clams (7 repetitions)
- One leg kick (7 repetitions)
- Side kick (8 repetitions)
- One leg circle (10 repetitions) <sup>[12]</sup>

**Education**

It included the ergonomic advice and precautions to be taken by the subject.

**2.3 Controlled group**

Those in the controlled group received conventional treatment and education which included strengthening exercises, stretching exercises and ultrasonic therapy for pain relief for two weeks. It included following:

**Session 1 -7**

- Hot water fomentation for 10 minutes.
- Isometric exercises for quadriceps <sup>[13]</sup>, hamstrings and VMO.
- Ultrasonic therapy for pain relief <sup>[14]</sup>.

**Session 7-14**

- Isometric exercises were progressed to isotonic exercises and further on to resisted exercises
- Mild squatting for 5 repetitions and 10 seconds hold.
- Hot water fomentation for 10 minutes.

**Education**

It included the ergonomic advice and precautions to be taken by the subject.

**Outcome measures**

1. Numeric Pain Rating Scale: It was used for pain mapping.
2. WOMAC Questionnaire: To evaluate pain, stiffness and physical functioning of subjects with OA knee WOMAC questionnaire was used.
3. Hospital Anxiety and Depression Scale: To determine the level of anxiety and depression in subjects with OA knee prior treatment and after treatment.

**2.4 Data analysis**

- Within group data was analysed with student t test and between group data was analysed with independent t test.
- The computer program used for data analysis was SPSS version 16

**3. Results**

**Table 1:** Demographic Data

	Group A		Group B	
	Mean	SD	Mean	SD
Age	45.00	7.745	52.80	8.243

**Table 2:** Within Group Analysis for NPRS

	Mean		SD		T	P
	Pre	Post	Pre	Post		
Group A	7.10	2.5	.994	.849	15.057	.000
Group B	7.0	4.8	.816	.918		

**Table 3:** Within Group Analysis for WOMAC

	Mean		SD		T	P
	Pre	Post	Pre	Post		
Group A	62.91	42.91	14.961	13.507	11.578	.000
Group B	55.1	44.94	10.376	10.581		

**Table 4:** Within Group Analysis for Depression

	Mean		SD		T	P
	Pre	Post	Pre	Post		
Group A	5.7	3.8	4.001	3.966	6.862	.000
Group B	6.2	4.9	4.638	4.863	3.881	.004

**Table 5:** Within Group Analysis for Anxiety

	Mean		SD		T	P
	Pre	Post	Pre	Post		
Group A	6.9	4.3	6.081	4.473	2.940	.016
Group B	4.4	3.3	4.880	4.191	3.498	.007

**Table 6:** Between Group Analysis for NPRS

	Mean		SD		T	P
	Group A	Group B	Group A	Group B		
Pre	7.1	7	0.994	0.816	.246	.809
Post	2.5	4.8	0.849	0.918	-5.811	.000

**Table 7:** Between Group Analysis for WOMAC

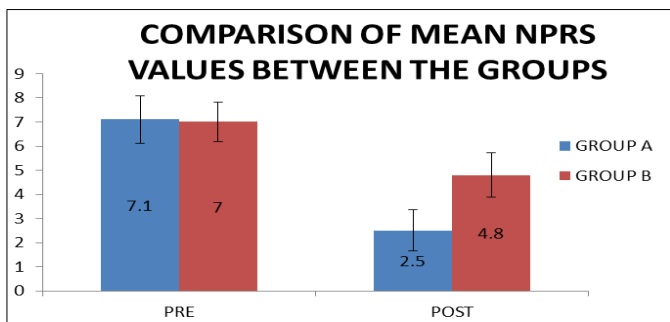
	Mean		SD		T	P
	Group A	Group B	Group A	Group B		
Pre	62.91	55.1	14.961	10.376	1.357	.192
Post	42.91	44.94	13.507	10.581	-.375	.712

**Table 8:** Between Group Analysis for Depression

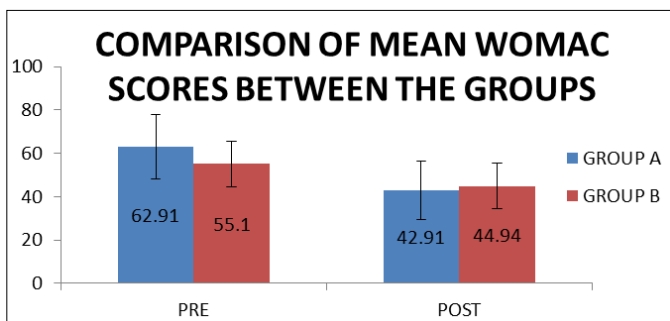
	Mean		SD		T	P
	Group A	Group B	Group A	Group B		
Pre	5.7	6.2	4.001	4.638	-.258	.799
Post	3.8	4.9	3.966	4.863	-.554	.586

