

EFFECT OF RESISTED EXERCISES VERSUS SURYANAMASKAR ON MUSCLE POTENCY IN OA KNEE PATIENTS

Esha S. Patil¹, Dr. Smrutika Shinde², Dr. Soniya Lohana³¹Intern DY Patil College of Physiotherapy, DY Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India²Assistant Professor at Department of Neuroscience Physiotherapy, D.Y. Patil College of Physiotherapy, D.Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India³Assistant Professor, Department of Sports Physiotherapy, D.Y. Patil College of Physiotherapy, D.Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India.*Received: 20th July, 2026; Revised: 6th Aug 2026; Accepted: 4th Sept, 2026; Available Online: 10th Sept, 2026*

ABSTRACT

Background: Osteoarthritis of the knee is one of the most common degenerative joint disorder affecting the elderly population. It leads to pain, reduced joint mobility, and decrease muscle strength, especially of quadriceps muscle. Physiotherapy intervention such as resisted exercise are commonly used to improve muscle strength and functional ability. Recently, yoga based practices like Suryanamaskar have gained attention due to their combined benefits of strengthening, flexibility and functional movement.

Methods: A Comparative experimental study was conducted on patients diagnosed with knee osteoarthritis. Participants were divided into two groups. Group A performed resisted exercises targeting quadriceps surrounding knee musculature, While Group B performed Surya namaskar. Both interventions were conducted for several weeks under supervision. Muscle Potency was assessed using standard outcomes mainly NPRS, WOMAC, Goniometer of knee, Kellgren and Lawrence grading scale with before and after interventions.

Result: In a study involving 66 participants with the complaint of OA knee pain including both the genders (male, female) with over all 33 participants in both groups age of participants was up to 45 and above with means age 54. 42 (7.12) years. Mostly participants were 66 in total number with age group of 45 to 70 and were suffering from OA knee pain with difficulty in daily activity since 6 months to 2 years. In our study the females suffering from OA knee were 37 (56.90 %) and males including 28 (42.10 %). The total number of participants were 66 and percentage was 100.00 % **Conclusion:** Resisted exercise and Surya namaskar are both beneficial in improving muscle potency in knee osteoarthritis patients. Resisted exercise may provide more targeted strengthening, whereas Surya namaskar offers combined benefits of flexibility, strength, and functional movement.

Keywords: Knee osteoarthritis, Resisted exercise, Surya namaskar, Muscle potency, Quadriceps strength, Functional Performance, Knee joint function.

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INTRODUCTION

Osteoarthritis is a noninflammatory degenerative disorder of the joints characterized by progressive deterioration of articular cartilage and formation of new bone (osteophytes). At the joint surfaces. It is two types:

(a). Primary osteoarthritis: When the aetiology is natural wear and tear with ageing, overuse or obesity. Various other factors such as obesity and hormonal and genetic factors have been found to predispose osteoarthritis.

(b). Secondary osteoarthritis: When it follows some known primary cause e.g. trauma, infection or rheumatoid arthritis (RA)

Knee Osteoarthritis (OA) is attributed by pain, articular cartilage deterioration, joint space narrowing, and reduced muscle strength.⁽¹⁾

Thereabout Osteoarthritis is most common disease which as high flown 20% of global population⁽¹⁻²⁾

Knee pain during activity due to OA is a well defended prognostication of tremendous need of functional assistance and also a cause of dysfunction.⁽¹⁾

The broad predominance of individual with osteoarthritis of knee (80%)⁽¹⁾

And acquaintance with pain and limited mobility.⁽¹⁾ 25% of individuals found it difficult to do ADLs.⁽¹⁾

Infirmity of Quadriceps muscles is most familiar detection in the individuals suffering with Osteoarthritis of the knee.⁽¹⁾ And also shows poor strength of hip muscles.⁽¹⁾ Reduced lower limb muscle strength is linked with pain and dysfunction \ disability and the count of individuals is elevated.⁽²⁾

Author for Correspondence: Dr. Smrutika Shinde

Biomechanics of the abnormal joint forces has been spotted as possible underlying cause of OA and its further progression.⁽²⁾ Abnormal motion on knee commonly shows degenerative changes.⁽²⁾ Poor muscle activation patterns put up unfavourable changes in joint kinematics during movements and ADLs. ⁽²⁾ Persistent kinematic alteration can cause degenerative changes in cartilaginous tissue. ⁽²⁾ Eventually the personal efficacy is reduced, and quality of life is going through a downturn.⁽²⁾

Increasing persistent pain of osteoarthritis can activate the psychological problems in the patients like anxiety and depression. ⁽²⁾ Increasing strength of muscles with resisted exercises, suryanamaskar can uplifts the the physical function the patients.⁽²⁾

Muscle strength affects osteoarthritis.

