“Effect Of Pelvic Stabilization Exercises And Conventional Physiotherapy On Pain And Function In Women With Primary Knee Osteoarthritis And Non-Specific Low Back Pain- A Controlled Trial”

By

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In

ORTHOPAEDICS

Under the guidance of

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Bhubaneswar, Odisha

2023-2025

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **"Effect Of Pelvic Stabilization Exercises And Conventional Physiotherapy On Pain And Function In Women With Primary Knee Osteoarthritis And Non-Specific Low Back Pain" A Randomized Controlled Trial"** is a bonafide and genuine research work carried out by me under the guidance of DR. Priyadarshini Mishra,Associate Professor, and there are no conflict of interest associated with this dissertation work.

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CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitles **"Effect Of Pelvic Stabilization Exercises And Conventional Physiotherapy On Pain And Function In Women With Primary Knee Osteoarthritis And Non-Specific Low Back Pain- A Randomized Controlled Trial"** is a bonafide research work done by Udita Mishra , under my guidance in partial fulfilment of the requirement for the degree of Master of Physiotherapy in Orthopaedics

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CERTIFICATE OF ACCEPTANCE

This is to certify that the dissertation entitled" **Effect Of Pelvic Stabilization Exercises And Conventional Physiotherapy Pain And Function In Women With Primary Knee Osteoarthritis And Non Specific Low Back Pain- A Randomized Controlled Trial"** carried out **by Ms. Udita Mishra** ,bearing university registration number 23MP435009 has been **evaluated and accepted** by me as an examiner appointed by **Odisha University of Health Sciences**,Bhubaneswar in partial fufillment of the requirements for the award of the degree of **Master of Physiotherapy(MPT) in (orthopaedics)**

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Date: **Signature**

Place: **Udita Mishra**

LIST OF ABBREVIATIONS

1. **ABSMARI-** Abhinav Bindra sports medicine and research institute
2. **SPSS-** Stastical package for social science
3. **WOMAC**- Western Ontario Mcmaster Universities Arthritis Index
4. **ODI-** Oswestry Disability Index
5. **MD**- Mean Difference
6. **SD-** Standard Deviation
7. **ACR-** American College of Rhuematology Criteria

ABSTRACT

Effect Of Pelvic Stabilization Exercises And Conventional Physiotherapy On Pain And Function In Women With Primary Knee Osteoarthritis And Non Specific Low Back Pain- A Randomized Controlled Trial

Background- The concurrent existence of low back pain and osteoarthritis gives rise to pain and disability levels in females above the age of 50 and overtime also affects their functioning.As our body is connected with a kinetic chain any problem in the spine could also lead to a problem in the knee through the hip knee spine syndrome affecting the overall pelvic stability and integrity..Literature has supported improvement in pain and function with pelvic stabilization exercises ,but no literature has studied the effect of both pelvic stabilization exercises and conventional physiotherapy in subjects with concurrent existence of low back pain and knee osteoarthritis

Objective- To check the added effect of pelvic stabilization exercises on the level of pain and function in women with primary knee osteoarthritis and non specific low back pain

Methods- 56 females diagnosed with primary knee osteoarthritis through ACR criteria and non specific low back pain through assessment aged more than 50 years were assigned randomly to two groups with 28 participants each, 12 sessions of pelvic stabilization exercises along with conventional physiotherapy was given to one group and only conventional physiotherapy to the other group for 4weeks. The

pre assessment was done using the outcome measures Womac and ODI, and again data was assessed after 4 weeks of protocol using the same outcome measures

Result- The results for WOMAC and ODI in the within group was found to be significant for both the groups for pain and function .No significant difference was noted between the groups comparison

Interpretation and Conclusion- This study concluded that both pelvic stabilization exercises along with conventional physiotherapy and conventional physiotherapy alone can be used for improving the level of pain and function in patients with both back pain of non specific nature and primary knee osteoarthritis

Key words- Knee osteoarthritis, low back Pain ,Pelvic stabilization exercises ,Pain, Function

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INTRODUCTION

Osteoarthritis is a very common degenerative condition leading to primary and progressive damage to the articular cartilage in early stages and subchondral bone in the later stages and also affects the surrounding the synovial structures[1].Osteoarthritis most commonly found in the knee joint damages the joint cartilage and can cause pain and swelling around the knee joint.Although other joints like shoulder,hip ,ankle are also affected but the knee is frequently affected in women above 60 years with 13%.[1]The knee joint is one of the largest synovial joint in humans which consists of bone,cartilage,ligaments,infrapatellar pad and synovium.Synovium is important as it has to produce synovial fluid which is a constant source of lubrication and nutrition for the articular cartilage,but because the knee joint is constantly subjected to higher loads it becomes the most frequent site for painful and degenerative joint conditions like knee osteoarthritis.[1]

The cause of osteoarthritis according to recent studies is not only degeneration but multiple factors like any injury, or any other biomechanical problems in the long run. .Studies have proved that because cartilage is avascular and lacks innervation ,it is not capable of causing any sort of inflammation and pain in the stages where the disease is just starting so pain can be due to other structures involved like ligaments ,muscle ,bones and synovium.

.As osteoarthritis progresses other changes which are highlighted are bone remodelling,osteophyte formation,joint laxity ,weakness of surrounding muscles and joint effusion.[2] Osteoarthritis mainly occurs when there is an imbalance repair mechanisms which overally affects the joint affects.[3]

Bone and cartilage- From biomechanical aspect knee joint is prone to more of shear forces as there are various movement occurring in the joint such as sliding,rotating and rolling.[4] Ligament instability and muscle weakness are prominent biomechanical changes in knee osteoarthritis, any kind of varus or valgus force over the knee brings about an overall change in the way there is distribution of load and accelerates the progression and severity of the condition.[5] Another study by Slemenda et.al relates weakness of muscle to narrowed joint space and hence leading to more pain and aggravation of symptoms of knee osteoarthritis in elderly women.[6] When talking about muscle weakness it is proved that decreased isokinetic strength of quadriceps has also been an important factor in increased loading of the lower limb during gait cycle.[7]

Joint inflammation- Inflammation one of the most commonest symptom is usually linked with malalignment, overuse or often accompanied by joint effusion and pain.[8]Adequate mechanical loading maintains physiological homeostasis of the joint, altered joint biomechanics which can include conditions like loss of cruciate ligaments ,removal of menisci, post traumatic cartilage damage ,changes in bone alignments and inadequate loading may lead to the commencement of the disease and lead to its progression.[9] The mechanical axis of the lower limb is determined by the hip knee ankle alignment which passes through the centre of the tibial head nearly one degree in varus ,therefore it has found that 60 to 70 % of the load is subjected over the medial compartment of the knee thus leading to tibiofemoral osteoarthritis.[10] Dynamic loads over the knee during gait and ambulation have been found to be three times than that in standing, so loads analysed during movement

which are characterized by alternate valgus and varus movements during gait very much explain the unpredictable load over the knee joint.[11]

Diagnostic criteria- The American college of rheumatology criteria is used while assessing patients foe patients wuth knee osteoarthritis,this helps us to distinguish from other forms of arthritis((Age> 50 yrs,Morning stiffness<30 mins,crepitus,bony tenderness,bony enlargement,no palapable warmth of joint,radiographic evidence of osteophytes- three of six criteria needs to be fulfilled).[12]

It is well known that exercise and physical activity is helpful for the treatment of primary knee osteoarthritis ,literature suggests "150 min of aerobic exercise of moderate intensity per week "to or" 2 days of moderate to vigorous physical activity ,including strengthening exercises" is beneficial along with other mainstream treatments including laser ,ultrasound and manual therapy.[13]

Non specific low back pain- Low back pain is one of the commonest condition affecting people of all ages and is one of the leading cause of increased disease burden. When we talk about low back pain there can be many causes responsible for it, but the most prevalent low back pain of no specific origin which is so called because there is no pathoanatomical cause associated to it.[14]According to studies done the mean point prevalence was estimated to be 18.3% and found to be more common in females aged between 49-60 years . Non specific low back pain is commonly describes as" pain and discomfort localized below the costal margin and above the inferior gluteal folds with or without leg pain".[15] Certain occupational exposures like whole body vibration ,frequently twisting or bending or prolonged

standing or sitting and other psychological variables such as depression and demographic parameters like age and female are certain factors which contribute to low back pain.[14] There are various interventional strategies which focus on treating the cause and reducing pain and its consequences.[16] which includes improving functioning either by increasing strength or working on mobility,working on core muscles for improving their stability and other manual therapy techniques including Maitland, Mulligan ,Mckenzie and kaltenborn.[17]

Biomechanical associations between low back pain of non specific origin and primary knee osteoarthritis- Primary knee Osteoarthritis and low back pain of non specific origin are the most common problems every physiotherapist comes across with, but sometimes it happens that[18]patients with knee osteoarthritis may not respond well to treatment specific to knee ,which can be due to the possibility of other conditions associated probably low back pain.[19]Lifestyle and activities of daily living is affected in most people because of simultaneous existence of both low back pain and knee osteoarthritis which has been found to be 57.4% prevalent[20]

