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Effect of Home Exercise Program in Chronic Non-specific Low Back Pain

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ABSTRACT

Home Exercise Programme (HEP) is an alternative to supervised exercise therapy for patients with Chronic Non-Specific Low Back Pain (CNLBP). Complexity and burden of exercises were found to be important barriers related to adherence to HEP, affecting its effectiveness. This pilot study was conducted with 7 CNLBP patients to determine the safety, feasibility, adherence and effectiveness of a simple and graded HEP. The HEP consists of 6 exercises a day, for 5 days a week, for 6 weeks. The outcome measure includes semi-structured questionnaires for assessing feasibility, safety and adherence, Pain intensity, Functional abilities and Quality of Life, was taken at baseline, end of III and VI weeks. Statistical analysis was done by Kruskal Wallis ANOVA. No adverse events were reported and found feasible with 98.41% adherence. Significant improvement was observed in all the outcome measures with $p < 0.05$. This HEP is a safe, feasible and effective intervention for CNLBP.

INTRODUCTION

Chronic Non-specific Low Back Pain (CNLBP) is a major cause of medical expenses, sickness absenteeism and disability among adults [1]. Though low back pain tends to resolve spontaneously in due course of time, it is prone for recurrence [2,3]. Evidence supports that therapeutic exercises are effective in managing CNLBP [4]. However, taking regular supervised exercise is more challenging for rural populations due to affordability, accessibility, lack of availability of rehabilitation facilities in the rural areas and dearth of time. Home Exercise Programme (HEP) was found to be an alternative for supervised physiotherapy intervention given at clinics [5]. However, evidence for the effectiveness of HEP is inconclusive due to lack of adherence and it has been found that the complexity and burden of exercises were found to be important barriers related to adherence of HEP [6,7,8]. Moreover, contextual factors like the availability of space, time and accessories for doing exercise could affect the feasibility of implementation of exercise intervention in a home setting, especially in rural areas [9]. Hence, a simple and graded exercise programme was developed for individuals with CNLBP. The primary aims of this study were to determine the safety, and adherence of this simple and graded HEP and the secondary aims were to explore the factors affecting the feasibility of implementing this HEP and to determine its effectiveness in patients with CNLBP.

Methodology

Study Design: This pilot study is a single group pretest post-test design, conducted in the rural community settings of Puducherry, India, as a part of a clinical trial to find out the effectiveness of a simple and graded HEP for patients with CNLBP during the period November 2022 to January 2023.

Sample selection: Participants were recruited by convenient sampling method from the Physiotherapy department of the randomly selected Community Health Centres and Primary Health Centres of the rural areas of Puducherry. CNLBP patients who met

the inclusion criteria and gave consent to participate were included in this pilot study.

Inclusion Criteria: (i) Male and female adults, aged between 25 and 55 years, residing in rural areas with persistent low back pain for about 12 weeks and less than 1-year duration, (ii) Back Pain localized anywhere between the costal margin and the gluteal folds with no radiating pain, and able to perform the Activities of Daily Living and occupational activities with the pain. (NPRS score, in the last 2 weeks, between 4 and 7), (iii) more than 26.6 cm in functional reach test.

Exclusion Criteria: Participants were excluded if they had: (i) red flag symptoms (e.g., trauma, infection, malignancy, neurological deficits), (ii) prior surgeries involving the lumbar spine, abdomen, pelvis, or hip, (iii) congenital conditions like severe stenosis or cauda equina syndrome, (iv) acquired disorders (e.g., spondylolisthesis, nerve compression, SI joint pathology, fibromyalgia), (v) recent radiological interventions (within 3 months), (vi) contraindications to exercise (e.g., uncontrolled hypertension, cardiac or respiratory disease), (vii) inability to sustain a 30-second isometric contraction, or (viii) pregnancy.

Intervention: Participants were instructed to carry out the home exercise protocol developed for this study. Based on the literature review these exercises were selected to improve the spinal and pelvic mobility, flexibility of muscles around this region, strength of the spinal muscles and core stability then validated by two independent physiotherapists.