Muscle commands four task like movements, stabilization, and shock absorption, and proprioception. (body's ability to sense movement, action, and location)⁽³⁾

Research as found that quadriceps muscle is infirm which contributes for increasing risk of osteoarthritis.⁽³⁾

By concentrating on boosting muscle strength adjoining the knee mostly the quadriceps muscles the wellness professionals can

succession of OA in knee.⁽³⁾

In one of the clinical analysis, the individuals as evidently seen than pain as been reduced upto 58%.⁽³⁾ Individual as also performed stair climbing, getting down to and up from the floor. Geriatric population is recommended to do strengthening exercises at the occurrence of the 1st symptom of osteoarthritis.⁽³⁾

Apparently the use of yoga, manual therapy, and resisted exercises in OA to enhance the quality of life, self-mobility, strength of muscles, reduction in pain, energy levels and confidence and psychosocial wellbeing.⁽³⁾

METHODOLOGY

An Interventional Prospective study conducted at Hospitals in Kolhapur on Males (45 and Above age), Females (45 and above) with Osteoarthritis of knee. The sample size of male - 33, and female 33. The duration of study was 6 months. The study participants were selected according to the exclusion and inclusion criteria. The study was started after getting ethical approval from the Institutional Ethics committee.

Inclusion Criteria Males (45 age group and Above) and Females (45 age group and above), Complaints of Osteoarthritis of knee, Family history of osteoporosis, X ray.

Exclusion Criteria- Previously existing pathology, Recent Fractures, Trauma (slip and fall), (blunt trauma), (road traffic accident).

PROCEDURE

Progressive Resistance Exercise- This involves exercise the muscles against resistance that is gradually increased as strength improves, using methods like resistance band, free weights are commonly used to increase muscle strength and improves function.

Chair squats: While standing hold the end of an exercise band or thera band in both hands. Loop the band under the feet. hold the band at the waist. Keep elbow straight slowly lower to the chair by bending the hip and knees keeping the back straight. Hold slowly and return to standing position. Perform the exercise 8-12 times.

Calf raises: Begin in the same starting position, holding the band at the waist. Keep elbows straight. Go up onto toes. Hold and slowly return. Perform this exercise 8-12 times.

Hip extension: Attach one end of a band to a door or chair the other to the ankle. Standing, balance on the leg without the band, either on a hard surface or a stability trainer. Extend the hip behind the body. Use a chair for support if necessary. Perform this exercise 8-12 times on each leg.

Hip Flexion: While seated in a chair, wrap the band around one foot, cross the body and connect the band around the opposite thigh. Lift hip upward toward the ceiling. Hold, and slowly returns. Perform this exercise 8-12 times on each leg.

Ankle dorsiflexion: Attach both the ends of the band to a door or chair and loop around the foot. Pull toes back towards the head against the band. Hold and slowly return. Perform this exercise 8-12 times on each leg.

Leg curls: Attach both the end of a band to a door or chair. Seated, tie the band behind the ankle. Bend the knee and pull leg back towards the chair. Hold and slowly return. Perform this exercise 8-12 times on each leg.

Leg extension: Attach both the ends of the resisted band to a door or chair. Seated, tie the band in front of the ankle. Extend the knee and point the foot towards the ceiling. Hold and slowly return. Perform this exercise 8-12 times on each leg.

Hamstring Curl with Band: Tie an exercise band around your ankle, and attach the other end to a fixed object (eg. Under a weight, or around the leg of a table). Lie face down. Bend your knees creating resistance in the band. This is a strengthening exercise for the hamstring muscle group (located at the back of the thigh).

Squat with Band: Place your feet shoulder width apart, or just outside shoulder width. Tie an exercise band around your knee keeping it quite tight. Slowly bend

your knees to go in squat position. Maintain a good curve in your lower back, and control the squat making your knee's do not drop inwards. When you have gone as a feel comfortable, push upwards through your legs to straightrn your knee into a standing position. Repeat as require.

Surya Namaskar: GROUP B

One round of suryanamaskar consist of following 12 postures.

Stand upright and join both the feet. The heels should be together while the toes should be apart. Head, neck and body should be in one line. Join the hands in namaskar position. Breathe normally. This is initial posture. When the round is over this is 12 th posture. Now chant 1st name of lord Sun and start 1st round of Surya Namaskar.

Step 1: Pranamasana (Prayer pose).

Stand erect with feet together let the hands be by the side of the body join both the hands in prayer posture rest on thechest, sternum fore arm should be straight so that hand position looks like triangle. **Breathing:** breathe out completely.

Step 2: Hasta Uttasnana (Crescent moon pose).

Stand tall with feets firm on ground and wieight evenly distributed. Inhale deeply and raise your arms overhead keeping them straight and parallel and palms facing each other.**Breathing** : inhale while moving backward.

Step 3: PadhaHastasana (Hand to foot pose).

Flat the back downwards.Touch the fore head to the shinebone point the elbows out .Place the palms under the feet .Lift hip bone higher legs should be straighten .Put the toes over the waist. **Breathing:**Exhale while bending forward.