Severe osteoarthritis exhibited a significantly pelvic incidence ,pelvic tilt and knee flexion angle with a smaller degree of lumbar lordosis which was higher in measurement.The degree of pelvic retroversion was also found to be highly related to knee osteoarthritis.[19]Pelvic retroversion is related to hip external rotation and varus deformity predominantly in standing position.This position tends to increase the medial tibiofemoral load and hence gives rise to knee osteoarthritis in the long run.[21] Thus it can be concluded that knee osteoarthritis and low back pain of non specific origin are biomechanically related[21]

Pelvic stabilization exercises- As already mentioned pelvic stability is found to be affected in patients with knee osteoarthritis and non specific low back pain therefore pelvic stabilization exercises aims to control the pelvic stability which affects the alignment and movement of the lower limb[18] Pelvic stabilization exercises target the core and and hip muscles which play an important role in maintaining the pelvic tilt and rotational movements during normal gait.[22]

Many a times during activities of daily living such as walking , any person with poor pelvic control might try to compensate using accessory muscles and the closed kinetic chain of our body tries to maintain the posture by shifting the forces to the distal joints such as knee. This might lead to varus stress over the knee in due course of time leading to tibiofemoral osteoarthritis.[22] Pelvic stabilization exercises as a whole therefore will help the therapist to target on the entire kinetic chain thus reducing any kind of impairments in both the proximal and distal lower limb joints.[23]

Outcome measures- Western Ontario Mcmaster Universities arthritis index is an important tool used for diagnosing ,evaluating and coming to a conclusion for patients with primary knee osteoarthritis. It consists of 24 items in which 5 items are for pain(walking, lying on bed using stairs),2 items for determining stiffness(in morning and throughout the day) and 17 items for assessing the physical function.(rising from sitting position ,standing, bending, taking on and off socks and getting in and out of car)[24].The scores range from 0-4 in each scale where 0 represents none and 4 represents extreme ,the possible scores for pain component ranges from 0 to 20,for stiffness it ranges from 0 to 8 and for physical function it

ranges from 0 to 68.[25] Thus womac can be used as a reliable and valid tool for primary knee osteoarthritis where internal consistency was found between 0.70 and 0.90 indicating good reliability

Oswestry Disablity Index- The Oswestry Disability Index which is also called as Oswestry Low Back Pain disability questionnaire is a self administered questionnaire used for assessing patients with low back pain and determining the level of functional disability.[26]The questionnaire consists of 10 domains with each section consisting of scores from 0-5 where 0 indicates no disability and 5 indicates maximum disability.[27] The total score is calculated as sum of scores of all the sections divided by total score multiplying it by 100,if sex life is omitted then the total possible score is taken as 45.[28] The interpretation for the scale is 0 to 20% indicates minimal disability,20-40% indicates moderate disbality,40-60% indicates severe disability,60-80% is crippled and 80-100% signifies that the person is bedridden[29] The Oswestry disability index can be used as a significant tool for assessing low back pain with an excellent test retest reliability of 0.90 and construct validity of 0.834[26]

Conventional Physiotherapy intervention focusing mainly on knee has always been the mainstream treatment and various researches have been done proving it to be significant but pelvic stabilization has not solely been considered for the purpose of research seeing its effect mainly on pain and function in primary Knee osteoarthritis is found to have a strong correlation with low back pain, therefore this study will help us to see a relationship and the impact pelvic stabilization will have on osteoarthritic knee

AIMS AND OBJECTIVES OF THE STUDY

AIM OF THE STUDY

To look for the added effect of pelvic stabilization exercises on the level of pain and function in women with primary knee osteoarthritis and back pain of non specific origin

OBJECTIVE OF THE STUDY

- To check the added effect of pelvic stabilization exercises on the level of pain in women with primary knee osteoarthritis and back pain of non specific origin

- To check the added effect of pelvic stabilization exercises on the level of function in women with primary knee osteoarthritis back pain of non specific origin

- To compare the effect of pelvic stabilization exercises and conventional physiotherapy with conventional physiotherapy alone on the level of pain and function in women with osteoarthritis of knee and back pain of non specific origin

HYPOTHESIS OF THE STUDY

Alternating hypothesis

There will be significant added effect of pelvic stabilization exercises and on the level of pain and function in women with primary osteoarthritis of knee.and back pain of non specific origin

Null Hypothesis

There will be no added effect of pelvic stabilization exercises on the level of pain and function in women with primary osteoarthritis of knee and back pain of non specific origin

REVIEW OF LITERATURE

SECTION-1 – Knee osteoarthritis and non specific low back pain

1.**Piyumi Amarsinghe et.al(2023)-** The systematic review conducted to establish a relationship between knee osteoarthritis and low back pain included 13 studies and found out through biomechanical analysis that change in pelvic incidence and lumbopelvic angle was found in patients with knee osteoarthritis and contributed to significant disability levels with the concurrent existence of both low back pain and knee osteoarthritis

2.**Yasushi Oshima et.al(2019)-** A prospective study conducted on total knee arthroplasty patients assessed them through radiographic parameters and concluded that lower extremity plays a significant role in the alignment and knee hip spine interrelations optimizes balance in patients.

3.**H.Lijima et.al(2018)**- A cross sectional study involving 260 adults and through radiograph ic measures the interaction between low back pain and knee pain and it was concluded that low back pain and knee pain contributed to more disabality level when present concurrently

4. **Laura Hutchinson** et.al(**2023**)- The systematic review and meta analysis conducted included 40 studies assessed the knee biomechanics in knee osteoarthritis patients and it ended with the conclusion that gait biomechanics also contributes to pain levels

5.**Sagrio Perez de la cruz et.al(2024**)- The study investigated the impact of non specific low back pain on spinal mobility in 86 participants and assessment was done through Schober test and it was concluded that low back Upain can alter the spinal mobility patterns

6**.Aimin Gong et.al (2024**)- This study had some genetic basis and revealed a significant relationship between arthritis and low back pain and it highlighted the findings of importance of genetic predisposition for development of both the conditions

7. **Oyko Tomay Aksoy et.al(2025)**- The cross sectional study conducted involved 69 women highlighted the relationship between spinopelvic alignment and knee osteoarthritis and the findings suggested that global sagittal imbalance and lumbopelvic mismatch are contributors for knee osteoarthritis

8.**Rakhmad Rosadi et.al(2022**)- The cross sectional study conducted had 372 participants and key factors for fall risk were identified and it was highlighted that knee proprioception and range of motion were influencing the fall associated risks

9. **Pradeep suri et.al(2010**)- This study highlighted that patients with knee osteoarthritis also had low back pain and the pain severity was higher as found on the womac scale ,any other associated pain in multiple regions of the body also highlighted the pain

10. **Oliver Guerard et.al(2020**)- The cross sectional study of 221 individuals with knee osteoarrhritis and the grouping was done according to pain pattern and it was said that widespread pain is linked to functional impairment in knee osteoarrhritis

11. **Tomohori oka et.al(2021**)- The study conducted in older adults with both knee osteoarthritis and low back pain suggested that the level of activity was reduced in such individuals .this study suggested that combined knee pain and low back pain is important for improving activity levels

12. **Doha Dahamani et.al**(**2023)-** The cross sectional study conducted in 178 knee osteoarthritis and 118 low back pain patients found the impact of central sensitization on pain and disbality and it was concluded that central sensitization level directly was proportional to pain and disability levels.

SECTION 2- Intervention- Pelvic stabilization exercises and conventional physiotherapy

13. **Salman Khan et.al**(**2024**)- The randomized controlled trial performed included patients with lumbar radiculopathy and the experimental group was given a combination of both stabilizationa exercises along with positional distraction unlike the control group and it was found that symptoms and function improved for the experimental group thus showing the utility of stabilization exercises

14.**Amr Abdel Aziem et.al(2023**)- The study was conducted in women with non specific low back pain and the experimental group received pelvic floor exercises along with strengthening exercises and physical therapy modalities and it was found that pain intensity,functional disability and trunk endurance improved for the group more than that of the control group

15.**J A Nicholson et.al**(**2016)-** The systematic review conducted included older adults with low back pain and knee osteoarthritis and graded behavioural exercises

along with counseling sessions found to increase the exercise compliance in older adults

16.**T.Hoglund et.al(2018**)- A 6 week exercise program focusimg on hip and core was carried out in women with patellofemoral osteoarthritis and there was significant improvement found in pain,quality of life and physical performance and the exercise compliance was also good(Pilot study)

17**.Lun Victor et.al**(**2015**)- A single blinded randomized trial was performed where hip and quadriceps strengthening was compared for patients with knee osteoarthritis and it was found that both the groups gave similar therapeutic benefits and both were equally significant

18.**Daniel Hernandez et.al(2019**)- The study was conducted for 12 week period where exeperimental group received both conventional and core strengthening exercises and control group received only conventional physiotherapy where it suggested that symptoms improved for the core exercise group

19.**Kim L.Benell et.al**(**2007)-** The study included hip strengthening for patients with knee osteoarthritis and it was found out that hip muscle strength and and enhanced the physical function suggesting hip strengthening for abductor and adductor is a viable physiotherapy option.

20.**Daniel W.Flowers et.al**(**2021**)- A narrative review done which suggested that core training improves gait,reduces load and improves function,but still has not been a standard protocol along with mainstream conventional protocol

21.**Freiezziero et.al(2021)-** The study talks about core stability exercises enhancing deep trunk muscle activation which includes transversus abdominis and multifidus, and also are efficient in improving prorprioception and balance.