**Table 9:** Between Group Analysis for Anxiety

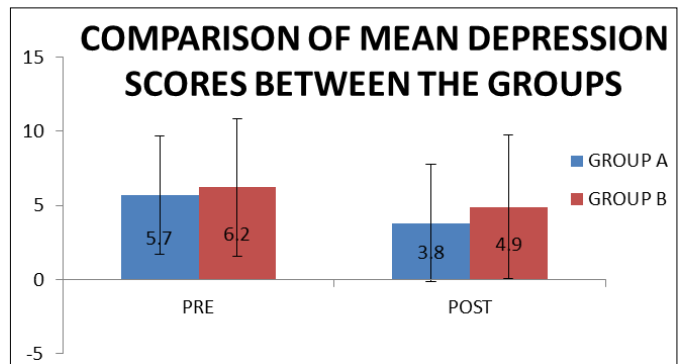
	Mean		SD		T	P
	Group A	Group B	Group A	Group B		
Pre	6.9	4.4	6.081	4.88	1.014	.324
Post	4.3	3.3	4.473	4.191	.516	.612



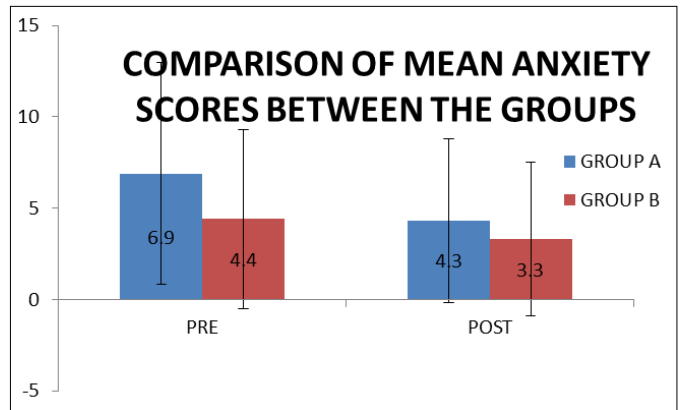
**Fig 1:** Comparison of mean NPRS values between the groups



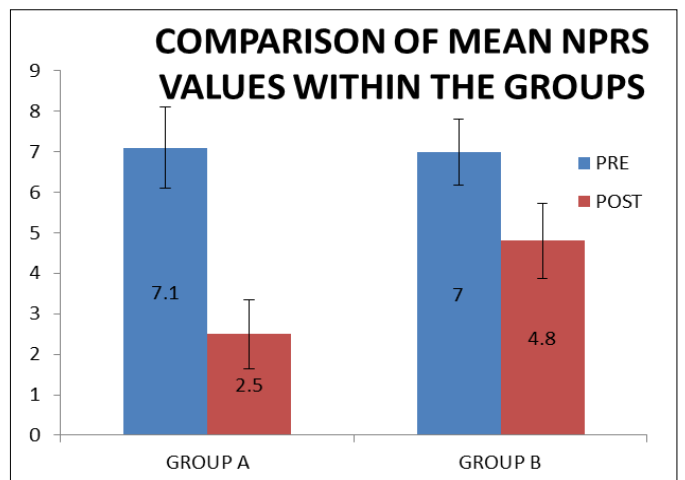
**Fig 2:** Comparison of mean WOMAC scores between the groups



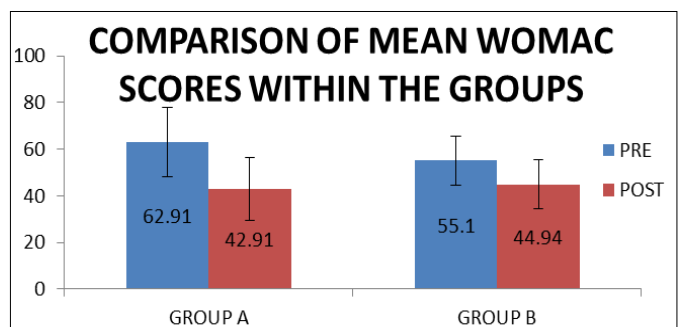
**Fig 3:** Comparison of mean depression scores between the groups