Step 4: AshwaSanchalanasana (Equestrian pose)

Body weight on front leg. Back knee resting on floor .Toes stretching back.Spine should be elongated pushing pelvis down lunge forword and fingers or tip of fingers resting on floor **Breathing:**inhale when the chest and head are raised.

Step 5: SethuBandha Asana (Bridge pose).

Lie down on your back near the edge of a yoga mat, having bent knee and feet positioned hip width apart parallel. Press feet on the mat, then lift your body upwards to form a straight line between your head and legs or an inverted "V" shape. **Breathing:** hold the breathe and support the weight of thr body.

Step 6: AstangaSanchalasana (Equestrian pose)

Body weight on front leg.Back knee resting on flor . Toes stretching back. Spine should be elongated. Pushing pelvis down. Lunge forward. And fingertip resting on floor. **Breathing:** exhale while lowering.

Step 7: Bhujangasana (Cobra pose)

Lie face down with legs together and palms under your shoulder then slowly raise your torso off the ground keeping your elbows slightly bent and engaging your core and back muscles.

Breathing: inhale while raising the torso.

Step 8: Parvathasana (Mountain pose)

Tuck your toes under. Exhale and lift the hip upwards forming v shape with the body. legs should be straight and heels grouned close to ground **Breathing:** Exhale to assume the posture.

Step 9: Ashwasanchalanasan (Equestrian pose)

Standing forward fold inhale and step your right leg far as possible. Keeping left foot firm planted between your hands. left knee is align between left ankle forming lunge. Engage core and keep back straight look forward. **Breathing:** inhale the while raising the chest.

Step 10: PadhaHastasana (Hand to foot pose).

Flat the back downwards touch the forehead to the shinebone. point the elboes out .Place the palm under the feet. Lift the sit bones higher leg should be straighten. Put toes over the waist.

Breathing: exhale completely.

Step 11: Hasta Uttanasana (Crescent moon pose)

Stand tall with feets firm on ground and weight evenly distributed. Inhale deeply and raise your arm overhead keeping them straight and parallel and palms facing each other. **Breathing:** inhale deeply.

Step 12: Pranamasana (Prayer pose)

Stand at the edge of your mat feet together and balance your weight equally on both feet. Expand your chest and relax your shoulder. As you breath in , lift both arms up from the sides and as subjects exhale , bring your palms together in front of the chest in prayer position. **Breathing:** Exhale deep.

Surya Mantras: Each round of suryanamaskar is done after a pronouncement of "OMKAR" with appropriate "BIJAMANTRA" along with the corresponding name of sun god in following sequence.

1. "AumMitrayeNamah"
2. "AumRavayeNamah"
3. "AumSuryayaNamah"
4. "AumBhanaveNamah"
5. "AumKhagayaNamah"
6. "AumPushneNamah"
7. "AumHiranyagarbhayaNamah"
8. "AumMarichayeNamah"
9. "AumAdityayaNamah"
10. "AumSavitreNamha"
11. "AumArkayaNamha"
12. "AumBhaskarayaNamha"

Treatment Protocol Duration:

One month of treatment program for group A with Progressive resisted excercises. Patients performed 1-3

sets of 10-15 repetations on bilateral Lower limbs. And One month of treatment

program for group B with Surya Namaskar. Repetations of Surya namaskar at least twice in a day.

RESULTS

GROUP A :

Additionally we have analysed comparison between NPRS and WOMAC scale and Goniometer of Knee in group A (Ressisted exercises)

Group A

Parameters	Assessment Period	Mean	Std. Deviation	p-value
NPRS On Rest	Pre	3.06	0.90	<0.001*
	Post	2.06	0.83	
NPRS On Movement	Pre	7.94	0.90	<0.001*
	Post	3.39	1.06	
WOMAC	Pre	40.76	6.86	<0.001*
	Post	8.21	2.69	
Goniometer of knee	Pre	49.58	8.48	<0.001*
	Post	116.06	11.23	

Table no. 1 NPRS on rest

The pain felt by participant before giving treatment was more upto 3.06 % (0.90) and after giving treatment was less upto 2.06 % (0.83)

NPRS on movement

The pain felt by participant before giving treatment was 7.94 % (0.90) and after giving treatment was less upto 2.06 % (0.83)