22. **Shahul Hameed Pakkir et.al(2022**)- A double blinded parallel study was done where one group was undergone conventional physiotherapy along with kinesiotaping and another group only conventional physiotherapy and it was concluded that pain and knee function along with womac and timed up and go scores improved in the conventional physiotherapy and kinesiotaping grou**p.**

SECTION 3 – Outcome measures

WOMAC- 23**. Jose Edson et.al(2023)-** The shortest version of the womac scale was assessed for reliability and construct validity which was >=0.76 and cronbach's alpha >=0.84, and construct validity>0.50 without any flooring and ceiling effect making it a reliable and valid tool for use

24.**Polaine TS Lage et.al(2020)-** The measurement properties of the Portuguese Brazilian version of WOMAC was assessed where Cronbach's alpha(0.92-0.98), Intraclass correlatiin coefficient was 0.85-0.97 suggesting the test retest reliability to be high making the Portuguese Brazilian version a reliable and valid tool

25.**Vincent Marot et.al(2018)-** A multicenter cross sectional study conducted were Knee osteoarthritis outcome score and WOMAc was compared it was suggested that both the scales showed significant difference based on age,gender and basal metabolic index.

26.**F.Salaffi et.al**(**2003**)- This study assessed the Italian version of the WOMAC questionnaire where cronbach's alpha was 0.91 for pain,0.81 for stiffness and 0.84 for function and the test retest reliability was 0.86 for pain,0.68 for stiffness and 0.89 for function thus indicating the Italian version to be a reliable and valid tool for assessment

ODI- 27.**Konsta Koivunen et.al(2024**)- The reliability and validity of the scale was measured in patients undergone lumbar spinal surgery in 1515 patients and the cronbach's alpha was 0.87 and some factors like travelling and social life had highest correlation making it a reliable and valid tool to use.

28.**Dinesh Sandal et.al**(**2021)**- The Punjabi version of the scale was assessed in mechanical low back pain punjabi patients and the values for internal consistency and test retest reliability was 0.72 and 0.891 respectively and the construct validity was found to have a moderate correlation with visual analogue scale for pain thus proving ODI to be valid and reliable

29.**Micheal Vianin et.al**(**2008)**- The psychometric properties for the ODI questionnaire was assessed and it exhibited a strong internal consistency and test retest reliability of 0.83-0.99 making it a reliable and clinically useful tool for use

30.**Allen Jenks et.al(2022)-** A comparison was made between the Roland Morris Disability Questionnaire, Oswestry Disability Index and Quebec Back pain disability scale and all showed a high internal consistency of 0.86-0.94 and high test retest reliability of 0.84-0.89 and also showed good construct validity suggesting these tools to be appropriate and accurate for use.

METHODOLGY AND PROCEDURE

METHODOLOGY

The study titled Effect of pelvic stabilization exercises and conventional physiotherapy on pain and function in women with primary knee osteoarthritis and non specific low back pain was a randomized controlled trial where participants where included based on American college of Rhuematology criteria and for primary knee osteoarthritis and any pain originating from bones,joints or muscles and not from any other underlying mechanism was considered to be the criteria for non specific low back pain.

Any participant having any history of previous knee surgery ,fracture and tumor infection and systemic arthritis ,intraarticular injection in the knee and any other joint pathology and surgery of the back were not included for the study

A total of 56 female participants calculated through G power were included in the study aged between 50 -75 yrs physically assessed and diagnosed for primary knee osteoarthritis and low back pain of non specific origin,participants were selected using simple random sampling

INTERVENTION- 28 participants each were assigned to both the control and experimental group ,the experimental group received both pelvic stabilization exercises along with conventional physiotherapy and the control group received only conventional physiotherapy ,for pelvic stabilization exercises Bilateral leg raise,Clamshell exercise,Single leg pelvic bridge and 90-90 hip knee flexion in crook lying was given and the conventional therapy included isometric exercises for the quadriceps,isotonic exercises,Vastus medialis oblique strengthening .The

exercise were administered to the participants for 4 weeks 3 sessions per week and for the first 2 weeks the hold time was 5 seconds which was increased to 10 seconds for the consecutive 2 weeks.

OUTCOME MEASURES- The primary outcome measure used was WOMAC(A scale primarily used for knee osteoarthritis which consists of five questions related to pain, two on stiffness and seventeen on activities of daily living where 0 represents no pain and 4 represents extreme pain and the total score is calculated out of 96) , and the secondary outcome measure used was ODI(A scale mainly used for low back pain,consists of 10 questions relayed to daily activities where 0 represents hardly any disability and 5 represents maximum pain and disability and the score is calculated out of 50 and converted into percentage) ,both the outcome measures taken had an excellent test retest reliability .The baseline scores were taken before intervention was administered and at the termination of 4 weeks the post exercise scores were recorded and the comparison was made

The result was obtained using the data by SPSS Version 27 software and ethical permission was obtained from Absmari Ethical committee

INCLUSION CRITERIA

INCLUSION CRITERIA FOR KNEE OSTEOARTHRITIS(According to American College of Rhuematology Criteria)

- Females> 50yrs
- Morning Stiffness< 30 min

- Presence of crepitus, bony tenderness and bony enlargement
- No palpable warmth

Criteria for low back pain of non specific origin

- Any Pain originating from bones, joints, or muscles and not from any other unique underlying mechanim

EXCLUSION CRITERIA

- Any history of previous knee surgery, fracture and tumor, infection
- Any systemic arthritis
- Any intraarticular injection in the knee
- Any other joint pathology
- Any surgery of the back

Outcome Measures

PRIMARY OUTCOME MEASURE

Western Ontario Mcmaster Universities Arthritis Index

SECONDARY OUTCOME MEASURE

Oswestry Disability Index low back Pain Index Scale.

Variables

Independent Variables

Age

Gender

Pelvic stabilization exercises and conventional physiotherapy

Dependent variables

Western Ontario Mcmaster Universities Arthritis Index

Oswestry Disability Index low back Pain Index Scale

Procedure

The study was conducted for a period of 4 weeks at Max Physio and Rehab Clinic

1. Participants were recruited from max physio and rehab clinic and the information regarding the study was provided by the principal investigator. The participants were chosen basing upon the inclusion and exclusion criteria. All the participants of the study were thoroughly explained regarding the purpose ,process and outcomes of the study. A written informed consent was taken before including the subjects for the trial.

2. After the participants were recruited through a baseline assessment basing upon the inclusion and exclusion criteria they were randomly allotted to two groups through an allocation concealment using opaque envelopes, each group containing 28 participants for a total of 56 subjects

3. After the subjects were allocated to two groups the data was taken usingWOMAC as the Primary outcome measure and ODI as the Secondary

outcome measure ,other assessment measures used were Numeric pain rating scale, manual muscle testing and ROM for the lower limb and spine using a goniometer.

4. Exercise Protocol

Group A- Conventional Physiotherapy

Participants in this group received standard physiotherapy exercises aimed at improving knee function. The key exercises were

- Isometrics for quadriceps
- VMO strengthening
- Isotonic exercises for quadriceps
- Straight leg raise

Group B- Experimental group- Pelvic stabilization along with conventional physiotherapy management .The structured exercise programme included the conventional physiotherapy protocol as administered to the control group along with other exercises like

- Clamshell
- Bilateral Leg raise
- Hip knee flexion-90-90
- Unilateral pelvic bridge

All the exercises were done with a hold time of 5 secs initially for the first 2 weeks and then progressed to a hold time of 10 secs for the next 2 weeks

Frequency- 3 days per week

Time – 30-45 minutes

Total period- 4 weeks

Groups	**Intervention**	**Dosage**	**Duration**
Experimental group	Pelvic stabilization exercises	30-45 mins for 10 reps, hold time of 5 secs for 1st 2 weeks progressed to 10 secs for next 2 weeks	3 sessions per week for 4 weeks
Control Group	Conventional Physiotherapy exercises	30-45 mins for 10 reps, hold time of 5 secs for 1st 2 weeks progressed to 10 secs for next 2 weeks	3 sessions per week for 4 weeks

5. At the termination of 4 weeks the data was recorded post exercise using WOMAC and ODI , the data was taken maintaining atmost accuracy and consistency for baseline comparison

6. During the trial the subjects were constantly checked for any kind of pain,swelling or any other unusual symptom.The sores were constantly evaluated and no adverse events were found during the trial duration
7. After the post exercise data was taken ,the pre and post exercise scores were saved in excel sheets for further data analysis

Sample size calculation

Sample size was calculated in G-Power software using effect size (0.8), alpha (0.05), power (0.95).

