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Effect of Stratified Exercise Therapy Versus Standard Physiotherapy on Pain and Function in Subjects with Knee Osteoarthritis

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Abstract: Knee Osteoarthritis (OA) is a common degenerative condition among the elderly, leading to pain and functional limitations. While standard physiotherapy is routinely used to manage symptoms, stratified exercise therapy, an approach tailored to patient subgroups based on specific characteristics, is less commonly applied in orthopedic settings. This quasi-experimental study aimed to compare the effectiveness of stratified exercise therapy versus standard physiotherapy in reducing pain and improving function in individuals with Grade 2 and 3 Knee OA. A total of 180 participants with a mean age of 52 years were clinically diagnosed with Knee OA and randomly assigned to two groups. Group A (n=135) was subdivided into three subgroups based on BMI and upper leg muscle strength and received stratified exercise therapy. Group B (n=45) received standard physiotherapy. Both interventions were administered for over 12 weeks. Outcomes were assessed using the Visual Analogue Scale (VAS) for pain and the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) for function. ANOVA and post hoc analyses revealed that while both groups showed significant improvements, stratified exercise therapy resulted in greater reductions in pain and improvements in function. These findings suggest that stratified exercise therapy may be a more effective option for managing Knee Osteoarthritis compared to standard physiotherapy.

Keywords: Knee osteoarthritis, Stratified exercise therapy, Standard physiotherapy, Visual Analogue Scale, Western Ontario and McMaster University Osteoarthritis Index

1. Introduction:

Osteoarthritis is one of the most common chronic health conditions and a leading cause of pain and disability among adults [1]. According to the WHO definition, osteoarthritis is a disease of the entire joint involving the cartilage, joint lining, ligaments, and underlying bones. The breakdown of these tissues eventually leads to pain and stiffness [2]. The most common type of joint disease is osteoarthritis, and the most commonly affected joint in the body is the knee. It is a modified hinge joint, a type of synovial joint, composed of three functional compartments: the medial and lateral tibiofemoral articulations connect the tibia, the main bone of the lower leg, with the femur, or thigh bone, and the patella, or "kneecap," which slides through the patellar groove on the front of the femur. The joint is bathed in synovial fluid, which is contained inside the synovial membrane called the joint capsule [3]. The global prevalence of knee osteoarthritis was 22.9% in people over 40 and 16.0% in people over the age of 15. The incidence among those over 20 was 203 per 10,000 individuals [4]. With a prevalence of 22% to 39%, osteoarthritis is the most common joint disease and the second most common rheumatological illness in India [5]. In the Asian region, the prevalence of knee osteoarthritis pain in the elderly varied from 38.1% to 50.0% [6]. The strongest prediction of the disease is age, and individuals with knee osteoarthritis often experience pain and functional loss. The condition is more common in older adults and those with a high body mass index (BMI). It can also be triggered by injury or overuse [7]. Osteoarthritis is a disease that affects the entire joint and has a multifactorial etiology, including developmental joint deformities, endocrine factors, nutrition, articular cartilage degeneration, genetic predisposition, age, sex, obesity, metabolic factors, bone density, overloading of the musculoskeletal system, joint injuries, infections, physical activity, occupation, and even muscle weakness [8]. Risk factors include advanced age, genetic predisposition, obesity, joint congruency, increased mechanical stress, and the disease's highly heterogeneous nature, which leads to wide variations in symptoms, progression, and response to treatment [9]. The pathogenesis of osteoarthritis is characterized by progressive erosion and loss of articular cartilage, hypertrophy of bone at the margins, osteophytic lipping, subchondral sclerosis, and a variety of biomechanical and morphological modifications to the synovial membrane and joint capsule [10].

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Clinical features of knee osteoarthritis include pain, swelling, stiffness, antalgic gait, reduced knee movement, and difficulty in stair climbing. In severe stages, knee deformities may be present [11], [12]. Diagnosis is made through proper assessment, involving history taking, clinical examination, and X-ray imaging to confirm the condition. Radiographic changes typically include joint space narrowing, subchondral sclerosis, subchondral cysts, and osteophyte formation. Additional investigations to determine underlying causes may include serological tests, ESR, serum uric acid levels, and arthroscopy [13], [14]. The severity of knee osteoarthritis is graded based on the duration of pain and structural changes observed on plain X-rays. Knee radiographs are commonly graded using the Kellgren and Lawrence (KL) grading system, which includes five stages. This classification was proposed by Kellgren et al. in 1957 and later accepted by the WHO in 1961 [13].

Treating individuals with osteoarthritis primarily focuses on symptom relief, improving joint stability, and delaying the disease's progression to its end stage [15]. Conservative treatment strategies include medication, physiotherapy management, and surgical interventions. Medical management involves the use of analgesics and anti-inflammatory drugs [16]. Physiotherapy management includes modalities such as ultrasound, Transcutaneous Electrical Nerve Stimulation (TENS), muscle stimulation, Pulsed Electrical Stimulation (PES), Short Wave Diathermy (SWD), kinesiotaping, and acupuncture. Exercise therapy comprises strength training, balance and perturbation training, aquatic therapy, manual therapy, Proprioceptive Neuromuscular Facilitation (PNF), retro walking, functional task training, and aerobic exercises. Surgical options include joint-preserving surgeries and joint replacement surgeries [17].

Standard physiotherapy consists of strengthening exercises, including static quadriceps exercises, vastus medialis oblique exercises, resisted quadriceps exercises, hamstring strengthening, hip abductor strengthening, and calf and hamstring stretching exercises. Each contraction is held for 10 seconds and repeated ten times. These exercises help reduce pain and improve function in individuals with knee osteoarthritis [18], [19]. Recent evidence also suggests that the beneficial effects of exercise therapy are primarily driven by improvements in upper leg muscle strength, highlighting the crucial role of strength training in patients with muscle weakness. Conversely, in patients with sufficient muscle strength, further strengthening is unlikely to improve pain or function. For such individuals, a minimal intervention focusing on self-management strategies—such as guidance on staying physically active without overloading the affected knee joint—may be more appropriate, thereby avoiding unnecessary care [20].

Knee osteoarthritis has traditionally been treated using shortwave diathermy, which provides a deep heating effect on tissues. This reduces muscle spasms, alleviates pain, and helps improve joint range of motion [21]. Recently, five clinically relevant phenotypes (subgroups) of knee osteoarthritis patients have been identified based on easily obtainable patient characteristics such as radiographic severity, BMI, upper leg muscle strength, and depressive symptoms. Stratified exercise therapy is a treatment model in which patients are allocated into subgroups such as “low muscle strength subgroup,” “high muscle strength subgroup,” “obesity subgroup,” or “depressive phenotype,” each receiving subgroup-specific therapy [22].

2. Need of the Study

Knee osteoarthritis (OA) is a degenerative joint disease that alters the structure of articular cartilage. Degeneration also affects surrounding tissues such as the synovial membrane, menisci, and subchondral bone. Over time, knee osteoarthritis leads to pain and a progressive loss of physical function, ultimately resulting in a reduced quality of life.

Standard physiotherapy, which includes strengthening, stretching, and pain-relieving interventions, has been widely accepted as an effective treatment for managing knee osteoarthritis. However, recent studies have shown that stratified exercise therapy, which tailors intervention based on individual patient characteristics such as muscle strength, body mass index, or psychological factors, may provide better outcomes. Despite its potential, there is limited literature comparing the effectiveness of stratified exercise therapy and standard physiotherapy. This gap in knowledge establishes the need for the present study.

3. Aim of the Study

The aim of the study was to compare the effects of stratified exercise therapy and standard physiotherapy on pain and function in individuals with knee osteoarthritis.

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4. Objectives of the Study

1. To determine the effect of stratified exercise therapy on reducing pain and improving function in individuals with knee osteoarthritis.
2. To determine the effect of standard physiotherapy on reducing pain and improving function in individuals with knee osteoarthritis.
3. Comparing the effect of stratified exercise therapy with standard physiotherapy on reducing pain and improving function in individuals with knee osteoarthritis.

5. Hypothesis

Research Hypothesis (H_r)

Stratified exercise therapy is more effective than standard physiotherapy in reducing pain and improving function in individuals with knee osteoarthritis.

Null Hypothesis (H_0)

There is no significant difference between stratified exercise therapy and standard physiotherapy in reducing pain and improving function in individuals with knee osteoarthritis.

6. Review of Literature

Aiyong Cui, Huizi Li, Dawei Wang et al. (2020) conducted a study on "Global, regional prevalence, incidence and risk factors of knee osteoarthritis," a population-based study. They selected relevant publications with data on the prevalence or incidence of knee OA in population-based observational studies and gathered information from reports to conduct this analysis. To produce estimates, they performed a meta-analysis of random effects. In people aged 15 and older, the pooled global prevalence of knee OA was 16.0% (95% CI, 14.3%-17.8%); in people aged 40 and older, it was 22.9% (95% CI, 19.8%-26.1%). Accordingly, 654.1 (95% CI, 565.6-745.6) million people (40 years of age and older) will have knee OA worldwide in 2020. The combined global incidence of knee OA in people 20 and older was 203 per 10,000 person-years (95% CI, 106-331). Accordingly, there are roughly 86.7 million with incident knee OA in 2020 worldwide. The prevalence and incidence varied substantially between individual countries and increased with age. The ratios of prevalence and incidence in females and males were 1.69 (95% CI, 1.59-1.80, $p<0.00$) and 1.39 (95% CI, 1.24-1.56, $p<0.00$), respectively.

EClinicalMedicine 29-30 (2020) 100587.

Harish Kumar et al. (2020) conducted a cross-sectional study on a target population from 5 metropolises, 5 cities near the metropolises, 5 towns, and 20 villages from blocks of these towns, i.e., 5 sample groups were covered. Sample size n = 4680, which was further divided into 5 sites equally (936 from each site). This was rounded to a sample of 1000 from each site. This evaluation study was conducted using the household as the primary sampling unit for the quantitative survey. The respondents for the study were above 40 years. Quantitative data was collected using structured questionnaire and X-Ray Investigation. OA was graded using the Kellgren and Lawrence scale. The result showed a prevalence of 28.7% of OA in the overall sample. OA prevalence was found to be higher in participants who used western toilets (42.1%), in sedentary people (82.9%), in females, and in obese individuals.