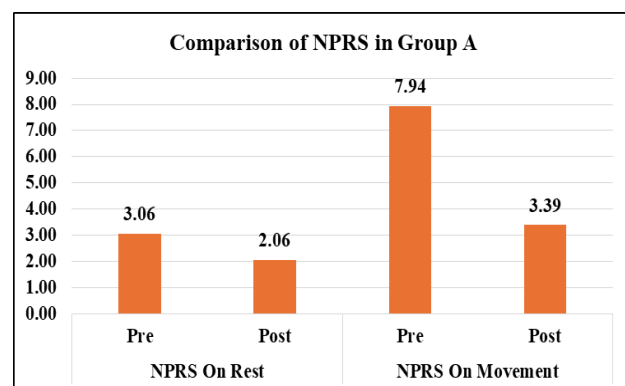


Figure no. 1

WOMAC scale

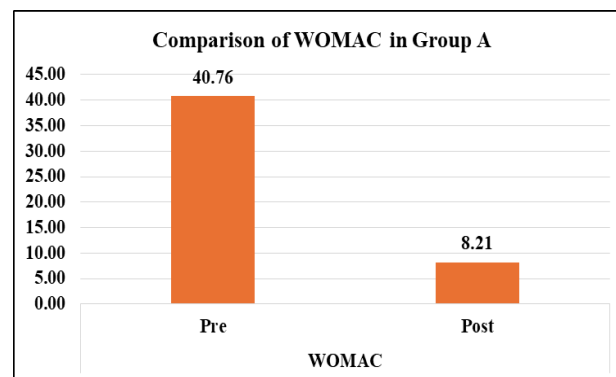


Figure no.2

Evaluation of pain intensity and join stiffness while doing activities like walking , using stair case , sitting or lying for prolong period of time and to identify functional limitations in OA knee patients WOMAC scale plays an important role.

We evaluated patients mobility, pain intensity while doing functional activities before giving treatment was accountably greater upto 40.76% (6.86) with p – value of <0.001*

Subsequently we evaluated patients mobility, pain intensity while doing functional activities after giving treatment was answerably reduced upto 8.21 % (2.69) with p- value of <0.001*

Goniometer of Knee

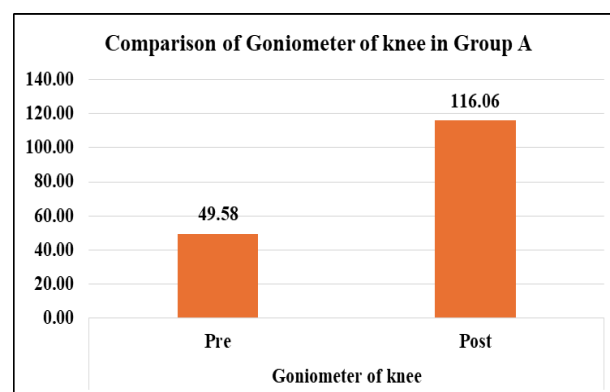


Figure no.3

Basically measures knee range of motion and also provides quantitative data regarding ranges of the knee joint movements and provides standardized value for patient records and clinical reporting.

We assessed knee range of motion of the patient before starting with resistive exercises we found the painful arc range of knee in most of patients was nearly 30 degrees to 60 degrees. The percentage of knee range of motion prior the treatment was upto 49.58 (8.48).

And later we assessed knee range of motion of the patient the pain was reduced and the range was enhanced byound 90 degrees of some patients and mostly where byound 100 degrees and the percentage after the treatment was 116.06 (11.23).

GROUP B :

Furthermore we analysed the comparison between NPRS, WOMAC scale and Goniometer of knee in group B (Suryanamaskar)

Group B

Parameter s	Assessmen t Period	Mea n	Std. Deviation	p-value
NPRS On Rest	Pre	2.94	0.91	0.169
	Post	2.78	0.75	
NPRS On Movement	Pre	8.63	1.16	<0.001 *
	Post	7.72	0.73	
WOMAC	Pre	55.31	10.00	0.174
	Post	54.50	11.33	
Goniometer of knee	Pre	51.56	8.27	<0.001 *
	Post	56.41	8.06	

Table no.2

NPRS at Rest

The pain felt by the participant before giving treatment was significantly more at most 2.94 % (0.91) with the p-value of 0.169 . Thereafter the treatment the pain was limited upto 2.78 % (0.75) with the p – value of 0.169.

NPRS on Movement

The pain experienced by the patients prior to treatment was significantly more at most 8.63 % (1.16). Thereafter the treatment the pain was limited upto 7.72 % (0.73) with p – value of <0.001*.

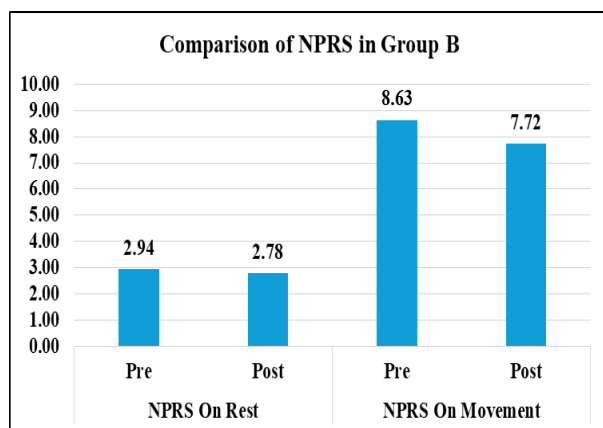


Figure no. 4

WOMAC scale

Evaluation of pain intensity and join stiffness while doing activities like walking, using stair case , sitting or lying for prolong period of time and to identify functional limitations in OA knee patients WOMAC scale plays an important role.