Materials used:

Pen

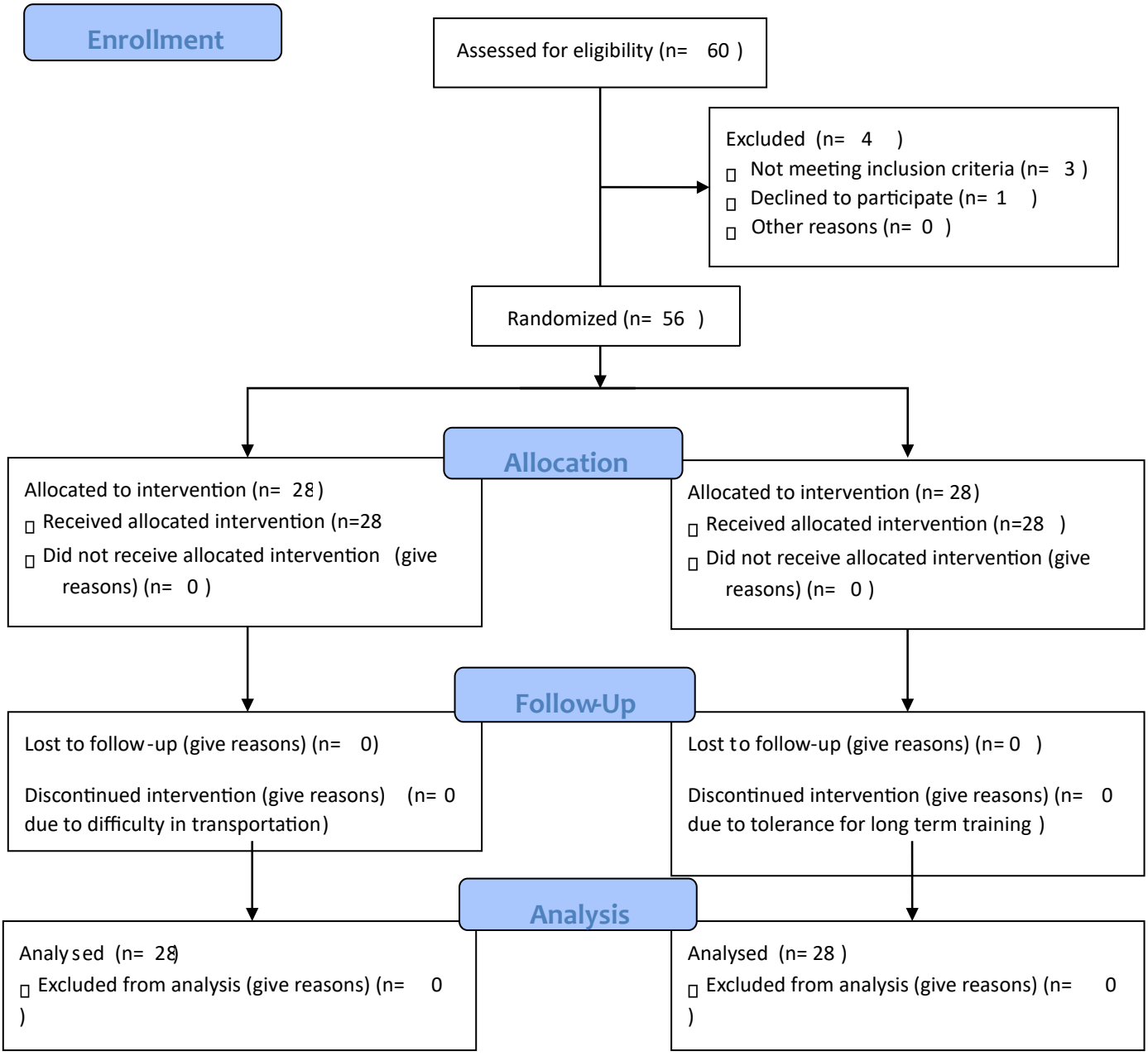
Print out of outcome measures

Assessment form

Goniometer

Manual muscle testing chart

CONSORT 2010 Flow Diagram



PELVIC STABILIZATION EXERCISES FOR THE EXPERIMENTAL GROUP

FIG 1.1- CLAMSHELL EXERCISE

FIGURE 1.2 – UNILATERAL PELVIC BRIDGING

FIG 1.3- BILATERAL STRAIGHT LEG RAISE

FIGURE 1.4 – HIP KNEE FLEXION 90^{O}-90^{O}

CONVENTIONAL EXERCISES FOR THE CONTROL GROUP

FIG 1.5- STATIC QUADRICEPS

FIG 1.6- STATIC HAMSTRINGS

FIGURE 1.7- STATIC VASTUS MEDIUS OBLIQUES

FIGURE 1.8- ISOTONIC CONTRACTION OF QUADRICEPS

STATISTICAL ANALYSIS

STATISTICAL ANALYSIS

Analysis of data was done using Statistical package for social sciences version 27, where the level of significance was < .05.For calculating mean and standard deviation descriptive statistics was taken into account .Normality of data was assessed using Shapiro wilk test. For evaluating the between and within group differences t test was done

RESULT OF THE STUDY

RESULT

In this clinical trial 56 Females having primary knee osteoarthritis and low back pain of non specific origin were recruited. The participants underwent a 4 week exercise program after which data was analysed with the help of SPSS for these subjects

Demographic Details - Group 1 (Table 1.1,Fig 1.9)

The Experimental group 1 consisted of 28 subjects with primary knee osteoarthritis and low back pain of non specific origin with mean Age(58±5.97)

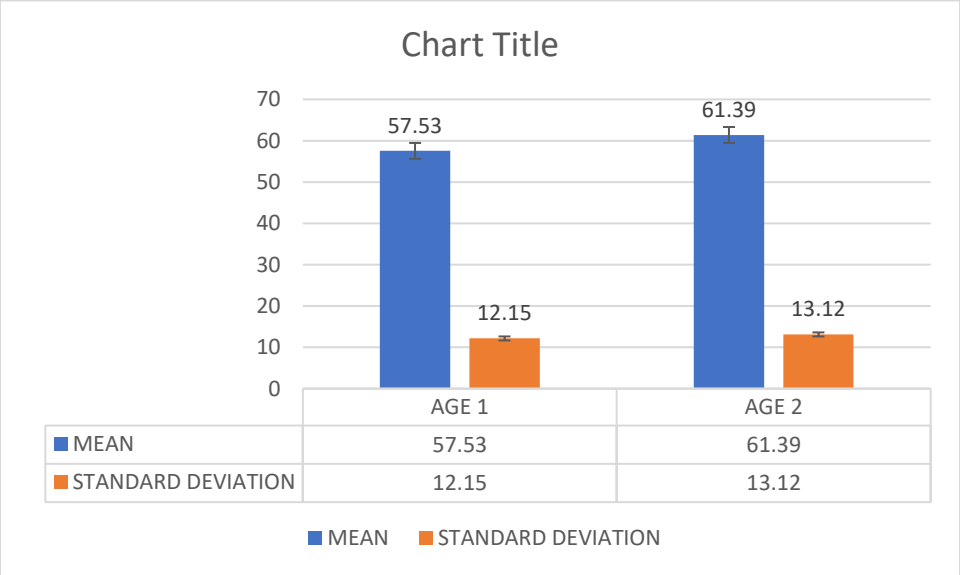
Demographic Details - Group 2

The control group comprised of 28 subjects with mean Age (61.39±6.61)year

Table 1.1: Demographic details of Group 1 and Group 2

Variables	Group 1 (n=28)	Group 2(n=28)
	Mean ± SD	Mean ± SD
Age (in years)	58 ±5.97	61.39 ±6.61

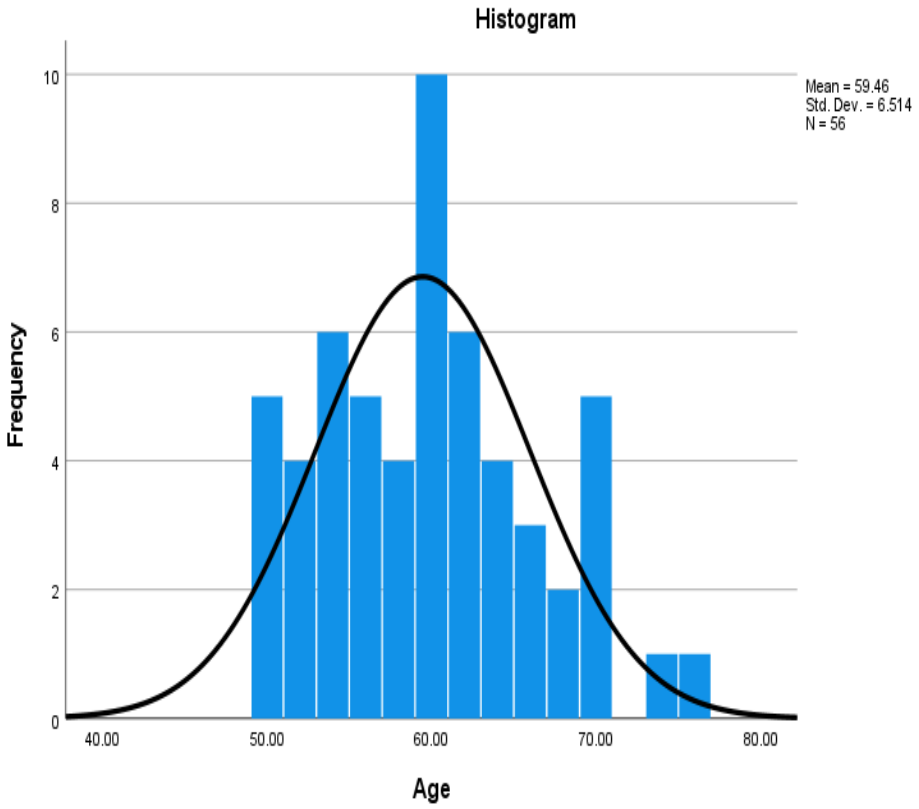
- Group 1- Experimental group
- Group 2- Control Group