J Clin Orthop Trauma.2020 Feb; 11 (Suppl 1):S125-S129.

Ali Mobsheri, Simo Saarakkala et al. (2019) conducted a study on "Recent advances in understanding the phenotypes of osteoarthritis." The disease represents a diversity of clinical phenotypes that are underpinned by a number of molecular mechanisms, which may be shared by several phenotypes and targeted more specifically for therapeutic purposes. The clinical phenotypes of osteoarthritis supposedly have different underlying etiologies and pathogenic pathways, and they progress at different rates. Large osteoarthritis population cohorts consist of a majority of patients whose disease progresses slowly and a minority of individuals whose disease may progress faster. The ability to identify people with relatively rapidly progressing osteoarthritis (OA) can transform clinical trials and enhance their efficiency. The identification, characterization, and classification of molecular phenotypes of rapidly progressing osteoarthritis, which represent patients who may benefit most from intervention, could potentially serve as the basis for precision medicine for this disabling condition.

F1000Research 8, 2019.

Riccardo Giorgino, Domenico Albano et al. (2023) conducted a study on "Knee Osteoarthritis: Epidemiology, Pathogenesis, and Mesenchymal Stem Cells." The incidence of knee OA differed amongst investigations, and these variations are reflected in the heterogeneity of information provided by studies carried out all over the world. This review provides an overview of the most recent and relevant data on the molecular mechanism of cartilage damage in knee OA. They gathered data from 842 knee OA patients from The Osteoarthritis Initiative. The severity of radiographic OA, strength of muscles in the lower extremities, body mass index, and level of depression were all compared to establish clusters using a cluster analysis method. In order to compare phenotypes for clinical outcomes (pain and activity limitations), including potential confounders, univariable and multivariable regression models were utilized.

International Journal of Molecular Sciences 24 (7), 6405, 2023.

Mohd Heikal Mohd et al. (2020) conducted a study on the pathophysiological perspective of osteoarthritis. Knee osteoarthritis has a multifactorial etiology and is characterized by pathological changes in the knee joint structure. To date, no efficient treatment is capable of altering the pathological progression of osteoarthritis. In this review, the significant risk factors and mediators that trigger the loss of normal homeostasis and structural changes in the articular cartilage are examined. Treatments are being developed that target specific mediators thought to promote the cartilage destruction that results from imbalanced catabolic and anabolic activity in the joint.

Medicina 56 (11), 614, 2020.

Ze Gong, Jia Li, Zijun He et al. (2022) conducted a study on "Quadriceps strength is negatively associated with knee joint structural abnormalities." This longitudinal observational study included men and women aged 45-79. Quadriceps strength was measured by isometric knee extension testing at baseline and one-year follow-up. They concluded that higher quadriceps strength was significantly associated with less progression of lateral patellofemoral joint cartilage damage, bone marrow lesions, and effusion-synovitis in females.

BMC Musculoskeletal Disorders 23 (1), 1-9, 2022.

Gail Sowden, Jonathan Charles Hill et al. (2018) conducted a study on "Advancing practice for back pain through stratified care." This approach to stratified care has been tested within the UK. It reduces unnecessary overtreatment in patients who have a good prognosis yet increases the likelihood of appropriate healthcare. They stated that implementation science literature can inform the development of innovations and efforts to support implementation of stratified care.

Brazilian Journal of Physical Therapy 22 (4), 255-264, 2018.

Carmen Caeiro, Helena Canhao et al. (2019) conducted a study on "Interdisciplinary stratified care for low back pain." The participants explored aspects related to the acceptability of the split project, emphasizing the satisfactory amount of effort that is expected to be required for its implementation. Potential facilitators to the implementation of the model were identified, such as participants' motivation.

Plos one 14 (11), e0225336, 2019.

J. Koop, J.W. de Joode, H. Brandt, J. Dekker et al. (2022) conducted a study on "Patients' and clinicians' experiences with stratified exercise therapy in knee osteoarthritis." The authors developed a model of stratified exercise therapy that distinguishes three knee osteoarthritis subgroups: low muscle strength subgroup, high muscle strength subgroup, and obesity subgroup. This study explored the experiences of patients with knee osteoarthritis.

BMC musculoskeletal disorders 23 (1), 1-14, 2022.

J. Knoop, M. van der Leeden, M. van der Esch, M. de Rooij et al. (2020) conducted a study on "Is a model of stratified exercise therapy by physical therapists in primary care feasible in patients with knee osteoarthritis?" Patients were allocated to a subgroup based on a simple stratification tool and received subgroup-specific, protocolized, 4-month exercise therapy and found clinically relevant improvements on physical functioning and knee pain for the total group. In general, the model of stratified exercise therapy was considered to be easily applicable and of added value for daily practice.

Physiotherapy, 106, 101-110.

S. Ozen, E.B. Doganci, A. Ozyuvali et al. (2019) studied the effectiveness of continuous versus pulsed short-wave diathermy in the management of knee osteoarthritis. The study included patients aged 49-65 with KOA who were randomized into two groups. One group was treated with cSWD, the other with pSWD for three weeks. Patients were assessed before, after, and at one month post-treatment. Outcome measures included visual analogue scale (VAS) for knee pain, Western Ontario and McMaster University Osteoarthritis Index (WOMAC), and a six-minute walking test (6MWT). They concluded that both treatment options appear to be efficacious in reducing pain and improving functionality in KOA.

Caspian journal of internal medicine 10 (4), 431, 2019.

Mohamed Hussein ElGendy et al. (2022) conducted a study on "Efficacy of rectus femoris stretching on pain, range of motion and spatiotemporal gait parameters in patients with knee osteoarthritis: a randomised controlled trial." Study participants (n=60, with age>45 years) with mild to moderate bilateral KOA were randomised into the study group and control group. The study group received rectus femoris stretching exercises together with stretching exercises of the calf, hamstring and iliotibial band, strength exercises for the quadriceps, gluteus medius, gluteus maximus and calf muscles, whereas the control group received all the exercises of the study group except rectus femoris stretching. Pain intensity, ROM, spatiotemporal gait parameters and function were measured. They concluded that simple rectus femoris stretching exercises are easy to perform even at home and are beneficial for pain, flexion ROM, function and spatiotemporal gait.

BMJ Open Sport & Exercise Medicine 8 (4), e001459, 2022.

Betsy Denisse, Perez Huerta et al. (2020) conducted a study on "Effectiveness of a program combining strengthening, stretching and aerobic training exercise in a standing versus sitting position in overweight subjects with Knee Osteoarthritis: A Randomized Controlled Trial." They stated that there is an increasing incidence, prevalence and burden of knee osteoarthritis due to a global increase in obesity and an aging population. Twenty-four subjects were randomly allocated to receive 36 sessions of 30 min duration of either sitting aerobic exercises (experimental group) or standing aerobic exercise (control group). Pain intensity, knee disability and quality of life data were collected at baseline and at 12, 24 and 36 sessions. Adding aerobic exercises in an unloaded position to a conventional exercise program produced superior effects over time for self-reported knee pain, knee pain and disability and quality of life compared to loaded aerobic exercises in overweight subjects with knee osteoarthritis.

Journal of Clinical Medicine 9 (12), 4113, 2020.

Waleed S. Mahmoud, Ahmad Osailan et al. (2023) conducted a study on "Radiological and clinical outcomes of concurrent hamstring stretching with quadriceps strengthening in patients with knee osteoarthritis: A randomized clinical trial." The study examined the effect of adding hamstring stretching to quadriceps strengthening exercises on joint space narrowing (JSN), medial joint space width (mJSW), and physical abilities in patients with knee osteoarthritis. A total of 42 osteoarthritis patients, aged from 50 to 65 years were randomized and assigned into 2 groups. Quadriceps strengthening exercises were given to both groups, while static hamstring stretching was applied to only the study group. Both groups were screened with a weight-bearing x-ray beam and WOMAC. The outcomes were evaluated at the baseline and immediately after 6 weeks of intervention. They concluded that adding static hamstring stretching to quadriceps strengthening exercise provided a substantial effect on mJSW, JSN and functional abilities in KOA patients.

Isokinetics and Exercise Science 31 (2), 137-147, 2023.

Chu Yang Zeng, Zhen Rong Zhang et al. (2021) conducted a study on "Benefits and mechanisms of exercise training for knee osteoarthritis." They stated that osteoarthritis in the knee is a long-term degenerative condition. The two main pathological alterations linked to knee osteoarthritis are cartilage and subchondral bone degradation and synovitis. Aging, hormonal fluctuations, metabolic variables, mechanical stress, and inflammation all contribute significantly to the worsening of knee osteoarthritis. Osteoarthritis in the knee is mostly treated with medication, physical therapy, and surgery. But medication has a lot of adverse effects, and individuals with end-stage osteoarthritis should only consider surgery. As an additional and supplemental form of physical therapy, exercise can stop cartilage deterioration, reduce inflammation, and stop the loss of the metaphyseal bone

trabeculae and subchondral bone. A growing body of research suggests that people with knee osteoarthritis may experience less pain, stiffness, joint dysfunction, and muscle weakness when they engage in exercise training.

Frontiers in physiology 12, 794062, 2021.

Reepa Avichal Ughreja et al. (2017) conducted a study on "Mulligan's mobilisation with movement (MWM) relieves pain and improves functional status in osteoarthritis knee." The study included 30 patients diagnosed with medical compartment tibiofemoral osteoarthritis of the knee who were randomized into two groups. The experimental group received Mulligan's mobilisation with movement (MWM), while conventional therapy in the form of shortwave diathermy (SWD), quadriceps strengthening and stretching of calf and hamstrings was given to both groups. They concluded that Mulligan's mobilisation with movement (MWM) along with conventional therapy showed significant improvement in pain and functional status in patients with OA knee.

International Journal of Physiotherapy, 132-138, 2017.