We evaluated patient's mobility, pain intensity while doing functional activities before giving treatment was accountably greater upto 55.31% (10.00) with p – value of 0.174.

Subsequently we evaluated patients mobility, pain intensity while doing functional activities after giving treatment was minimal at most 54.50 % (11.33) with p-value of 0.174.

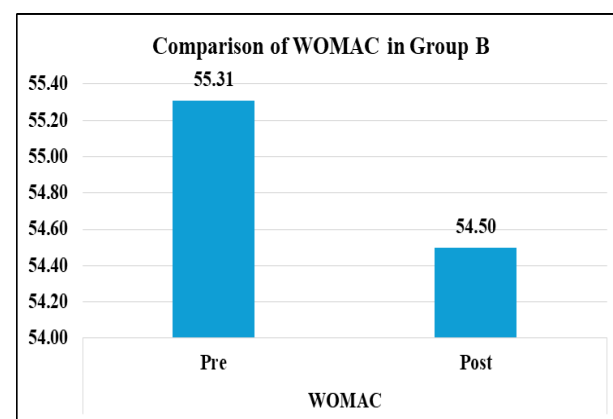


Figure no. 5

Goniometer of Knee

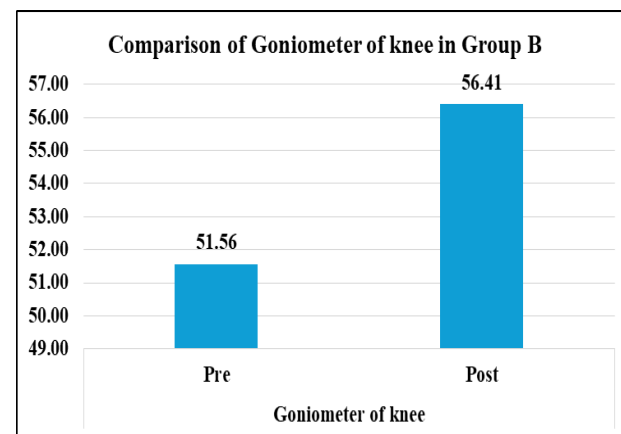


Figure no.6

Basically measures knee range of motion and also provides quantitative data regarding ranges of the knee joint movements and provides standardized value for patient records and clinical reporting.

We assessed knee range of motion of the patient before starting with resistive exercises we found the painful arc range of knee in most of patients was nearly 30 degrees

to 60 degrees. The percentage of knee range of motion prior the treatment was upto 51.56 % (8.27)

And later we assessed knee range of motion of the patient the pain was reduced minimally and the range of motion in participants where increased with the difference of 5 to 10 degrees and the percentage after the treatment was 56.41 % (8.06) with the p – value of <0.001

Group Comparison: Group A and Group B

Group Comparison

Parameters	Grou p	Mean	Std. Deviation	p-value
NPRS On Rest	A	2.06	0.83	<0.001 *
	B	2.78	0.75	
NPRS On Movement	A	3.39	1.06	<0.001 *
	B	7.72	0.73	
WOMAC	A	8.21	2.69	<0.001 *
	B	54.50	11.33	
Goniometer of knee	A	116.06	11.23	<0.001 *
	B	56.41	8.06	

Table no. 3

NPRS at Rest

Pain of the patients were evaluated on the core of Numerical pain rating scale at rest.

In group A the pain evaluated was atmost 2.06 % (0.83)

And on the other side the in group B patients the pain was slightly more at rest upto 2.78 % (0.75) with the p-value <0.001*

Interpretation: Group A has less pain at rest compared to group B

NPRS on Movement

Pain of the patient was evaluated on the bases of Numerical pain rating scale on movement

In group A the pain intensity of the patient was atmost 3.39 % (1.06) and in group B on doing functional activity the use get aggravated upto 7.72 % (0.73). with the p-value <0.001*

Interpretation: Group A shows much lower pain during movement , indicating better improvement than Group B

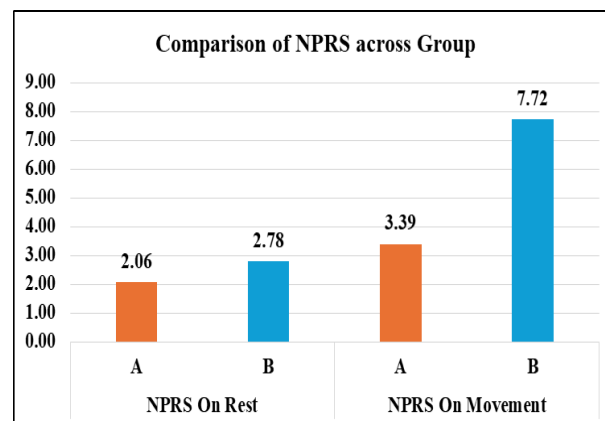


Figure no. 7

WOMAC scale

On the bases of the movements like climbing staircase, walking, getting up from the bed. Participants use to feel much pain intensity and as we shot listed the sessions exercises to the participants there was much difference in the activities patient felt ease in doing functional activities .