Graph – 1.9- Graph for age(Demographic details) for both the groups

p value > 0.05(0.138)- group 1, p value>0.05(0.506)- Significant for both the groups, mean value for group 1 is 57.53 and for group 2 it is 61.39

0



Graph 1.10- Normality graph for AGE

Pre exercise and Post exercise comparison scores of Group 1

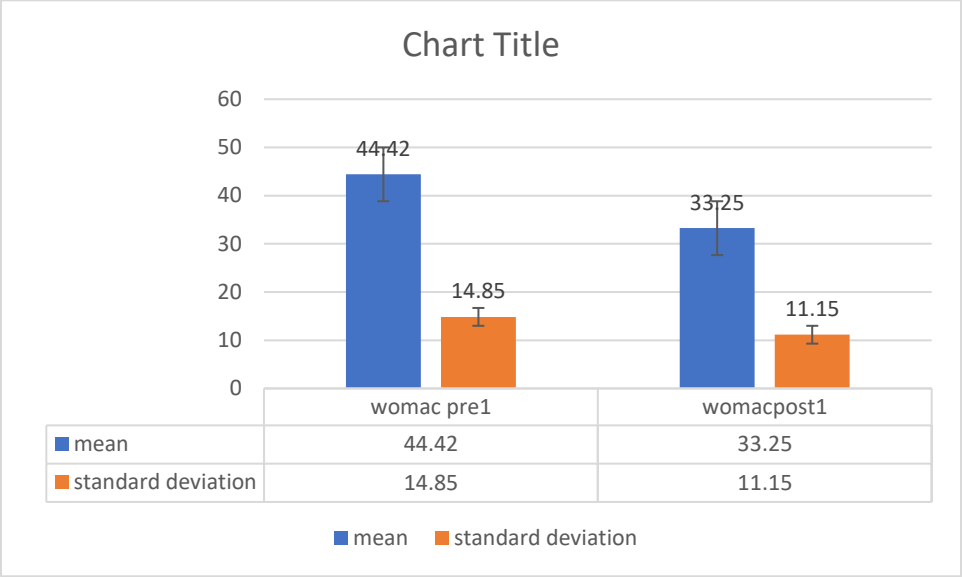
The pre exercise scores (mean=44.42, Standard deviation=12.57) and post exercise scores (mean=33.25, Standard deviation=9.46) for WOMAC in Group 1 reflected significant difference (t=18.84, p=0.00)

(Table 1.2, Figure 1.10,1.11)

The pre exercise scores (mean=12.5, SD=6.23) and post exercise scores (mean=8.78, SD=4.31) for ODI in Group 1 reflected significant difference (t=10, p=0.00)

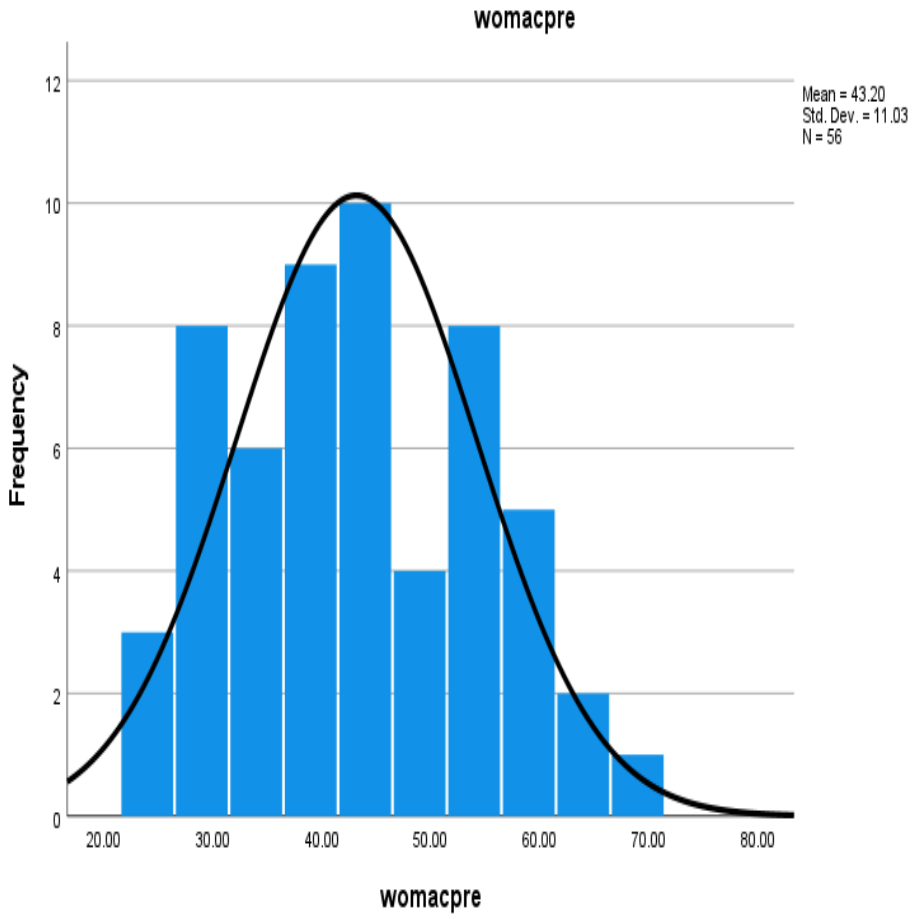
Table 1.2: Comparison of pre and post intervention scores of Group 1

Variables	Scores		t	P*
	Pre Mean (SD)	Post Mean (SD)		
WOMAC	44.42 ±12.57	33.25±9.46	18.84	0.00
ODI	12.5 ±6.23	8.78±4.31	10	0.00

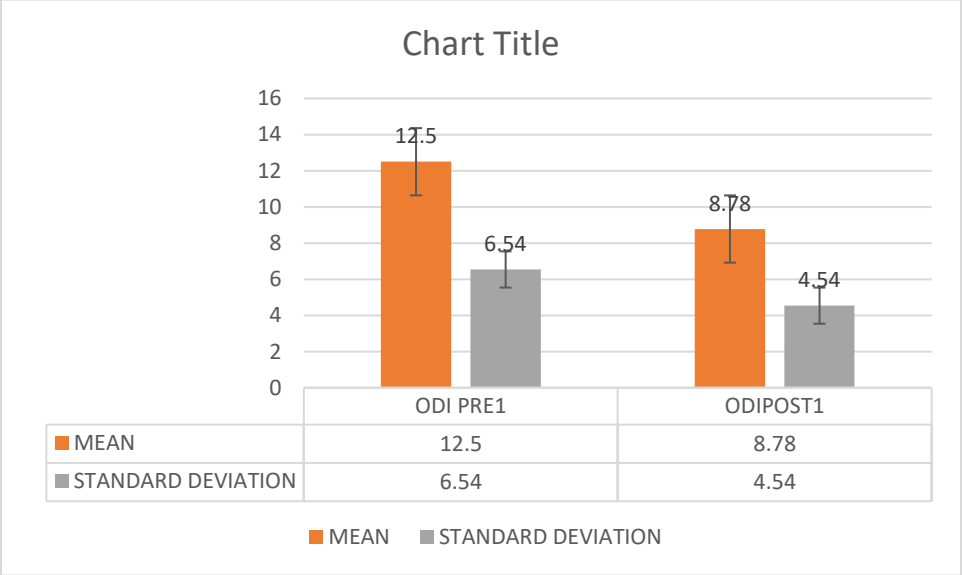


Graph--1.11- Graph for mean and standard deviation for WOMAC scores(pre - post)- group 1

p value<0.01(significant) ,mean value for WOMAC for group1(pre) is 44.42 and for post it is 33.25 indicating improvement

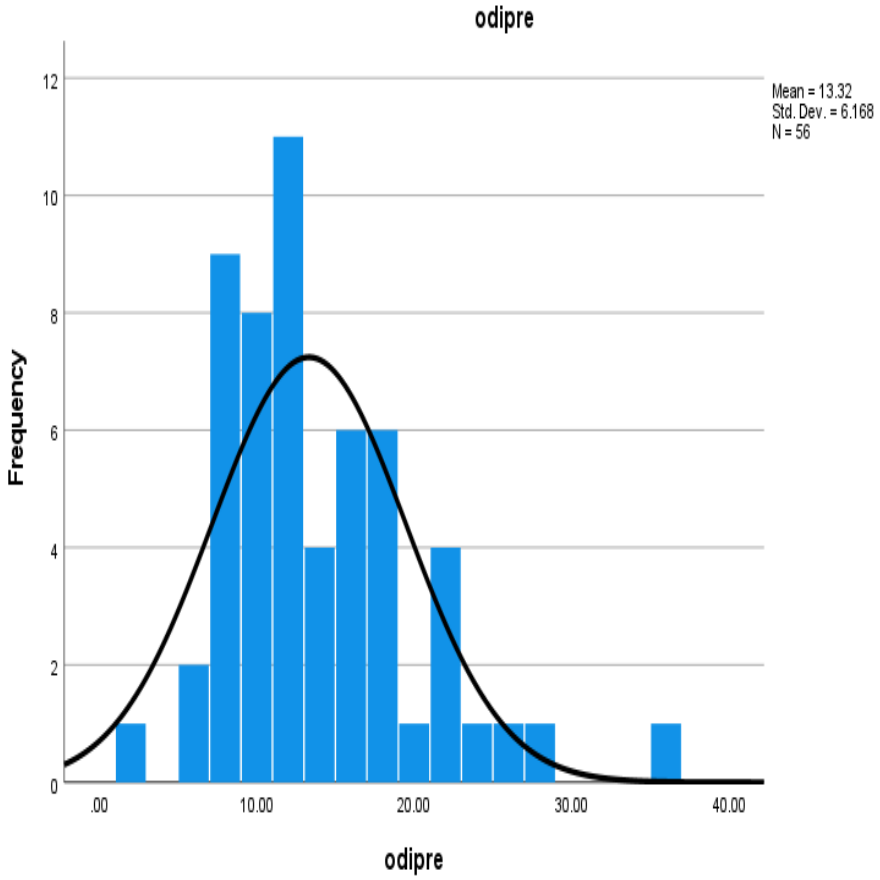


Graph 1.12 Normality graph for WOMAC(PRE DATA)