Filipe Raposo, Marta Ramos et al. (2021) conducted a study on "Effect of exercise on knee osteoarthritis: A systematic review." Eligible studies were randomized control trials or clinical control trials that compared an intervention consisting of an exercise programme in adult participants with knee osteoarthritis against no intervention. A total of 4499 studies were retrieved and 19 articles met the inclusion criteria. Beneficial effects of exercise were found on pain and strength. Exercise programmes appear to be safe and effective in knee osteoarthritis patients; regarding function, functional performance and quality of life, evidence is controversial. Both strengthening and aerobic exercise showed positive effects, and both aquatic and land-based programmes presented improvement of pain, physical function and quality of life.

Musculoskeletal care 19 (4), 399-435, 2021.

Luis Ceballos Laita, Silvia Lahuerta Martin et al. (2023) conducted a study on "Strength training vs. aerobic training for managing pain and physical function in patients with knee osteoarthritis: a systematic review and meta-analysis." Randomized controlled trials comparing strength training and aerobic training on pain intensity and physical function in patients with knee osteoarthritis were included. Methodological quality and risk of bias were assessed with a PEDro scale and risk of bias tool respectively. They concluded that both types of exercises showed clinical benefits in people with knee osteoarthritis, but no differences between strength training and aerobic training were found.

Healthcare 12 (1), 33, 2023.

Abdulhamit Misir, Kadir Ilker Yildiz et al. (2020) conducted a study on "Kellgren-Lawrence grade of osteoarthritis is associated with change in certain morphological parameters." Morphology was evaluated using magnetic resonance (MR) images of 200 participants with knee OA (50 each of K-L grades 1–4) and 50 without knee OA, matched for age, body mass index, sex, and tibiofemoral angle. Knees with a coronal alignment within five degrees of neutral and no apparent bone loss on radiographs were included. Twenty-one morphologic parameters of the distal femur and proximal tibia were measured on MR images. Correlation between the K-L grade and measured parameters and differences in measured parameters across the K-L grades and between the OA and control groups were evaluated. They concluded that, among knees without significant angular deformity, progression of knee OA is associated with a change in the morphology of the femoral condyles but not of the proximal tibia.

The Knee 27 (3), 633-641, 2020.

Kohn MD, Sassoon AA, Fernando ND et al. (2016) conducted a study on "Classifications in brief: Kellgren-Lawrence classification of osteoarthritis." In this study, the authors concluded that the KL classification has been commonly used as a research tool in epidemiological studies of OA, and also used in development of atlases of radiographic features of osteoarthritis of knee.

Clinical Orthopaedics and Related Research 474, 1886-1893, 2016.

Lalita Khuna, Tussaneeporn Soison et al. (2024) conducted a study on "Reliability and concurrent validity of 30-s and 5-time sit-to-stand tests in older adults with knee osteoarthritis." This cross-sectional study included 60 older

participants diagnosed with knee osteoarthritis. Baseline demographic information and data on pain, stiffness and physical function using the modified Western Ontario and McMaster Universities Osteoarthritis were obtained. Participants performed the 30-s and 5-time STS tests as well as knee muscle strength assessment using a hand-held dynamometer. After 1 week, 30 participants were reassessed to evaluate test-retest reliability. They concluded that 30-s and 5-time STS tests are reliable assessment tools and correlate with knee muscle strength, pain, stiffness and physical function in older adults with knee osteoarthritis.

Clinical Rheumatology 43(6), 2035-2045, 2024.

Zheng Wang, Jianhua Yan et al. (2022) conducted a study on "Reliability and validity of sit-to-stand test protocols in patients with coronary artery disease". 112 subjects with diagnoses of atherosclerosis or post-percutaneous coronary intervention, or post-acute myocardial infarction (post-AMI) participated in the validity analysis. All 3 STS tests demonstrated moderate and significant correlation with the 6MWT. Correlations between left ventricular ejection fraction (LVEF) and all STS tests and between 6MWT and LVEF were only weak (r values ranged from 0.27 to 0.31). The intraclass correlation coefficients (ICC) for repeated measurements of the FTSTS, 30-s STS and 1-min STS tests were 0.96, 0.95 and 0.96 respectively, with the minimal detectable change (MDC95) computed to be 1.1 sec, 1.8 repetitions and 3.9 repetitions respectively. They concluded that all STS tests demonstrated good test-retest reliability, convergent and known-groups validity. STS tests may discriminate low from high levels of risk for a cardiovascular event in patients with CAD.

Frontiers in Cardiovascular Medicine 9, 841453, 2022.

Mst. Rabea Begum et al. (2019) conducted a study on validity and reliability of visual analogue scale for pain measurement. A critical review was done for this study. Total ten studies are included in this study, with the majority of study designs being cross-sectional. In analyses, most of the studies used spearman correlation to see the strength of the study. The participants' age was more than 18 years. Most of the studies examined post-operative pain using pain measurement scales. The scales used were visual analogue scale, numerical rating scale, color analogue scale and faces pain scales. The authors concluded that the majority of the studies showed that visual analogue scale is a valid and reliable scale. Also, it is an interval scale. So, in clinical practice we can use this scale for pain measurement.

Journal of Medical Case Reports and Reviews 2 (11), 2019.

Hoon Jo, Kyoung Kim et al. (2023) conducted a "study of the Reliability and Validity of the WOMAC Index in patients with Total knee replacement". Seventy-one inpatients and outpatients who underwent total knee replacement for knee osteoarthritis were included in the study. WOMAC was used to evaluate the participants every two weeks to test test-retest reliability, internal consistency, construct validity and concluded that WOMAC showed high test-retest reliability and good validity.

Korean Society of Physical Medicine 18 (2), 93-101, 2023.

YY Leung, J Thumboo et al. (2022) conducted a study on "Construct Validity, Reliability, Responsiveness and Interval Scale Transformation of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) in patients undergoing Knee Arthroplasty". They used data collected from knee OA patients undergoing Knee Arthroplasty and at 6 months after Knee Arthroplasty. They collected demographics, WOMAC, Short-form-36 and Oxford Knee Score (OKS) with the latter two as comparison. Data was analysed for 1136 patients who underwent Knee Arthroplasty. They concluded that the WOMAC total, pain and function scales had adequate fit to the Rasch model, providing unidimensional measure with good reliability and responsiveness. Transformation of WOMAC to interval scale measurement is feasible and applicable to wide ranges of studies.

Annals of the Rheumatic Diseases 81 (Suppl 1), 885-886, 2022.

7. Materials and Methods

Study Design: Quasi experimental study design

Ethical Clearance and Informed Consent: The study protocol was approved by the Ethical Committee of GSL Medical College & General Hospital (Annexure-I), the investigator explained the purpose of the study and given

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the patient information sheet. The participants were requested to provide their consent to participate in the study (Annexure-II). All the participants signed the informed consent and the rights of the included participants have been secured

Study Population: Subjects diagnosed with grade 2 and 3 osteoarthritis (according to Kellgren and Lawrence grading scale)

Study Setting: The study was conducted at Department of Physiotherapy OPD, Tertiary Care Teaching Hospital, Rajamahendravaram.

Study Duration: Study had been conducted during period between August 1st 2023 to July 31st 2024.

Intervention Duration: For GROUP - A, Sub group-1: High muscle strength group had 3 to 5 individual sessions, Sub group- 2: Low muscle strength group had 8 to 12 individual sessions, Sub group -3: Obese group had 12 to 18 individual sessions in 12 weeks. For GROUP - B, 24 sessions, 2 days per week for 12 weeks.

Sampling Method: Systematic random sampling

Sample Size: 180 subjects for prevalence of 39% knee osteoarthritis by formula Z2PQ/L2 (Here Prevalence (P) =39%, Q=100-P= 61, Relative error (L) = 1 - 6% of P)

A total of 180 subjects diagnosed with grade 2 and 3 knee osteoarthritis were recruited according to inclusion and exclusion criteria. The participants were explained in detail about the need and procedure of the study then an information sheet was administered. After obtaining informed consent all the eligible participants were randomized into two groups with 135 subjects in Group-A Stratified exercise therapy and 45 subjects in Group-B Standard physiotherapy.

Group-A: Stratified exercise therapy along with standard physiotherapy

(135 subjects for each sub group 45subjects)

Group-B: Standard physiotherapy

(45subjects)

<table>
<tr><th colspan="2">GROUPS</th><th>NO. OF SUBJECTS</th><th>TREATMENT</th></tr>
<tr><td rowspan="3">GROUP-A</td><td>HMS</td><td>45</td><td rowspan="3">Stratified exercise therapy</td></tr>
<tr><td>LMS</td><td>45</td></tr>
<tr><td>OS</td><td>45</td></tr>
<tr><td colspan="2">GROUP-B</td><td>45</td><td>Standard physiotherapy</td></tr>
</table>

Materials used

1. Data collection form
2. Bicycle-ergometer

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3. Visual Analogue scale
4. Western Ontario and McMaster Universities Osteoarthritis Index
5. Short-wave diathermy
6. Chair

8. Criteria for Sample Collection

Inclusion Criteria

- Age group of >50 years
- Morning stiffness <30 minutes
- Joint crepitus
- Bony tenderness
- No palpable warmth
- Both male and female
- Knee pain persisting for at least 3 months with pain severity during walking is more than or equal to 2/10 on Visual Analogue Scale
- Grade 2 and 3 (according to Kellgren and Lawrence grading scale)

Exclusion Criteria

- Severe knee pain (i.e., Visual Analogue Scale pain severity during walking less than or equal to 9/10)
- Physical or mental co-morbidity severely affecting daily life
- Presence of total knee arthroplasty or on waiting list for total knee arthroplasty in any knee
- Received physiotherapy in past 6 months because of knee pain
- Received intra articular injections in past 6 months because of knee pain

9. Outcome Measures

Visual Analogue scale (VAS)

It is used to measure the severity of the pain. It is a 10 cm line shown to the subjects where one end is marked 0 and the other end is marked 10. It will be explained to subjects that 0 represents no pain and 10 represents the maximum pain. The subjects will mark the scale based on the severity (ANNEXURE-III). [23]