In Group A mean was 8.21 % (2.69), In Group B means was 54.50 % (11.33)

Interpretation: Lower WOMAC = better function

Group A has significantly better knee function and less disability than Group B

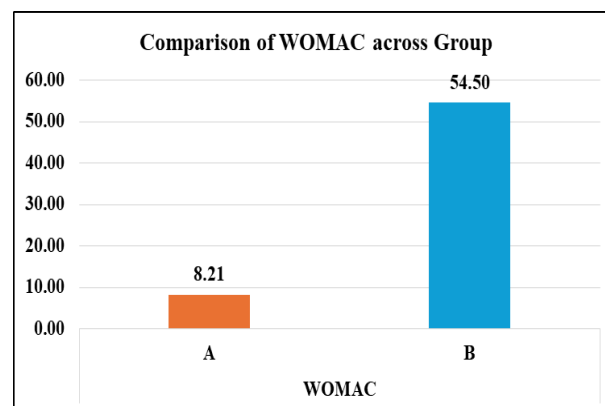


Figure no.8

Goniometer of Knee

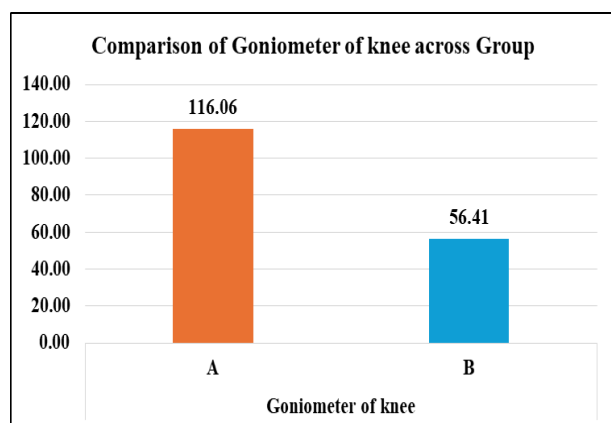


Figure no.9

According to knee bending of the patient patient has gained required range of knee flexion In Group A mean was 116.06 degrees (11.23), In Group B mean was 56.41 degerees (8.06)

Interpretation: Group A has musch greater knee range of motion, showing better mobility and flexibility.

Conclusion: Group A is significantly better than Group B in Reducing pain (both at rest and during movement) , Improving functional ability (WOMAC) and Increasing knee range of motion .

This suggests that interventions used in Group A is more effective than that used in Group B for OA Knee Patients.

Kellgren and Lawrence Grading Scale

Post kellgren and lawrence grading	Group		Total	p-value
	A	B		
grade 1	0	1	1	<0.001*
	0.00%	3.10%	1.50%	
grade 2	33	0	33	
	100.00%	0.00%	50.80%	
grade 3	0	26	26	
	0.00%	81.30%	40.00%	
grade 4	0	5	5	
	0.00%	15.60%	7.70%	
Total	33	32	65	
	100.00%	100.00%	100.00%	

Table no. 4

The comparison of post Kellgren and Lawrence grading between Group A and Group B shows a statistically significant difference ($p < 0.001$).

In Group A, all participants (100%) were classified as Grade 2, with no patients in Grades 1, 3, or 4.

In Group B, the majority of patients were in Grade 3 (81.3%), followed by Grade 4 (15.6%), and a very small proportion in Grade 1 (3.1%). No patients in Group B were in Grade 2.

Overall distribution:

Grade 2 was most common (50.8%), mainly from Group A.

Grade 3 accounted for 40%, mostly from Group B.

Grade 4 (7.7%) and Grade 1 (1.5%) were less frequent.

Interpretation

The highly significant p-value (<0.001) indicates that the difference in osteoarthritis severity between the two groups is not due to chance.

Group A consists of patients with moderate OA (Grade 2).

Group B consists of patients with more advanced OA (Grades 3 and 4).

DISCUSSION

Resisted exercise plays a central role in the rehabilitation of patients with knee osteoarthritis. The present discussion highlights its effects on muscle potency, pain reduction, and functional improvement.

Patients who participated in resisted exercise programs showed a significant increase in muscle strength, particularly in the quadriceps and hamstring muscle groups, which are essential for knee joint stability. This improvement can be attributed to the principle of progressive resistance training, where muscles adapt to increasing loads, resulting in enhanced muscle fiber recruitment and hypertrophy. Stronger muscles help in better shock absorption and reduce excessive load on the degenerated joint surfaces.