Graph- 1.13 - Graph for mean and standard deviation for ODI scores(pre -post)- group 1

p value<0.01(significant) ,mean value for ODI(pre) for group 1 is 12.5 and for post it is 8.78,suggesting overall improvement



Graph 1.14 Normality graph for ODI (PRE DATA)

Pre-exercise and Post exercise comparison scores of Group 2

The pre exercise scores (mean=41.96, Standard deviation=9.29) and post exercise scores (mean=39.42, Standard deviation=9.44) for WOMAC in Group 2 reflected significant difference (t=12.143, p=0.00)(Table 1.3,Fig 1.12,1.13)

The pre exercise scores (mean=14.14, Standard deviation=6.10) and post exercise scores (mean=12.03, Standard deviation=5.96) for ODI Group 2 reflected significant difference (t=19.66, p=0.00)

Table 1.3: Comparison of pre and post intervention scores of Group 2

Variables	Scores		t	P*
	Pre Mean (SD)	Post Mean (SD)		
WOMAC	41.96±9.29	39.42±9.44	12.143	0.00
ODI	14.14±6.10	12.03±5.96	19.66	0.00

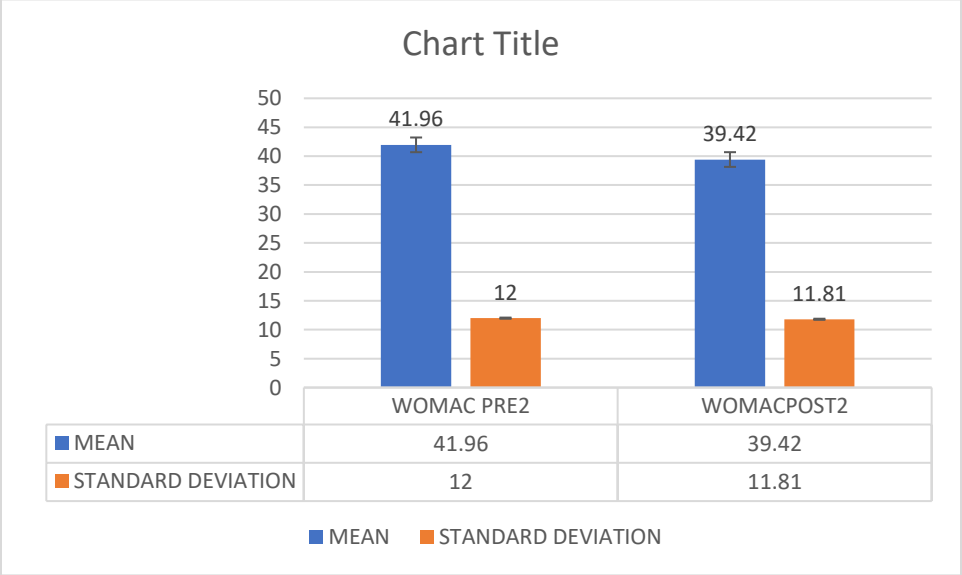


Fig- 1.15 - Graph for mean and standard deviation for WOMAC scores(pre -post)- group 2

p value<0.01(significant), mean value for WOMAC for group 2(pre) is 41.96 and for (post) it is 39.42,indicating improvement

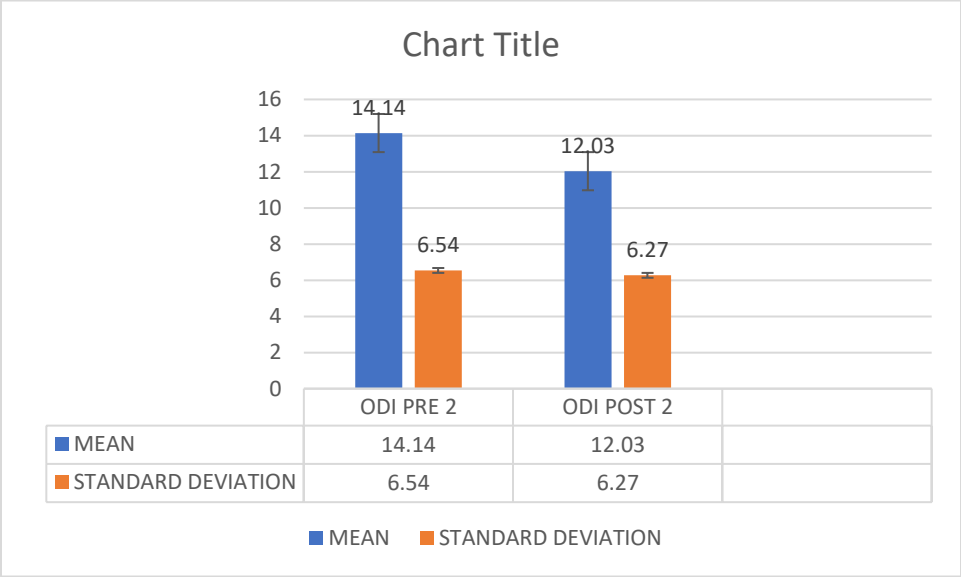


Fig 1.16- Graph for mean and standard deviation for ODI scores (pre-post)- Group 2

P value<0.01(Significant) ,mean value for ODI for group 2(pre) is 14.14 and for(post) it is 12.03 indicating improvement

Mean change score comparison of Group 1 and Group 2

The mean change scores for WOMAC between Group 1 (mean=33.25, Standard deviation=9.46) and Group 2 (mean=39.42, Standard deviation=9.44) showed no significant difference (Mean difference =6.17 t =- 2.44, P=0.018) (Table 1.4, Figure 1.14,1.13).

The mean change scores for ODI between Group 1 (mean=8.78, Standard deviation=4.31) and Group 2 (mean=12., Standard deviation=5.96) showed no significant difference (MD=3.25 t = -2.336, P=0.023) (Table 1.4, Figure 1.14).

Table 1.4: Comparison of mean change of scores in both the groups

Variables	Group1 (n=28)		Group2(n=28)		Mean Diff	t	P*
	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)			
WOMAC	44.42 ±12.57	33.25±9.46	41.96±9.29	33.92±3.94	6.17	-2.44	0.018
ODI	12.5 ±6.23	8.78±4.31	14.14±6.10	12±5.96	3.25	-2.336	0.023

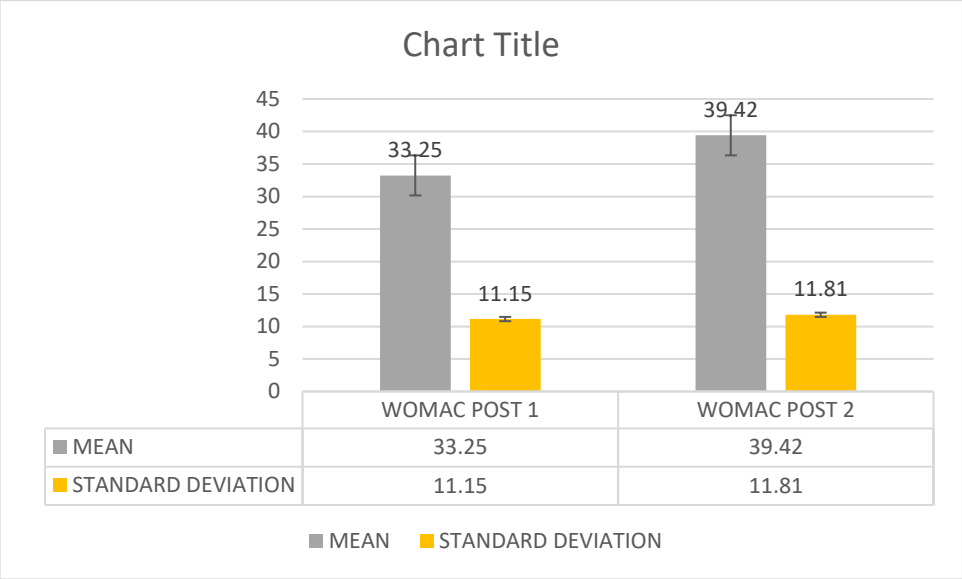


Fig 1.17- Graph for mean and standard deviation for WOMAC POST scores - Group 1 and Group 2