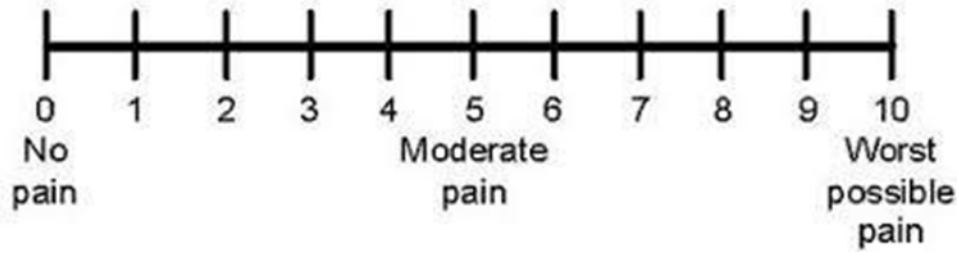

Figure-1 Visual Analogue Scale

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Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

A patient reported scale was used to assess pain and physical function levels in the subjects. It measures 5 items of pain, 2 items for stiffness and 17 for functional limitation. Physical functioning questions cover activities of daily living. Its psychometric properties have been established (ANNEXURE IV). [24]

10. Intervention

The study consists of 12 weeks of intervention. Group A subjects were treated with Stratified exercise therapy and Group B with Standard physiotherapy. Before the commencement of the treatment a brief demonstration about the intervention was given. Pre-test was done to measure Pain and Function by Visual Analogue Scale [VAS] and Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC]. Intervention durations for a period of 12 weeks. After 6 weeks and 12 weeks post treatment outcome data was analyzed for results.

Group-A

Stratified Exercise Therapy

In this Stratified exercise therapy, subjects were allocated to homogeneous subgroups and receive a subgroup specific intervention [22].

Treatment period and number of sessions

High muscle strength group: 3 to 5 individual sessions in 12 weeks treatment period

- week 1 to 4: + 1 to 2 sessions
- week 5 to 8: + 0 to 1 sessions
- week 9 to 12: + 1 session

Low muscle strength group: 8 to 12 individual sessions in 12 weeks treatment period

- week 1 to 4: + 1 session/week
- week 5 to 8: + 2 sessions
- week 9 to 12: + 1 to 2 sessions

Obese group: 12 to 18 individual sessions in 12 weeks treatment period

- week 1 to 4: + 2 sessions/week
- week 5 to 8: + 1 session/week
- week 9 to 12: + 2 sessions

Exercise Therapy Types

Strength Training

The strength training in Stratified exercise therapy includes squats, lunges, stepping up and down and from platform (forward, sideward, and backward).

SQUATS: Subjects stand upright with feet apart and shoulders at 900 flexion, keep their chest up and shifts weight onto heels as they push hips back into a sitting position. Squats down until the top of thighs are parallel to the ground and returns to the initial stating position.

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Figure-2 Squats

Dosage: 3 sets for 10 repetitions with 1 minute rest between sets.

Lunges: Subject start with a split stance, with both feet pointed forward and bends at knees to lower body towards the floor. Back knee guides the movements and front knee kept behind toes to lower straight down.

Figure-3 Lunges

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Dosage: 3 sets for 10 repetitions with 1 minute rest between sets.

Stepping Up and Down and from Platform: Subjects step up and down from a platform in all directions (i.e. forward, backward and lateral). Stand facing platform with hip width apart. Lifts one foot and place it firmly on the center of the platform and shift weight to bring the other foot.

Dosage: 3 sets for 10 repetitions with 1 minute rest between sets.

Aerobic Training

Aerobic training includes physical activities without large knee loading, such as cycling.

Bicycle-Ergometer: Subjects sit with back straight and shoulders relaxed and pedal according to their comfortable pace.

Figure-4 Bicycle Ergometer

Functional Training

Functional training includes exercises of daily activities like walking, sitting at a chair, standing from a chair, stair climbing and descending.3 sets for 10 repetitions with 1 minute rest between sets.

Group-B

Standard Physiotherapy

In this Standard physiotherapy subjects receive strengthening and stretching exercises for treating Knee Osteoarthritis [18].

Strengthening Exercises

Static Quadriceps Exercise: The position of the patient in supine lying therapist stands beside the patient. A rolled-up towel was put beneath the knee, and they were instructed to maximally contract their thigh muscles to straighten their knee.

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Figure-5 Static Quadriceps Exercise

Dosage: 10 repetitions for 10 seconds hold, 2 Sessions per week for a period of 12 weeks.

Vastus Medialis Oblique Exercise: The position of the patient in supine lying therapist stands beside the patient. Then the patient legs are bent at the knee with feet flat on the floor, hip-width apart. Places a pillow or small cushion between knees and instructed them to squeeze it hard enough to produce a slight resistance.

Figure-6 Vastus Medialis Oblique Exercise

Dosage: 10 repetitions for 10 seconds hold, 2 Sessions per week for a period of 12 weeks.

Resisted Quadriceps Exercise: The position of the patient in supine lying, therapist stands beside the patient. Secured a weight cuff around patient's ankle. Then slowly extends the leg, straightening the knee until leg is out in front of them.

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Figure-7 Resisted Quadriceps Exercise

Dosage: 10 repetitions for 10 seconds hold, 2 Sessions per week for a period of 12 weeks

Hamstrings Strengthening Exercise: The position of the patient in prone lying, therapist stands beside the patient. Attached a weight cuff to the ankles, then slowly bend the knees by bringing the heel towards the glutes. Throughout the motion, engaged their hamstrings and lift as far as they feel comfortable.

Figure-8 Hamstrings Strengthening Exercise

Dosage: 10 repetitions for 10 seconds hold, 2 Sessions per week for a period of 12 weeks.

Hip Abductors Strengthening Exercise: The position of the patient inside lying, therapist stands behind the patient. Attached a weight cuff to the ankles, then slowly lift the leg upward by keeping it straight. Throughout the motion, engaged their hip abductors and lift as far as they feel comfortable.

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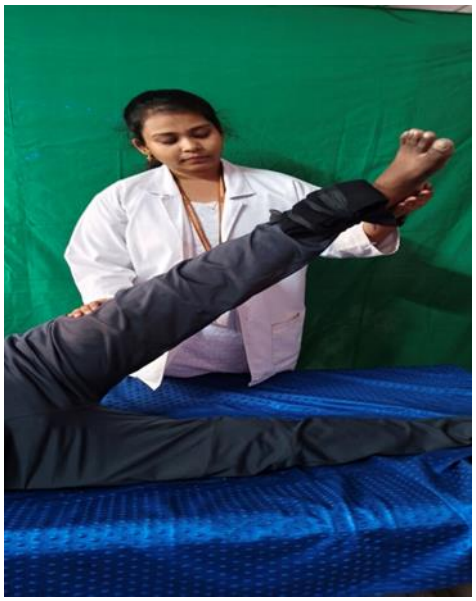

Figure-9 Hip Abductors Strengthening Exercise

Dosage: 10 repetitions for 10 seconds hold, 2 Sessions per week for a period of 12 weeks

Stretching Exercises

Calf Stretching: The position of the patient in supine lying, therapist stands beside the patient. With one hand therapist stabilizes the knee with the other hand holds the heel and rest of the foot supported on therapist forearm then gently stretch is applied.

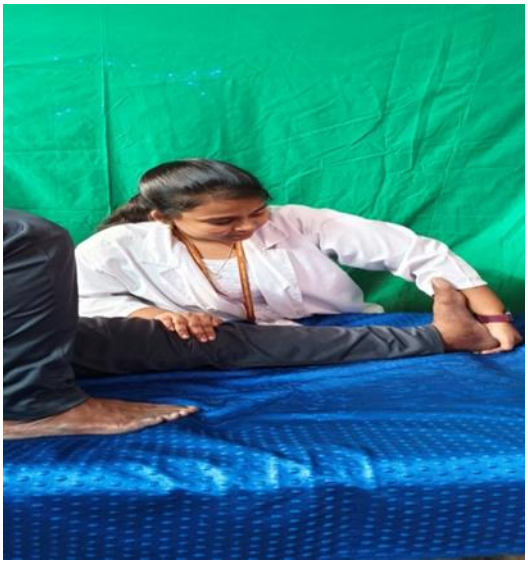

Figure-10 Calf Stretching

Dosage: 3 repetitions for 30 seconds hold, 2 Sessions per week for a period of 12 weeks

HAMSTRINGS STRETCHING: The position of the patient in supine lying, therapist stands beside the patient leg to be stretched, lifting it while keeping the other leg flat on the table. The therapist supports the patient's leg by holding it just above the knee with one hand and the ankle with the other, ensuring the leg remains straight, then the leg is slowly raised until the patient feels a gentle stretch.

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Figure-11 Hamstrings Stretching

Dosage: 3 repetitions for 30 seconds hold, 2 Sessions per week for a period of 12 weeks

SHORTWAVE DIATHERMY (SWD): SWD is a therapeutic treatment used to provide deep heat to tissues. It is a Standard physiotherapy treatment given to both groups. [21]

The position of the patient in supine lying, therapist stands beside the patient. The area is cleaned, and any metal objects are removed from the vicinity to avoid interference with the electromagnetic field. The therapist positioned the SWD machine close to the knee and placed pads on either side of the knee. The intensity adjusted to ensure the patient comfort.

Dosage: 10 minutes per session, 2 Sessions per week for a period of 12 weeks.