In addition to strength gains, resisted exercises contributed to pain reduction. This may be due to improved joint support and decreased mechanical stress on the knee. Strengthening the surrounding musculature helps distribute forces more evenly across the joint,

thereby reducing irritation and inflammation associated with osteoarthritis.

Functional performance also improved in patients undergoing resisted exercise training. Activities such as walking, stair climbing, and sit-to-stand transitions became easier due to increased muscle power and joint stability. These improvements are clinically significant, as they directly enhance the quality of daily living in individuals with knee osteoarthritis.

Another important aspect is the improvement in neuromuscular control. Resisted exercises enhance coordination and proprioception, which reduces the risk of falls and further joint injury. This is particularly important in elderly populations who are more prone to instability.

Despite these positive outcomes, certain limitations should be considered. Patient compliance, proper technique, and supervision are crucial for achieving optimal results. Excessive or improperly performed resistance training may lead to joint strain or injury. Therefore, exercise programs should be individualized based on the patient's condition and tolerance.

Overall, resisted exercise is an effective and evidence-based intervention for improving muscle potency and functional ability in patients with knee osteoarthritis. It should be considered a key component of physiotherapy management, either alone or in combination with other treatment approaches.

The present study compared the effects of resisted exercises and Surya Namaskar on muscle potency in patients with Osteoarthritis of the Knee. The findings indicate that both interventions were effective in improving muscle strength, reducing pain, and enhancing functional performance; however, resisted exercises showed a greater impact on muscle potency.

Participants in the resisted exercise group demonstrated significant improvement in the strength of the quadriceps and hamstring muscles. This can be attributed to the principle of progressive overload, where muscles adapt to increasing resistance, resulting in hypertrophy and improved neuromuscular activation. Enhanced muscle strength leads to better joint stability and reduces mechanical stress on the knee joint, which is crucial in managing osteoarthritis.

In contrast, the Surya Namaskar group also showed noticeable improvements, although comparatively less in muscle potency. Surya Namaskar involves a sequence of dynamic and static postures that provide mild resistance along with stretching. These movements help in improving flexibility, balance, and circulation, thereby reducing joint stiffness and improving overall mobility. While it contributes to muscle endurance and functional fitness, it may not provide sufficient resistance to achieve maximal strength gains like resisted exercises.

Both groups experienced pain reduction and improved functional ability, such as ease in walking, stair climbing, and daily activities. These improvements may be due to better muscle support around the knee joint and enhanced joint mechanics. However, the targeted strengthening

The mean age of participants is 54.42 ± 7.12 years, indicating a middle-aged population.

Gender distribution:

Females: 56.9% (n=37)

Males: 43.1% (n=28)

This shows a slight female predominance, which is common in knee-related conditions like osteoarthritis.

2. Pain Intensity (NPRS) – Group B

At Rest

Pre: 2.94 ± 0.91

Post: 2.78 ± 0.75

$p = 0.169$ (not significant)

Interpretation:

There is a small reduction in resting pain, but it is not statistically significant, suggesting the intervention had limited effect on pain at rest.

On Movement

Pre: 8.63 ± 1.16

Post: 7.72 ± 0.73

$p < 0.001$ (highly significant)

Interpretation:

There is a significant reduction in pain during movement, indicating the intervention is effective in improving functional pain.

3. Functional Outcome (WOMAC) – Group B

Pre: 55.31 ± 10.00

Post: 54.50 ± 11.33

$p = 0.174$ (not significant) Interpretation:

Although there is a slight improvement in WOMAC score, it is not statistically significant, suggesting limited impact on overall function and stiffness.

4. Range of Motion (Goniometer – Knee) – Group B

Pre: 51.56 ± 8.27

Post: 56.41 ± 8.06

$p < 0.001$ (highly significant)

Interpretation:

There is a significant improvement in knee joint range of motion, showing that the intervention effectively enhances mobility.

5. Between-Group Comparison (A vs B)

WOMAC: Group B appears better than Group A

Goniometer:

Group A: 116.06

Group B: 56.41

Interpretation:

Group B shows better improvement in functional and mobility outcomes, depending on measurement scale.

Differences suggest intervention in Group B may be more effective, though interpretation depends on baseline comparability.

1. Overview of Study Comparison

The data compares Group A and Group B using four parameters:

NPRS (pain) at rest

NPRS during movement

WOMAC (functional outcome)

Goniometer of knee (range of motion)

All comparisons show p-value < 0.001, which means the results are highly statistically significant.

2. NPRS (Pain Score) Analysis

a) NPRS at Rest

Group A: 2.06 ± 0.83

Group B: 2.78 ± 0.75

Interpretation:

Group A has lower pain at rest compared to Group B.

This suggests better pain control in Group A.

b) NPRS on Movement

Group A: 3.39 ± 1.06

Group B: 7.72 ± 0.73

Interpretation:

There is a large difference between groups.

Group B experiences much higher pain during movement, indicating poorer functional comfort.