P value=0.018, the mean value for WOMAC for post scores in both the groups has not been found to be decreased much suggesting mild improvement

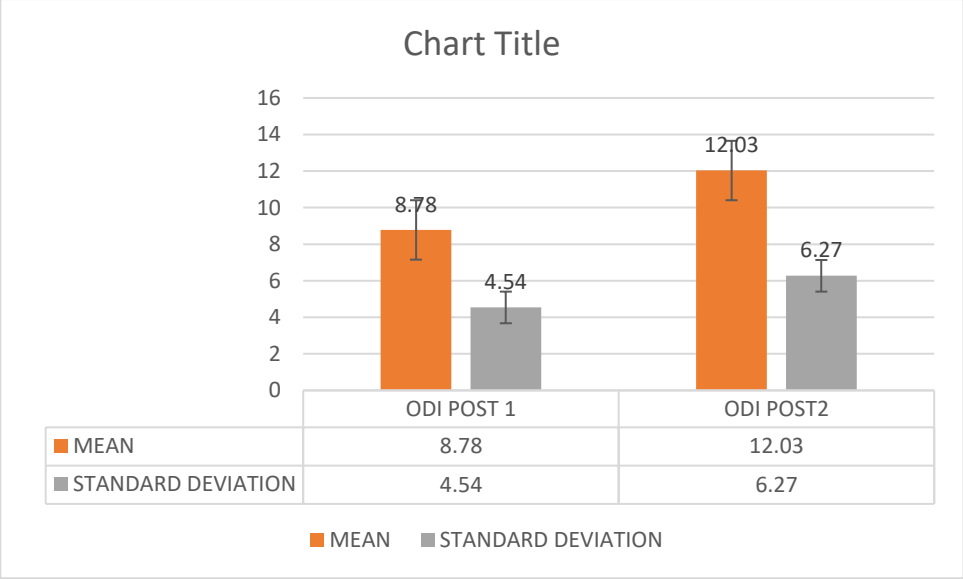


Fig 1.18- Graph for mean and standard deviation for ODI post scores- Group 1 and Group 2

P value= 0.023, the mean value for ODI for post scores in both the groups has not been found to be decreased much suggesting mild improvement

DISCUSSION

People having simultaneous occurrence of primary knee osteoarthritis and non specific low back pain have face a lot of difficulties due to increase in pain and disability levels (18).Conventional physiotherapy has always been used to treat patients with such conditions but a biomechanical link of the body of the spine and knee sometimes helps us to work on associated proximal joint which can also be the real cause of pain.In this study pelvic stabilization exercises along with conventional physiotherapy was used as the main treatment to work on pain and function in subjects with primary knee osteoarthritis and non low back pain of non specific origin

Previous studies have proven the existence of closed kinetic chain in the body.Any problem in any of the joint like in the spine can bring about a biomechanical change in the associated distal joint like in the knee. The knee hip spine syndrome helps guides in assessing and treating the patient as a whole to eliminate the source of pain from any other associated joint apart from the complaining joint.(20).

The presence of both knee osteoarthritis and low back pain of non specific origin has lead to increased level of pain and reduce the functional level of individuals.In the current study pelvic stabilization exercise along with conventional physiotherapy was used to primarily see the effect on pain and function in females with primary knee osteoarthritis.

Of the total number of subjects of 56, 28 subjects belonging to the experimental group were given pelvic stabilization exercise along with conventional

physiotherapy and the control group with 28 subjects was treated with only the conventional means

The results showed significant improvement in the pain and functional components for the pain and functional components in the experimental group for WOMAC. This could be due to activation of pelvic muscles which overall improves the knee joint biomechanics,providing proximal stability to the knee(23).There is reduction of load on the knee joint thus reducing pain and improving the overall perceived functional disability.Basing on previous studies increase in pelvic stability improves the lower extremity alignment and thus alleviates pain and enhances physical function.According to findings based on Osteoarthritis Research Society International for managing osteoarthritis strengthening exercises help to inhibit the action of pain fibres,there is found to have been release of endorphin post exercise which potentially relieves pain and reduces disability levels(30).

The results showed significant improvement in the ten item ODI questionnaire for the experimental group. The positive results could have been attributed to the enhancement of lumbar function and trunk muscle strength.Pelvic stabilization program helps in the activation of deep stabilizing muscles and enhance the efficiency of activating the muscles through the help of motor learning.This leads to better control over muscle contractions and improving spinal stability thus reducing pain and giving a positive outcome for functional activities(31).

The results were significant for the control group were conventional therapy was administered ,the results were positive for the WOMAC questionnaire ,which can be primarily because of release of endogenous opiods resulting in decreased pain

perception(30).The conventional protocol improves the descending pain by releasing serotonin and other neurotransmitters like dopamine.Exercise also is proven to have an anti inflammatory effect improving functioning and also works on axonal regeneration which leads to proper pain signal conduction(32)

The results found out were also significant for the Oswestry low back pain disability questionnaire. The conventional therapy given primarily for knee osteoarthritis targeted on hip and knee muscles.The possible reason could be due to the co relation of the joints in the body which share a biomechanical connection(18). The close link between abnormal spinal posture and overloading of the knee brings about simultaneous changes in both the joints.Exercise triggers the inhibition of pain perception as a result of which there is decrease in pain and improved functional level in the knee, and that as a result of the closed kinetic chain of the body also brings about a change in the spinal posture thus reducing disability levels for the back and reducing the pain perception(20)

The results between both the groups was found to be mild significant for both WOMAC and ODI for both the groups. The primary reason could be due to existence of both the conditions in a single subject.

The analysis conducted primarily wanted to see the effect of pelvic stabilization exercises along with conventional physiotherapy primarily on knee osteoarthritis. thus leading to establishment of relationship within the outcome measures,but the current study could not establish a significant relationship between both the measures in patients with concurrent existence of knee osteoarthritis and low back pain of non specific origin.To establish a significant relationship between both the

conditions probably a study with a large sample size could be done.Future studies can focus on longitudinal studies by increasing the time duration of intervention for more significant results between both the groups.

CONCLUSION

The study concluded that pelvic stabilization exercises along with conventional physiotherapy is useful for improving pain and functional outcomes in patients with primary knee osteoarthritis and low back pain of non specific origin

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE STUDY

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE STUDY

To establish a significant relationship between both the conditions and results with more significance probably a study with a large sample size could have been done.Future studies can focus on longitudinal studies by increasing the time duration of intervention for more significant results between both the groups

SUMMARY OF THE STUDY

SUMMARY

The study conducted on females with primary knee osteoarthritis and low back pain of non specific origin where pelvic stabilization exercises along with conventional physiotherapy was administered to one group and only conventional exercises was administered to a other group pre and post evaluation was done through WOMAC and ODI and the results obtained through analysis of data showed us that both the exercise protocols are effective in improving symptoms in simultaneous existence of both the conditions and a standard protocol targeting both the knee and back can be implemented in subjects having both the conditions

STATEMENT OF FUNDING

Source of Funding: Not Applicable

Nature of Funding: Not applicable

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ANNEXURES

INFORMED CONSENT

Informed Consent form to participate in a clinical trial

Study Title Effect of Multimodal Cawthorne-Cooksey Exercises on enhancing locomotion and cognitive functions in older adults with mild cognitive impairment: A Single-Blind Experimental Design

Study Number:

Subject 's Name: _____ Subject 's Initials: _____

Date of Birth / Age: _____

Address of the Subject_____

Qualification _____

Occupation: Student/Self-Employed/ Service/Housewife/Others (Please tick as appropriate)

Please initial box

(Subject)

I. I confirm that I have read and understood the information sheet dated _____ [ ] for the above study and have had the opportunity to ask questions.

II. I understand that my participation in the study is voluntary and that I am [ ] free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

III. I understand that the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.

IV. I agree not to restrict the use of any data or results that arise from this [ ] study provided such a use is only for scientific purpose(s)

V. I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:

_____

Date: ____/____/_____

Signatory 's Name: _____

Signature of the Investigator: _____

Date: Study Investigator 's Name: _____

Signature of the Witness: _____

Date: _____/_____/_____

Name of the Witness: _____

*Copy of the Patient Information Sheet and duly filled Informed Consent Form shall be handled over to the subject or his/her attendant.

NO OBJECTION CERTIFICATE

This is to certify that, **MAX PHYSIO AND REHAB CLINIC** has no objection for the participation of patients in the research work being conducted by **UDITA MISHRA, MPT(ORTHO)**. The patients selected according to the inclusion and exclusion criteria have been granted permission to participate in the research project titled **Effect of pelvic stabilization and conventional Physiotherapy Treatment on women with Primary Knee Osteoarthritis and Non specific Low Back Pain :Randomised Controlled Trial** under supervision.WE acknowledges that the research will be conducted in a safe and ethical manner, and we have no objections to their involvement.

We trust that the participation of our patients in this research will be a valuable learning experience for them. Kindly ensure their safety and well-being throughout the research process.