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11. Flowchart

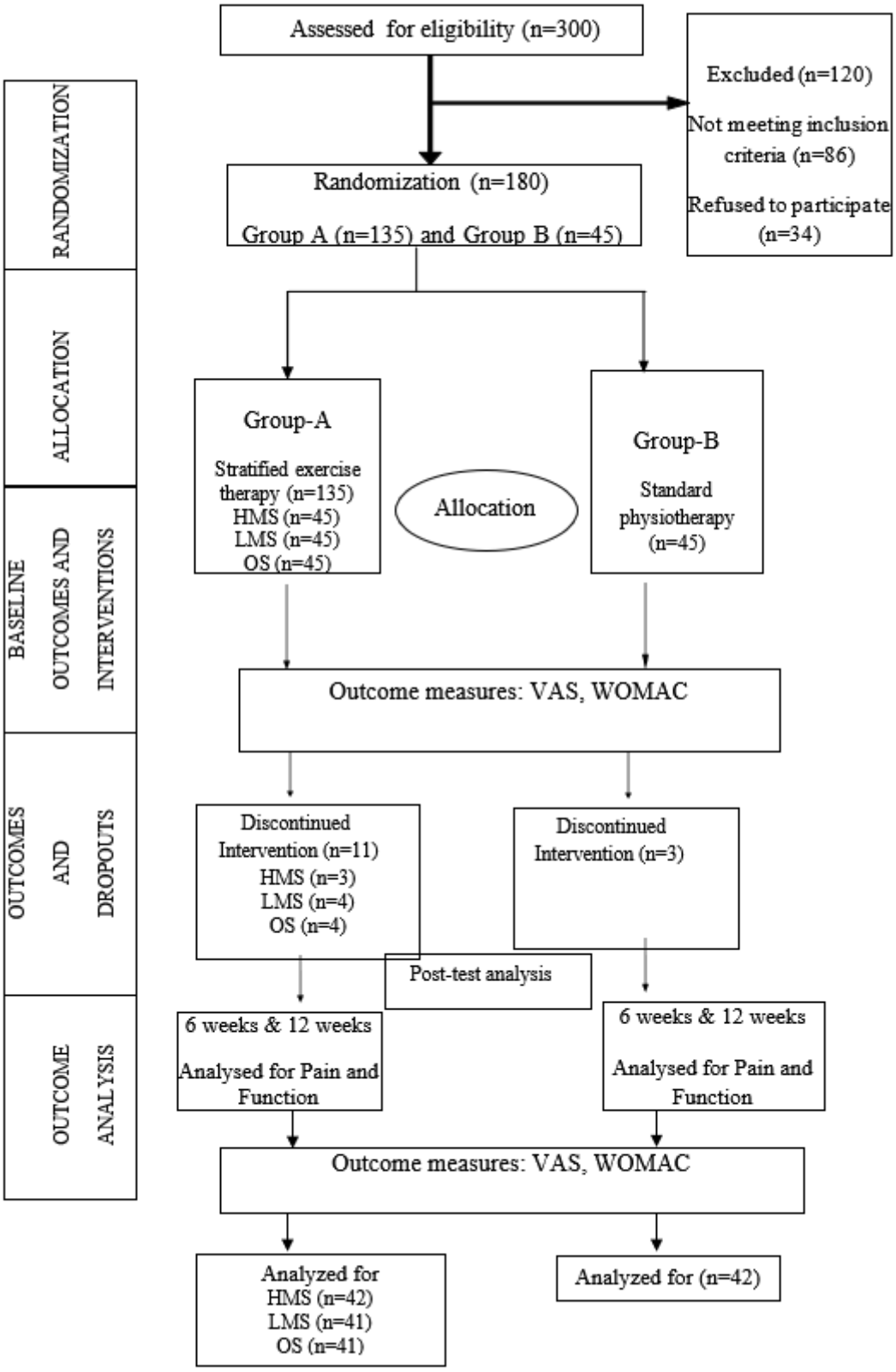

Figure-12 Flowchart

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12. Statistical Analysis

All statistical analysis was done by using SPSS software version 20.0 and MS excel 2010.

All descriptive statistical data was presented as mean + standard deviation and main differences will be calculated and presented.

Within the groups: ANOVA was performed to assess the statistical difference within the groups for knee osteoarthritis pain and function from pre-test, after 6th week and post-test values.

Between the groups: ANOVA post Hoc test was performed to assess the statistical significant difference in mean value between the groups for Visual Analogue scale for pain, Western Ontario and McMaster Universities Osteoarthritis Index for function.

Data also tabulated and graphically represented.

For all statistical analysis $p<0.05$ will be considered as statistically significant.

13. Results

The results of this study were analyzed in terms of reduction of pain on Visual Analogue scale [VAS], improved function on Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC]. The consort flow chart of the study showed the study organization in terms of subjects screening, random allocation and analysis following the intervention.

A total of 300 subjects with grade 2 and 3 knee osteoarthritis (according to Kellgren and Lawrence grading scale) were screened for eligibility, amongst 180 subjects were included in the study trail. All the 180 subjects who met the inclusion criteria randomized into two groups. In group A subjects were sub divided into 3 subgroups consisting of 45 participants each based on BMI and upper leg muscles strength using 30 seconds sit-stand test and 45 participants in group B.

In this study within Group-A, 42 participants completed training in High muscle strength subgroup with dropouts of 3, 41 participants completed training in Low muscle strength subgroup and Obesity subgroup with dropouts of 4 in each group and in Group-B 42 participants completed training with dropouts of 3.

Comparison was made within the groups as well as between the groups. So as to evaluate the intra group and inter group effectiveness of Stratified exercise therapy and Standard physiotherapy which are under considerations in the present study.

14. Analysis of Mean Score of VAS within HMS Subgroup of Group A

HIGH MUSCLE STRENGTH SUBGROUP		MEAN	SD	P VALUE	INFERENCE
VAS	PRE TEST	6.38	0.91	0.001	Highly Significant
	6^{TH} WEEK	3.88	0.89		
	12^{TH} WEEK	1.64	0.69		

Table -1

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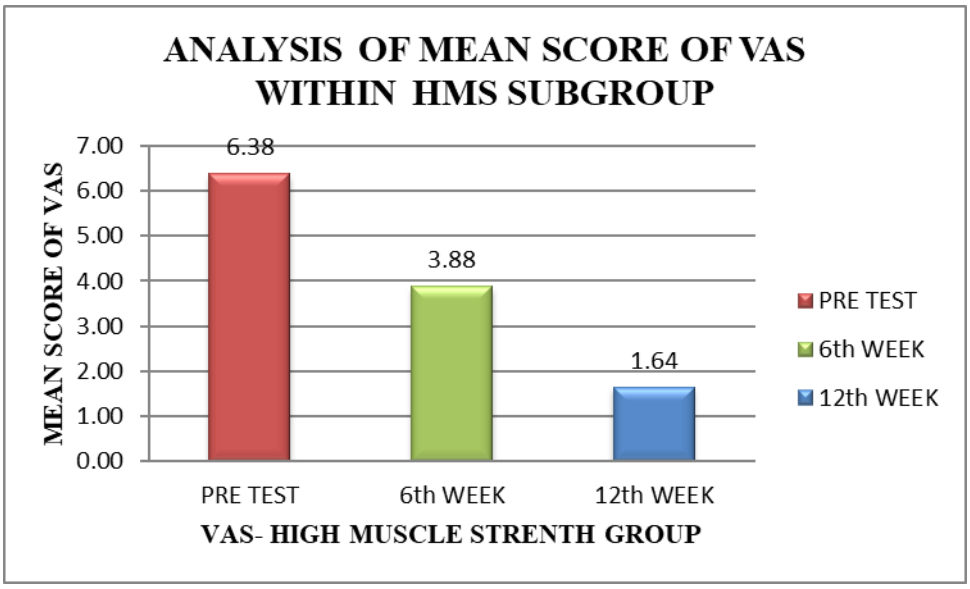

Graph-1

Results: The above table and graph shows that the mean score of VAS changes from pre- test to 6th week and post-test values within High muscle strength subgroup in group A were found to be statistically highly significant ($p<0.005$).

15. Analysis of Mean Score of VAS Within LMS Subgroup of Group A

LOW MUSCLE STRENGTH SUBGROUP		MEAN	SD	P VALUE	INFERENCE
VAS	PRE TEST	6.39	0.92	0.001	Highly Significant
	6TH WEEK	4.1	0.83		
	12TH WEEK	2	0.71		

Table-2

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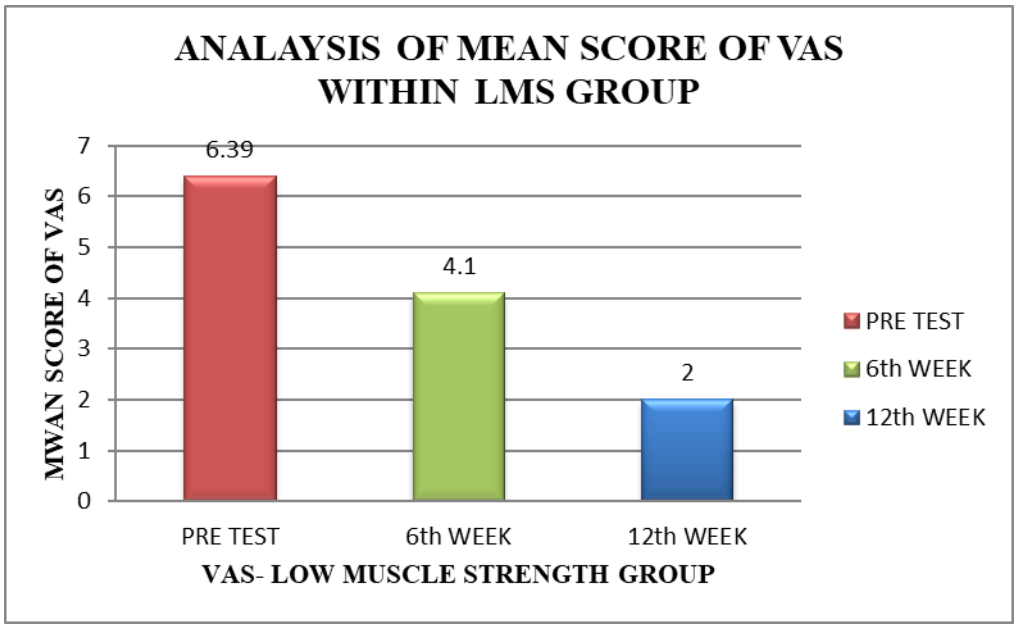

Graph-2

Results: The above table and graph shows that the mean score of VAS changes from pre- test to 6th week and post-test values within Low muscle strength subgroup in group A were found to be statistically highly significant ($p<0.005$).