3. WOMAC Score (Function & Disability)

Group A: 8.21 ± 2.69

Group B: 54.50 ± 11.3

Interpretation:

Lower WOMAC score = better function

Group A shows very good functional ability

Group B shows high disability and poor function

This is a clinically very significant difference.

4. Goniometer of Knee (Range of Motion)

Group A: $116.06^\circ \pm 11.23$

Group B: $56.41^\circ \pm 8.06$

Interpretation:

Group A has much better knee range of motion

Group B shows restricted movement

This indicates better joint mobility in Group A.

5. Overall Interpretation

Across all parameters:

Group A performs better than Group B

Shows:

Less pain (both at rest and movement)

Better functional ability

Greater knee mobility

6. Statistical Significance

All results have $p < 0.001$

This means:

Differences are not due to chance

Findings are highly reliable

7. Clinical Conclusion

The intervention or treatment given to Group A is significantly more effective than that of Group B in:

Reducing pain

Improving function

Increasing knee range of motion

8. Suggested Final Statement (for report writing)

“The results demonstrate a statistically and clinically significant improvement in Group A compared to Group B across all outcome measures (NPRS, WOMAC, and knee ROM), indicating the superior effectiveness of the intervention applied to Group A.”

The post-intervention distribution of osteoarthritis severity, assessed using the Kellgren and Lawrence scale, demonstrates a marked difference between Group A and Group B.

In Group A, all participants (100%) were classified as Grade 2, with no subjects in Grades 1, 3, or 4. This uniform distribution suggests that participants in this group predominantly had moderate osteoarthritic changes, characterized by definite osteophyte formation and possible joint space narrowing. The absence of higher grades (Grade 3 and 4) indicates that severe disease progression was not observed in this group post-intervention.

In contrast, Group B showed a wider distribution across severity levels. A small proportion of participants (3.1%) were classified as Grade 1, indicating doubtful joint space narrowing with minimal osteophyte formation. However, the majority of participants were in Grade 3 (81.3%), reflecting moderate-to-severe osteoarthritis, with multiple osteophytes, definite joint space narrowing, and possible deformity of bone ends. Additionally, 15.6% of participants were classified as Grade 4, representing severe osteoarthritis, characterized by marked joint space narrowing, large osteophytes, severe sclerosis, and definite bone deformity.

When considering the overall sample ($n = 65$), the largest proportion of participants fell into Grade 2 (50.8%), followed by Grade 3 (40.0%), while Grade 4 (7.7%) and Grade 1 (1.5%) were less common. This indicates that the study population was primarily composed of individuals with moderate to advanced osteoarthritis.

The comparison between groups suggests that Group A had a more favorable severity profile, with all participants remaining within Grade 2, whereas Group B exhibited progression toward higher severity grades (Grade 3 and 4). This difference may indicate that the intervention applied to Group A was more effective in limiting disease progression or maintaining joint

condition, while Group B showed signs of greater structural deterioration.

CONCLUSION

The present study evaluated and compared the effectiveness of resisted exercises and Surya Namaskar on muscle potency in individuals with Osteoarthritis of the knee. Based on the findings, it can be concluded that both interventions produced positive outcomes in terms of improving muscle function, but the magnitude and nature of improvement differed between the two groups.

The findings indicate that both interventions contributed to improvements in muscle potency; however, resisted exercises demonstrated greater effectiveness in enhancing muscle strength and functional performance. This may be attributed to the principle of progressive overload in resisted training, which directly targets muscle hypertrophy and strength gains.

Resisted exercises demonstrated a significantly greater improvement in muscle potency, likely due to their direct focus on strengthening specific muscle groups through progressive resistance. This approach enhances neuromuscular activation, increases muscle fiber recruitment, and improves overall strength, which are essential for stabilizing the knee joint and reducing functional limitations in osteoarthritis patients.

On the other hand, Surya Namaskar also showed beneficial effects, particularly in improving flexibility, coordination, and overall functional mobility, though its impact on muscle potency was comparatively less pronounced.

In contrast, Surya Namaskar, while beneficial, showed comparatively moderate improvements in muscle potency. Its effects are more holistic, contributing to increased flexibility, balance, coordination, and circulation. These factors support joint health and functional mobility but may not provide the same level of targeted strength gains as resisted exercises.

Clinically, these findings suggest that resisted exercises should be prioritized as a primary intervention for enhancing muscle potency in patients with Osteoarthritis of the knee. However, incorporating Surya Namaskar as an adjunct therapy may further improve overall physical function, promote adherence through variation, and enhance quality of life.

In conclusion, a combined rehabilitation approach, with an emphasis on resisted strengthening exercises supplemented by Surya Namaskar, may provide optimal therapeutic benefits for improving muscle potency and functional outcomes in individuals with Osteoarthritis of the knee.

Overall, resisted exercises can be considered a more effective intervention for improving muscle potency in individuals with Osteoarthritis of the knee, while Surya

Namaskar may serve as a supportive or complementary approach in rehabilitation program.

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