**Fig 4:** Comparison of mean anxiety scores between the groups



**Fig 5:** Comparison of mean NPRS values within the groups



**Fig 6:** Comparison of mean WOMAC scores within the groups

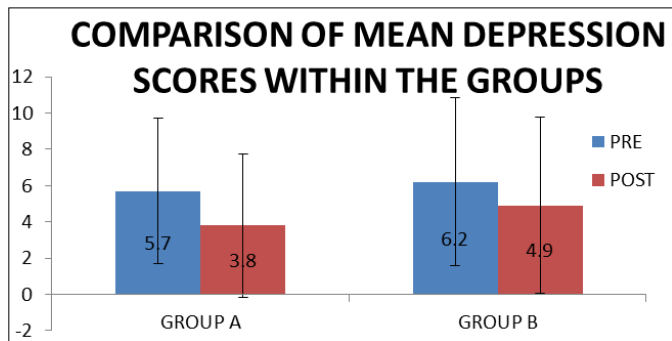


Fig 7: Comparison of mean depression scores within the groups

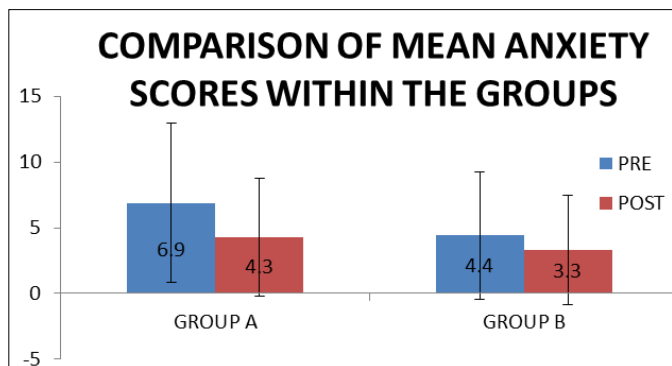


Fig 8: Comparison of mean anxiety scores within the groups

#### 4. Discussion

The main aim of this study was to compare the effect of Pilates exercises and conventional treatment for OA knee patients. A total of 20 subjects were included in this study. Subjects were selected according to the inclusion, exclusion criteria and information that was collected through the self-made assessment sheet. NPRS, WOMAC and HADS scores were recorded before the beginning of intervention.

After the intervention for two weeks NPRS, WOMAC and HADS scores were taken again.

Clinically the finding of this study suggest that program of specific exercises based on Pilates exercises, received by experimental group was more efficacious in reducing pain, functional disability levels, anxiety and depression when compared with controlled group.

Mean NPRS values within group A was reduced from 7.1 to 2.5 and in group B, mean NPRS was reduced from 7 to 4.8. Mean WOMAC score in group A was reduced from 62.91% to 42.91%. Mean WOMAC score in group B was reduced from 55.1% to 44.94%. Mean depression score in group A was reduced from 5.7 to 3.8 and mean depression score in group B was reduced from 6.2 to 4.9. Mean anxiety score in group A was reduced from 6.9 to 4.3 and mean anxiety score in group B was reduced from 4.4 to 3.3.

Statistically within groups all variables are significant for both groups. Experimental group is better but statistical difference only exist in terms of NPRS. The reason for this difference can be the small sample size and 30 to 60 age group difference.

Pilates enthusiasts, such as improving core strength, and increasing flexibility, circulation and balance have been

slowly finding support in the completed research on the movement principles found in the Pilates exercises [15].

Similar study was conducted by Linnea Rothenmaier October 2015. It was a case study which suggested that Pilates has so many benefits for an osteoarthritic client. In addition to the inherent benefits to all practitioners of Pilates, the OA client will benefit particularly from the culture of non-competition and focus found in most studios. The key take home point here should be to focus on range of motion and low impact strengthening for the area affected while working the body as a whole. Potentially the greatest benefit that Pilates can offer the OA client is to help them feel successful and confident in their ability to stay active, even with their limitations [1].

#### Future research

Future research could be done by:

- Comparing various Pilates exercises in different grades of osteoarthritis.
- This research could also be done with large sample size with a least age group variation.

#### Relevance to clinical practice

This study shows that patient with knee OA shows improvement in pain reduction, functional performance, anxiety and depression levels as compared to those who received conventional treatment. Thus, Pilates exercises should be incorporated in knee OA patients to improve functional performance and decreasing pain.

#### 5. Conclusion

The results of the study support the hypothesis that an exercise therapy approach based on the Pilates method was efficacious in the treatment of a group of individuals with osteoarthritic knee. A 2-week Pilates treatment intervention was more efficacious than conventional care in reducing pain intensity, functional disability levels, anxiety and depression but statistical difference was only in terms of NPRS due to small sample size and age variation in terms of accessible population.

The key point in Pilates is to focus on range of motion and low impact strengthening for the area affected while working the body as a whole. Potentially the greatest benefit that Pilates can offer the OA client is to help them feel successful and confident in their ability to stay active, even with their limitations.

#### Limitation of the study

- The sample size was small due to time constraints.
- Variation exist in terms of age group selected.
- Equal number of males and females were not taken because of the limitation of accessible population.

#### 6. Acknowledgment

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