16. Analysis Of Mean Score of VAS Within Obesity Subgroup of Group A

OBESITY SUBGROUP		MEAN	SD	P VALUE	INFERENCE
VAS	PRE TEST	6.39	0.91	0.001	Highly Significant
	6^{TH} WEEK	4.29	0.87		
	12^{TH} WEEK	2.1	0.7		

Table-3

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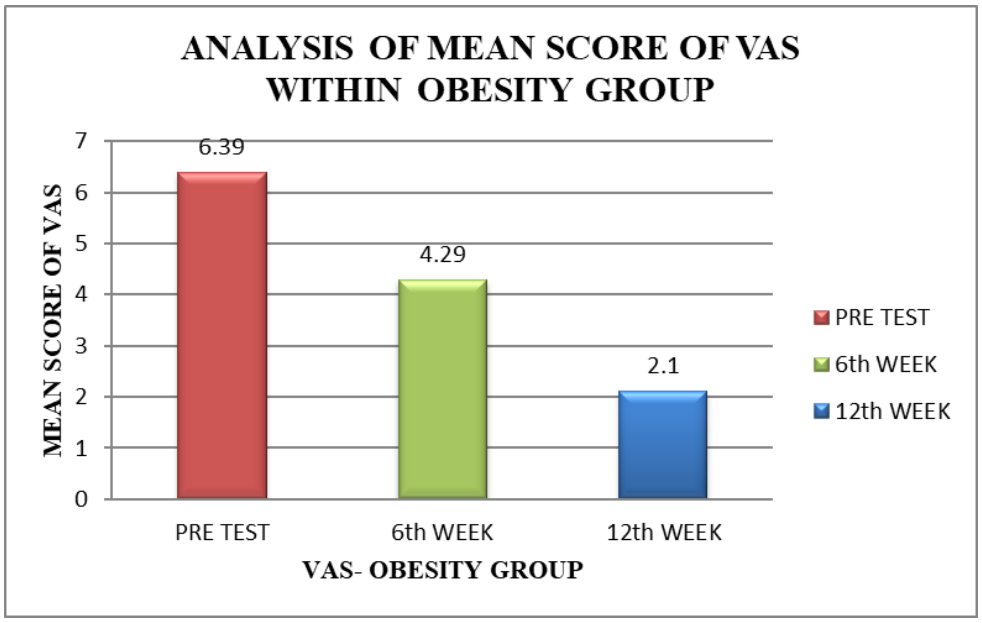


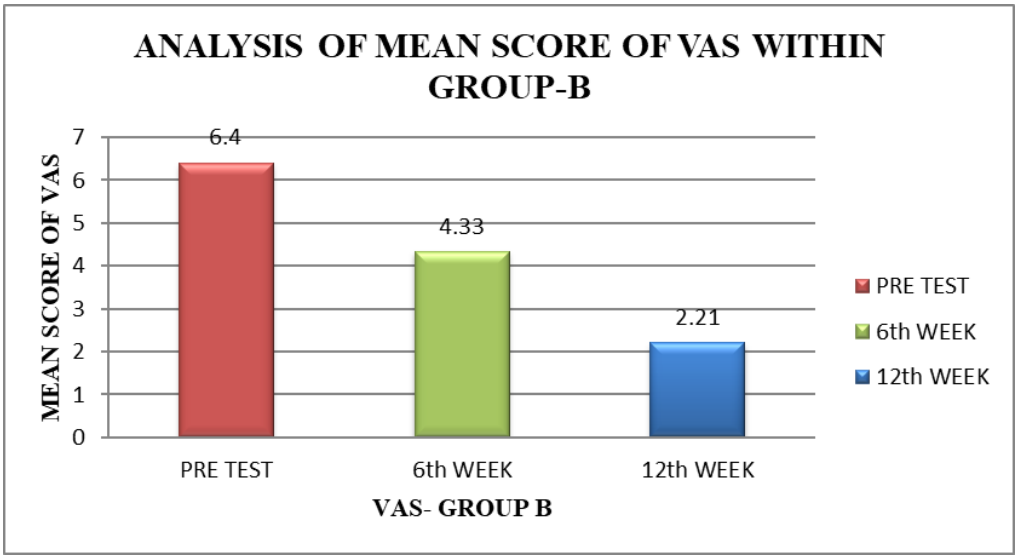
Graph-3

Results: The above table and graph shows that the mean score of VAS changes from pre- test to 6th week and post-test values within Obese subgroup in group A were found to be statistically highly significant ($p<0.005$).

17. Analysis Of Mean Score of VAS Within Group B

GROUP-B		MEAN	SD	P VALUE	INFERENCE
VAS	PRE TEST	6.4	0.91	0.001	Highly Significant
	6^{TH} WEEK	4.33	0.85		
	12^{TH} WEEK	2.21	0.68		

Table-4



Graph-4

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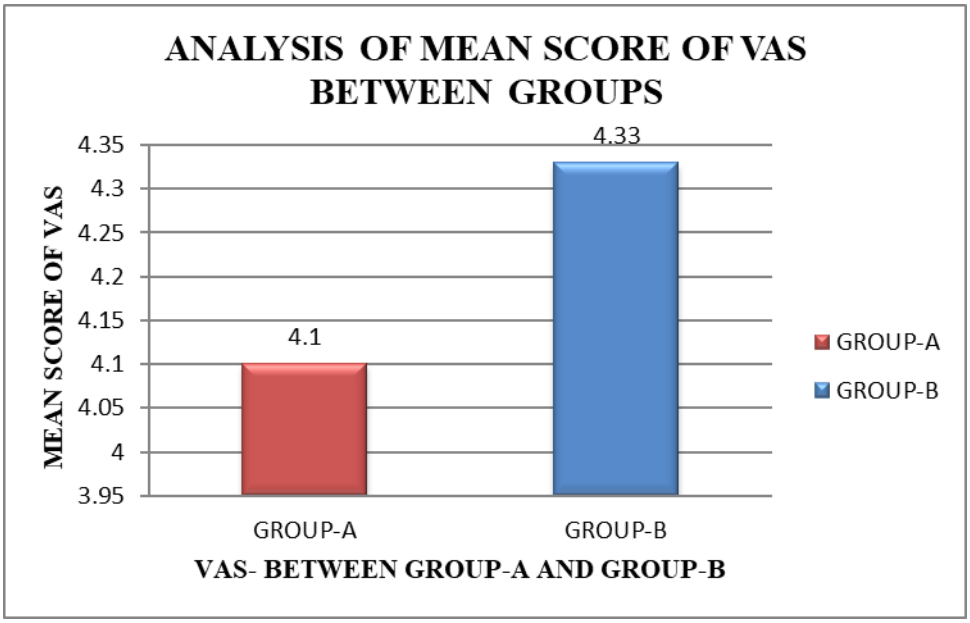
Results: The above table and graph shows that the mean score of VAS changes from pre- test to 6th week and post-test values within group B were found to be statistically highly significant ($p<0.005$).

18. Analysis of Mean Score of VAS Between Groups for 6th Week

6th WEEK		MEAN	SD	P VALUE	INFERENCE
VAS	GROUP-A	4.1	0.36	0.102636	Insignificant
	GROUP-B	4.33	0.85		

Table-5



Graph-4

Results: The above table and graph shows that the 6th week measurements of VAS in between the groups were found statistically insignificant.

19. Analysis Of Mean Score of VAS Between Groups for 12th Week

12th WEEK		MEAN	SD	P VALUE	INFERENCE
VAS	GROUP-A	1.92	0.36	0.01	Highly significant
	GROUP-B	2.21	0.68		

Table-6

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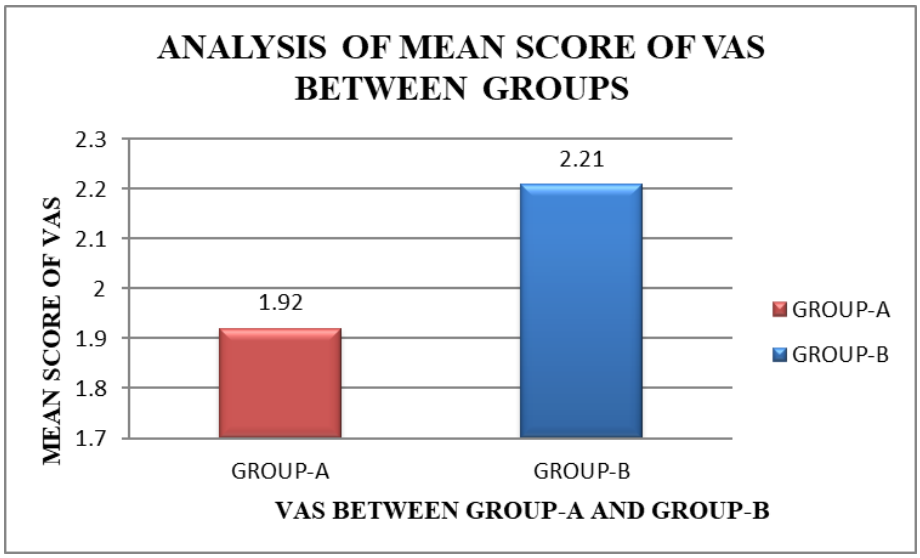


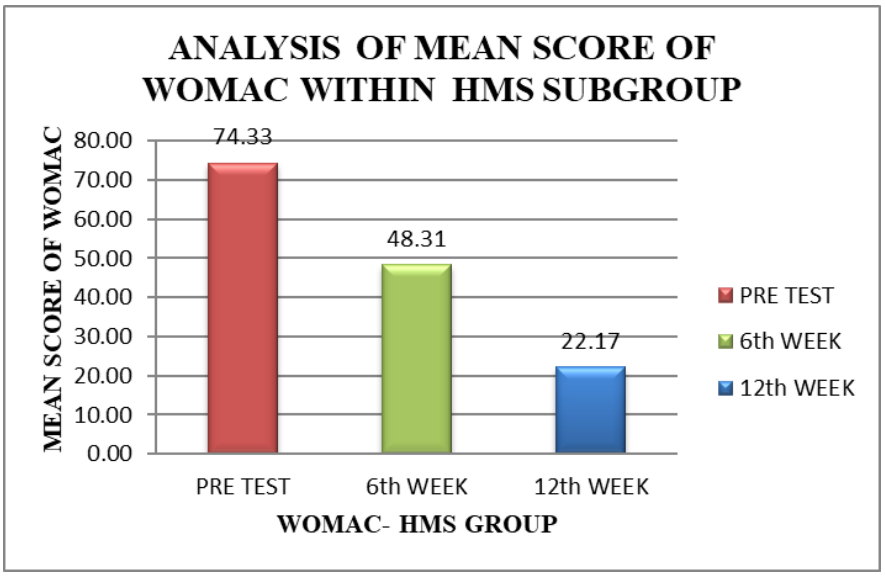
Graph-6

Results: The above table and graph shows that the 12th week measurements of VAS in between the groups were found statistically Highly significant.