Swasti Parida

Max Physio & Rehab Clinic
Professor Pada, Cuttack
Mob- 9124777195

Seal and signature of the clinic head

Name of clinic: MAX PHYSIO AND REHAB CLINIC

Place: Bajrakabati, Cuttack

Date:

ANNEXURE -2

Patient Information:

- **Name**: _____
- **Age**: _____
- **Sex**: _____
- **Occupation**: _____
- **Date of Assessment**: _____
- **Chief Complaint**: _____

---

1. Patient History:

- **Knee Osteoarthritis (OA)**:
    - Onset of knee pain: _____
    - Duration of symptoms: _____
    - Symptom progression: Gradual/Acute
    - Aggravating factors: (e.g., walking, stairs, prolonged sitting) _____
    - Previous treatments: (e.g., physiotherapy, injections) _____
- **Non-Specific Low Back Pain (NSLBP)**:
    - Onset of low back pain: _____
    - Duration of symptoms: _____
    - Aggravating factors: (e.g., bending, lifting, prolonged sitting) _____
    - Previous treatments: (e.g., physiotherapy, medication, massage) _____

---

2. Pain Assessment:

- **Pain Intensity**: Numeric Pain Rating Scale (0-10 scale) _____
- **Pain Characteristics**:
    - Type of pain: (e.g., dull, sharp, aching, throbbing, burning): _____
    - Pain onset: (Sudden/Gradual): _____
    - Aggravating factors: _____
    - Relieving factors: _____
    - Pain during activity: _____
    - Pain at rest: _____

---

3. Functional Assessment:

- **Knee OA**:
    - **WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index)**:
        - Pain Subscale: _____
        - Stiffness Subscale: _____
        - Physical Function Subscale: _____
        - Total Score: _____ (higher score indicates worse function)
- **NSLBP**:
    - **Oswestry Disability Index (ODI)**: (Score range: 0-100, higher score = worse disability)
        - Pain intensity: _____
        - Personal care: _____
        - Lifting: _____
        - Walking: _____
        - Sitting: _____

- Standing: _____
- Sleeping: _____
- Social life: _____
- Traveling: _____

---

4. Physical Examination:

- **Knee OA**:
  - **Inspection**: Joint swelling, deformity, muscle atrophy
  - **Palpation**: Tenderness over joint line, patella, medial/lateral aspects of the knee
  - **Range of Motion (ROM)**:
    - **Flexion**: _____° (Normal: 0-135°)
    - **Extension**: _____° (Normal: 0°)

    Hip – Flexion-

    Extension-

    Internal Rotation-

    External Rotation-

    Ankle- Plantarflexion-

    Dorsiflexion-

    Inversion-

    Eversion-
  - **Special Tests**:
    - **McMurray's Test** (for meniscal tear): Positive/Negative
    - **Apley's Compression Test** (for meniscal pathology): Positive/Negative
    - **Patellar Grind Test** (for patellofemoral dysfunction): Positive/Negative
    - **Anterior Drawer Test** (for ACL injury): Positive/Negative

        - **Lachman's Test** (for ACL injury): Positive/Negative

- **NSLBP**:
    - **Inspection**:
        - Postural assessment (e.g., scoliosis, lordosis, kyphosis)
        - Gait abnormalities (e.g., limping, shuffling)
    - **Palpation**: Tenderness in lumbar spine, sacroiliac joints, or paraspinal muscles
    - **Range of Motion (ROM)**:
        - **Flexion**: _____° (Normal: 80-90°)
        - **Extension**: _____° (Normal: 20-30°)
        - **Lateral Flexion**: _____° (Normal: 25-30°)
        - **Rotation**: _____° (Normal: 30-40°)
    - **Special Tests**:
        - **Straight Leg Raise (SLR)**: Positive/Negative
        - **Prone Knee Bend Test** (for femoral nerve involvement): Positive/Negative
        - **Slump Test** (for neural tension): Positive/Negative
        - **Patrick's Test (FABER)** (for hip or SI joint pathology): Positive/Negative
        - **Trendelenburg Test** (for gluteal weakness): Positive/Negative

---

5. Neurological Examination

- **Reflexes**: Normal deep tendon reflexes (e.g., patellar, Achilles, biceps, triceps).
- **Sensory Testing**: Normal sensation to light touch, pinprick, and temperature.
- **Motor Function**: Normal strength in all major muscle groups (graded from 0-5).

- **Cranial Nerves**: Intact and normal.
- **Coordination**: Normal (e.g., finger-to-nose test, heel-to-shin test)

ANNEXURE-3

ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE, BHUBANESWAR, ODISHA

CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/184

Date: 13/05/2025

APPROVAL LETTER
APPENDIX- VIII

To,

UDITA MISHRA
ABSMARI
273, PAHAL, BHUBANEWAR-752101

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

Protocol Title: Impact of pelvic stabilization exercises and conventional Physiotherapy Treatment on women with Primary Knee Osteoarthritis and Non specific Low Back Pain- A Randomized Controlled Trial

Protocol ID.: ABS-IEC-2025-PHY-088

Subject: Approval for the conduct of the above referenced study

Dear Mr./**Ms.**/Dr **Udita Mishra**
With reference to your Submission letter dated 06/01/2025 the ABSMARI IEC has reviewed and discussed your application for conduct of the study on dated 26/04/2025.

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	26/04/2025
2	Informed Consent Form	26/04/2025
3	Undertaking form PI	26/04/2025
4	CRF	26/04/2025
5	COI from the Investigators	26/04/2025

The following members were present at meeting held on 26-04-2025

ABSMARI ETHICS COMMITTEE * BHUBANESWAR * Dt. 13/05/25

ANNEXURE -4

EXPERIMENTAL GROUP

	NAME	AGE	WOMAC(PRE)/96	ODI(PRE)/45	WOMAC(POST-4WEEKS)	ODI(POST-4 WEEKS)
1	VANDANA PANIGRAHI	55	30	15	22	10
2	JANAKI PATTANAIK	63	54	18	40	13
3	JANAKI BISOI	54	38	11	28	8
4	TULASI CHOUDHARY	51	57	19	43	13
5	UMARANI PANDA	59	58	9	44	6
6	BUDDHAN BHUMIZ	60	45	7	34	5
7	RENUPRABHA SAHOO	55	28	12	21	8
8	SANJUKTA RATH	62	57	8	43	6
9	MAMTA MISHRA	64	35	7	26	5
10	KUMUDINI SATPATHY	73	61	22	46	15
11	MANJUSHREE JENA	53	50	16	38	11
12	JYOSHNARANI SAHOO	58	44	5	33	4
13	KANAKLATA PANIGRAHI	63	62	23	46	16
14	SUMI ORAM	52	62	17	46	12
15	MAMTA PRUSTY	53	53	8	40	6
16	PUSPALATA BARIK	60	60	22	45	15
17	RITARANI PRADHAN	50	48	9	36	6
18	SOBHA SAHOO	62	41	10	31	7
19	MANJULATA PANDA	50	54	25	40	18
20	SANGEETA PRUSTY	50	25	7	19	5
21	SUCHETA MOHAPATRA	62	28	2	21	1
22	GEETANJALI PANDA	61	54	8	40	6
23	SHAKUNTALA PATTANAIK	67	33	5	25	4
24	NAMITA SAHOO	60	38	12	28	8
25	SUGYANI PANDA	59	44	18	33	13
26	SANGEETA PANIGRAHI	52	24	7	18	5
27	RASHMI BEHERA	53	30	11	22	8
28	RASMITA SAHOO	50	31	17	23	12

CONTROL GROUP

	NAME	AGE	WOMAC(PRE)	ODI(PRE)	WOMAC(POST)	ODI(POST)
1	BIDISHA SAHOO	52	41	14	41	12
2	JAGYESENI BARAL	66	46	11	46	10
3	SUBHADRA MOHAPATRA	50	41	13	41	11
4	DAMYANTI BEHERA	59	34	9	32	7
5	MAHALAXMI PATRA	60	44	9	42	8
6	LOPAMUDRA PANDA	55	41	12	39	10
7	PRANATI DAS	65	32	15	30	13
8	CHAPALA MISHRA	70	43	11	39	9
9	MEERA MOHAPATRA	58	40	8	37	6
10	RUPALI KAR	55	31	17	27	15
11	GAYATRI PUROHIT	62	68	35	66	32
12	VANITA MODAK	54	47	17	44	15
13	JASHODA MOHAPTRA	76	55	9	52	7
14	TARULATA MISHRA	70	52	14	49	13
15	GOLAPA SWAIN	70	52	16	48	14
16	SABITA PRUSTY	60	40	11	37	8
17	BINDUSHREE MISHRA	55	31	9	28	7
18	LEENA PANDA	59	42	8	40	6
19	SUKANTI ADHIKARI	65	51	15	48	13
20	KAMALINI GOUDA	67	33	16	30	14
21	BINDU KUMARI	57	44	28	41	26
22	RAJIYA DEVI	70	30	21	26	19
23	RAJANIGANDHA	57	54	21	51	18
24	AMITA MISHRA	53	26	11	23	9
25	KALYANI MISHRA	62	42	11	40	8
26	KUNTALA SABAT	60	33	13	30	10
27	GITANJALI CHEMAI	63	37	12	35	9
28	SASIREKHA BEHERA	69	45	10	42	8

Udita Mishra

EFFECT OF PELVIC STABILIZATION EXERCISES AND CONVENTIONAL PHYSIOTHERAPYON PAIN AND FUNCTION ...

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Udita Mishra

EFFECT OF PELVIC STABILIZATION EXERCISES AND CONVENTIONAL PHYSIOTHERAPYON PAIN AND FUNCTION ...

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