20. Analysis Of Mean Score of WOMAC Within HMS Subgroup of Group A

HIGH MUSCLE STRENGTH SUBGROUP		MEAN	SD	P VALUE	INFERENCE
WOMAC	PRE TEST	6.38	0.91	0.001	Highly Significant
	6TH WEEK	3.88	0.89		
	12TH WEEK	1.64	0.69		

Table-7



Graph-7

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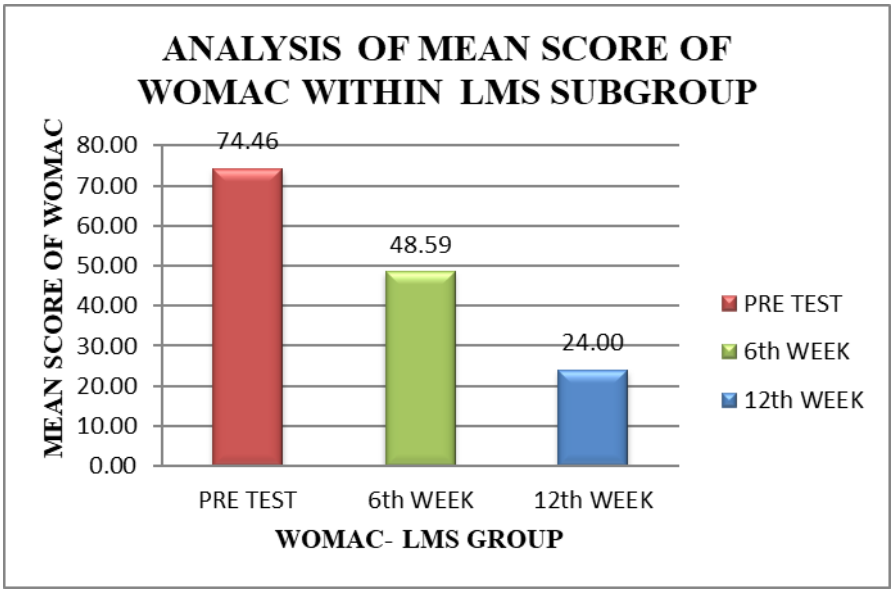
Results: The above table and graph shows that the mean score of WOMAC changes from pre- test to 6th week and post-test values within High muscle strength subgroup in group A were found to be statistically highly significant ($p<0.005$).

21. Analysis Of Mean Score of WOMAC Within LMS Subgroup of Group A

LOW MUSCLE STRENGTH SUBGROUP		MEAN	SD	P VALUE	INFERENCE
WOMAC	PRE TEST	74.46	2.49	0.001	Highly Significant
	6TH WEEK	48.59	3.67		
	12TH WEEK	24	4.27		

Table-8



Graph-8

Results: The above table and graph shows that the mean score of WOMAC changes from pre- test to 6th week and post-test values within Low muscle strength subgroup in group A were found to be statistically highly significant ($p<0.005$).

22. Analysis Of Mean Score of WOMAC Within Obesity Subgroup of Group A

OBESITY SUBGROUP		MEAN	SD	P VALUE	INFERENCE
WOMAC	PRE TEST	74.46	2.49	0.002	Highly Significant
	6TH WEEK	49.12	3.72		
	12TH WEEK	24.54	4.20		

Table-9

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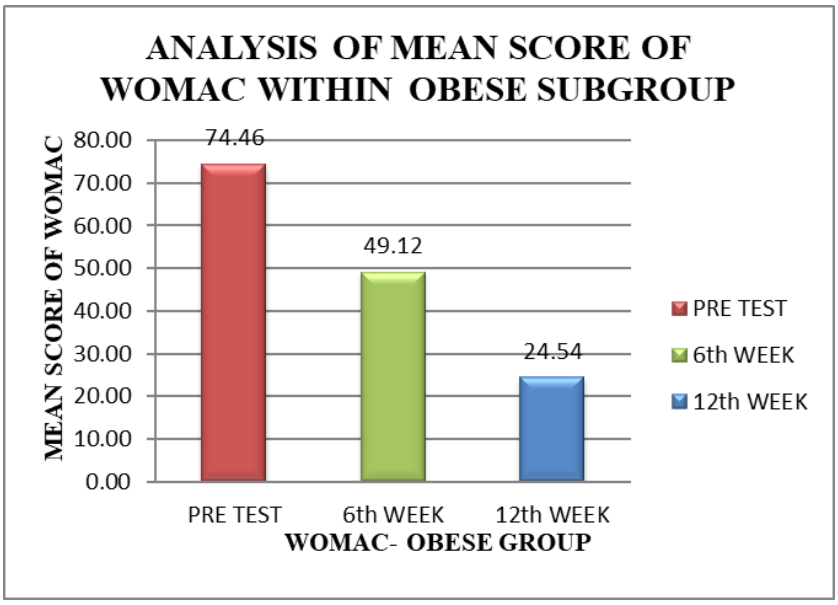


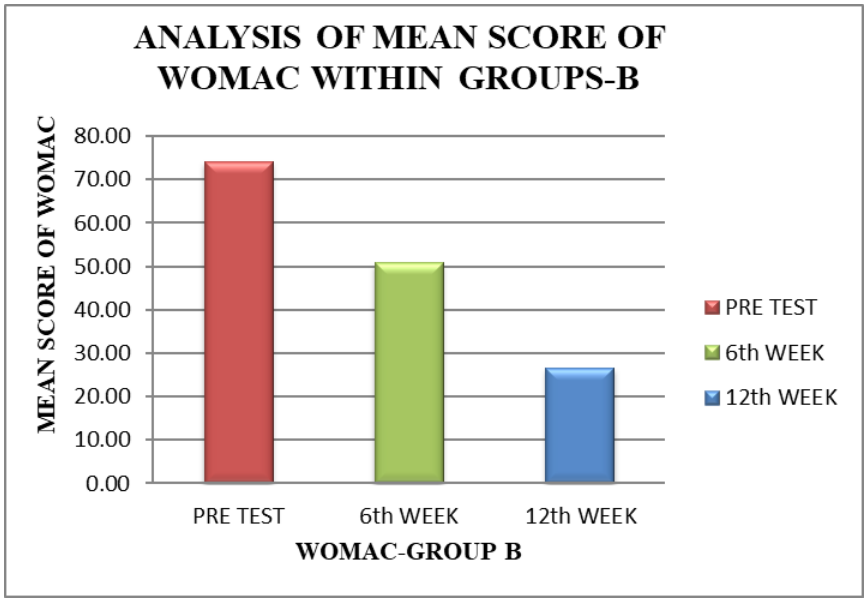
Graph-9

Results: The above table and graph shows that the mean score of WOMAC changes from pre- test to 6th week and post-test values within Obese subgroup in group A were found to be statistically highly significant ($p<0.005$).

23. Analysis Of Mean Score of WOMAC Within Group B

GROUP-B		MEAN	SD	P VALUE	INFERENCE
WOMAC	PRE TEST	74.46	2.49	0.001	Highly Significant
	6TH WEEK	49.12	3.72		
	12TH WEEK	24.54	4.20		

Table-10



Graph-10

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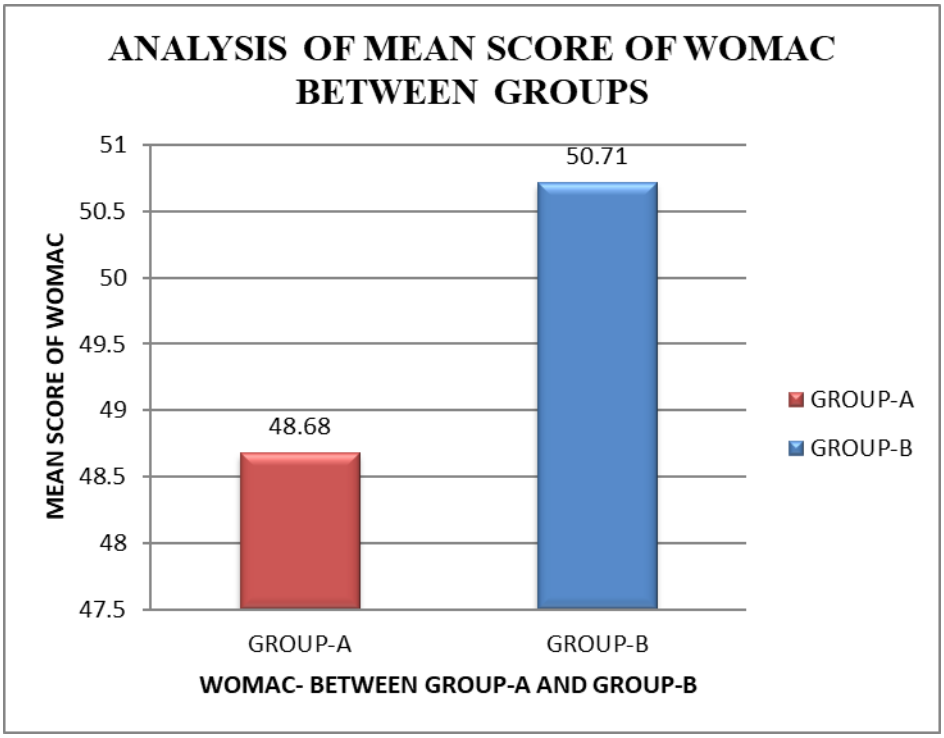
Results: The above table and graph shows that the mean score of WOMAC changes from pre- test to 6th week and post-test values within group B were found to be statistically highly significant ($p<0.005$).

24. Analysis Of Mean Score of WOMAC Between Groups For 6th Week

6th WEEK		MEAN	SD	P VALUE	INFERENCE
WOMAC	GROUP-A	48.68	3.25	0.01	Highly significant
	GROUP-B	50.71	4.44		

Table-11



Graph-11

Results: The above table and graph shows that the 6th week measurements of WOMAC in between the groups were found statistically Highly significant.

25. Analysis Of Mean Score of WOMAC Between Groups For 12th Week

12th WEEK		MEAN	SD	P VALUE	INFERENCE
WOMAC	GROUP-A	48.68	3.25	0.01	Highly significant
	GROUP-B	50.71	4.44		

Table-2

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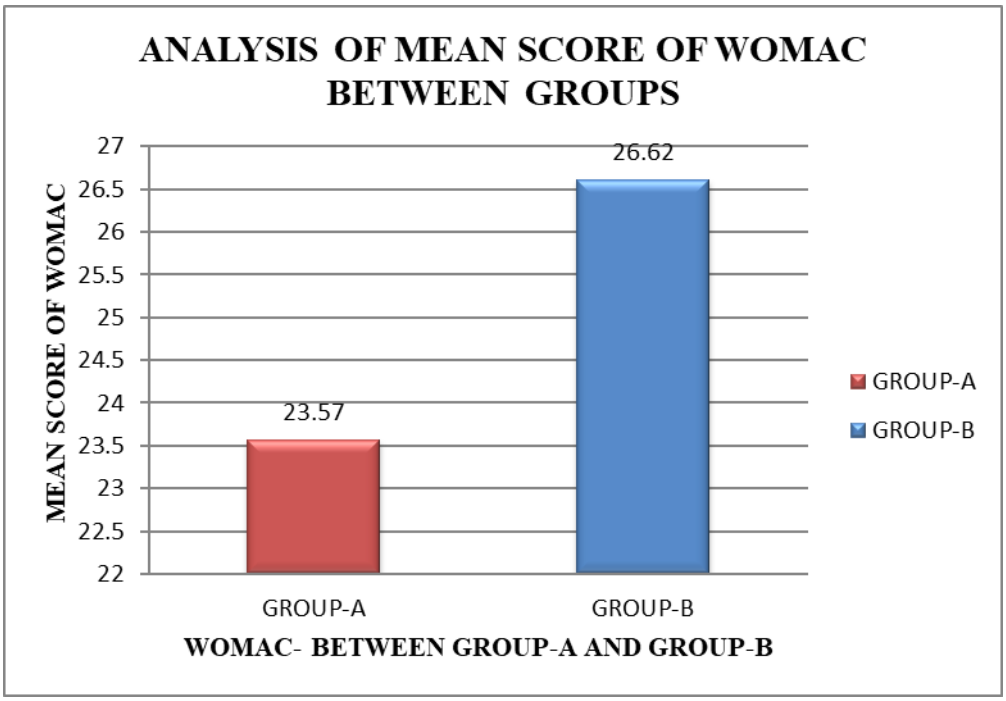

Graph-12

Results: The above table and graph shows that the 12th week measurements of WOMAC in between the groups were found statistically Highly significant.

26. Discussion

The aim of the present study was to evaluate the effectiveness of Stratified exercise therapy and Standard physiotherapy on pain and function in subjects with knee osteoarthritis. In stratified exercise therapy group, subjects were categorized into High muscle strength subgroup (HMS), Low muscle strength subgroup (LMS) based on 30 second sit-stand test [22] where score more than 12 considered as HMS, below that were LMS and more than 30 kg/m2 Body Mass Index (BMI) [25] were Obesity subgroup (OS) and this Obesity subgroup in Stratified exercise therapy was given instructions to lose weight.

In this study, subjects were assessed for pain and function. The following outcome measures are visual analogue scale (VAS) and western Ontario and McMaster university osteoarthritis index (WOMAC) were used to measure the intensity of pain and function.

Subjects were assessed for pain and function at baseline, 6th week and at the end of the intervention using VAS for pain, WOMAC for function. There were a total of 11 dropouts in Group-A (Stratified exercise therapy group) i.e, 3 dropouts with 42 subjects in High muscle strength group (HMS), 4 dropouts in Low muscle strength group (LMS) and Obesity group (OS) with 41 subjects each and 3 dropouts with 42 subjects in Group-B (Standard physiotherapy) due to their own reasons.

In Group-A (Stratified exercise therapy) there is statistically less significant improvements in the 6th week, but statistically more significant improvements seen at the end of the study i.e at 12th week (p=0.001) in VAS and also statistically more significant improvements seen in WOMAC (p=0.002). Exercises in this group shown to effectively strengthen key muscles around the knee joint, which can enhance joint stability and reduces stress on the knee. Stronger muscles absorb impact forces, which decreases the load directly placed on the knee joint, thereby reducing pain and improving function for individuals with osteoarthritis of knee and incorporating aerobic exercise not only enhances cardiovascular health but also improves circulation, thus creating an optimal healing environment and potentially leading to pain relief and functional improvement [26].

According to J Knoop et al the model had a positive response from the interviewees due to its added value and applicability. Patients underlined the significance of appropriate exercise, adequate patient education and

customizing their treatment. The physiotherapist emphasizes the applicability of the algorithm and subgroup specific exercise protocols [27].

Whitehurst DG et al stated that Stratified management for low back pain according to patient's prognosis and matched care pathways has been shown to be effective treatment approach in primary care and concluded that Stratified primary care management for low back pain is more cost-effective than current best practices in providing resources for all risk defined subgroups [28].

According to Van der Leeden et al exercise therapy is effective in decreasing pain and activity limitations in knee osteoarthritis, but the effect sizes are low to moderate. Optimizing treatment effects in a cost-effective manner can be achieved through stratified exercise therapy tailored to clinically relevant subgroups of patients [29].

In Group-B (Standard physiotherapy) of the current study had significant improvements on VAS (P=0.001) and WOMAC (p=0.001). The protocol of standard physiotherapy of this study was taken from previous study. In our study participants were given strengthening exercises, stretching exercises and shortwave diathermy was given to both groups.

Chinelo N Onwunzo et al stated that the exercise group's increased quadriceps strength and decreased discomfort may be the cause of their enhanced function and decreased pain, which in turn increases the stability of their knee joint [30].

Alshami AM et al stated that muscles that are strong and flexible can lower pain and disability, improve and maintain the range of motion, physical function of a joint, postural stability and balance [31].

According to Stefano Masiero et al Shortwave diathermy effects give both thermal and non-thermal. Vasodilation, elevation of pain threshold, reduction in muscle spasm, acceleration of cellular metabolism and increased soft tissue extensibility are all included by thermal effects. The cell's energy absorption from oscillating electrical fields likely causes the non-thermal effects which in turn induce cellular activity, these include boosting blood flow, alleviating joint discomfort and stiffness, reducing inflammation, resolving edema and accelerating wound healing [32].

After 12 weeks of intervention the results showed significant improvement in all outcome measures i.e visual analogue scale (VAS) and western Ontario and mcmaster university osteoarthritis index (WOMAC) in Stratified exercise therapy compared to Standard physiotherapy. Therefore, the study findings indicate that Stratified exercise therapy was effective for reducing pain and improving function in the sample studied.

27. Limitations

1. Lack of control group in this present study.
2. Lack of blinding of evaluators.
3. No follow up

28. Conclusion

The present study concluded that 12 weeks intervention of Stratified exercise therapy and Standard physiotherapy showed a statistically significant difference in reducing Pain, improving Function. However, a higher percentage of improvement was found in the subjects received Stratified exercise therapy when compared to Standard physiotherapy. From the findings of the current study, it can be recommended that Stratified exercise therapy maybe opted as a treatment of choice for reducing Pain, improving Function in subjects with Knee Osteoarthritis.

29. Summary

Title: Effect of Stratified Exercise Therapy Versus Standard Physiotherapy On Pain And Function in Subjects With Knee Osteoarthritis

Purpose: The purpose of the study was to find the effectiveness of Stratified exercise therapy versus Standard physiotherapy on pain and function in subjects with knee osteoarthritis.

Methods: Quasi Experimental Study Design. This study includes 180 subjects with a mean age of 52 years have clinically diagnosed with Grade 2 and 3 Osteoarthritis were randomly allocated into 2 groups. In group A (135) subjects were sub divided into 3 subgroups consisting of 45 participants each based on BMI and upper leg muscle were treated with Stratified exercise therapy whereas Group B (n=45) received Standard physiotherapy. Participants were treated for 12 weeks. The outcome measures of this intervention were measured in terms of VAS for pain, western Ontario and mcmaster university osteoarthritis index WOMAC for Function.

Results: ANOVA was performed to assess the statistical difference within the groups. ANOVA post Hoc test was performed to assess the statistical significant difference in mean value between the groups. Statistical analysis of data revealed that Stratified exercise therapy showed significant improvement in parameters when compared to Standard physiotherapy on pain and function in subjects with grade 2 and 3 knee osteoarthritis.

Conclusion: After 12 weeks of intervention both Stratified exercise therapy and Standard physiotherapy showed significant improvement in reducing Pain, improving Function in subjects with knee osteoarthritis. However Stratified exercise therapy group was found to be more effective when compare to Standard physiotherapy. From the findings of the current study, Stratified exercise therapy can be opted as treatment of choice for the management of subjects with Knee Osteoarthritis.

Keywords: Knee Osteoarthritis, Stratified exercise therapy, Standard physiotherapy, Visual Analogue Scale, Western Ontario and McMaster University Osteoarthritis Index.

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