This 6-week HEP consists of 6 exercises each week. Each participant was given the week-wise exercise chart, one after the other for the respective weeks, as they completed. The participants carried out the first session of every week's HEP under the supervision of a therapist trained in the exercise protocol of this study, at the health centre. To improve flexibility, self-stretching exercises for 1) spinal extensors and side flexors, and 2) hip flexors, extensors, adductors and rotators were done by the participants. Each muscle group was stretched 10 times with a hold time of 15 to 20 seconds. The mobility exercises for the spinal column and the pelvis were repeated 10 times. The core stability exercises and the strengthening exercises for the abdominals, spinal extensors and rotators, hip flexors and extensors were done 10 times, with a hold time of 5 to 10 seconds for the isometric exercises.

Outcome Measures: At baseline, participant information including age, gender, education, occupation, body mass index (BMI), and duration since symptom onset was collected. The primary outcomes were safety and adherence to the graded Home Exercise Program (HEP), assessed using a semi-structured questionnaire. Safety was evaluated weekly by documenting adverse events such as increased pain, soft tissue strain, or falls during or after exercises. Adherence was measured based on the number of exercises performed daily, repetitions, and frequency per week, along with the quality of performance rated on a 5-point ordinal scale. Week-wise and overall adherence scores were calculated at the end of each week before the subsequent supervised session.

The secondary outcomes focused on feasibility and effectiveness. Fifteen dichotomous items assessed feasibility-related factors, including participant perceptions, demographic and contextual influences such as age, gender, BMI, comorbidities, exercise complexity, motivation, time management, and external support. These responses were collected weekly prior to initiating the next exercise schedule.

To evaluate effectiveness, pain intensity, functional ability, and quality of life were measured using the Numeric Pain Rating Scale (NPRS), Patient-Specific Functional Scale (PSFS), and WHOQOL-BREF, respectively, at baseline, week 3, and week 6. The NPRS, an 11-point scale, quantified pain intensity; a 1.5-point reduction is considered a Minimal Clinically Important Difference. The PSFS assessed activity limitations and functional outcomes, showing good reliability (ICC = 0.82) and a Minimal Detectable Change (MDC) of 2.8. WHOQOL-BREF measured overall quality of life, with higher scores indicating better outcomes, and showed high internal consistency.

Sample Size Estimation: Based on the previous study [10], detecting a between-group pain intensity difference of 1.06 on the VAS with 80% power and 5% alpha required 62 participants per group. Accounting for potential dropouts, 70 participants per group were estimated for the main trial. Following Cocks and Torgerson (2013), who recommend a minimum of 9% of the main sample size for pilot studies, 10% (7 participants) of the intervention group was selected for this pilot. Sample size was calculated using OpenEpi Version 3.

Statistical Analysis: The demographic information, data on safety and feasibility were analysed using descriptive statistics and Chi-square test. The scores of NPRS, PSFS and WHOQOL-BREF were analysed by Kruskal Wallis ANOVA. A two-sided test was carried out with a 'level of significance' of 0.05.

Findings

Seven patients including three females with CNLBP pain were recruited. The mean age was 45.7 (9.09) years, the mean duration of the illness was 10.43 (7.57) years and the mean BMI was 23.6±2.34. The mean score of pain intensity, functional ability and quality of life at baseline were 7.29±1.38, 48.71±5.56 and 44.29±7.02 respectively.

Safety: There were no adverse effects like an increase in pain, soft tissue strain, or falls reported while performing the exercises. One participant reported muscle soreness after completion of exercises in the 5th and 6th week.

Adherence: The exercise adherence score was one hundred percent for the first four weeks. The exercise adherence score in the 5th and 6th weeks was 95.24% and the overall adherence score for this six-week simple and graded HEP was 98.41%.

Feasibility: Factors affecting feasibility are summarized in Table 1. All the participants showed interest in doing the exercises and reported that it was useful and the number of exercises for each week was appropriate. Seventy-five percent of the male participants enjoyed all the exercises. One male and all three female participants had reported difficulty in performing a full plank, tube stretch out and tube walk out due to toughness. Twenty-nine percent of participants had reported that they were not confident about the correctness of the exercise due to difficulty in understanding the complexity of the clamp shell and inverted bug. No participants reported constraints in space, equipment and devoting the time for doing exercises. Eighty-six percent of participants reported that they were encouraged by their family members with positive feedback.

Table – 1 Patient-perceived factors affecting the feasibility of implementing Simple and Graded Home Exercise Programme

Factors	Number (%)
Age	Not reported
Gender	3 (43) *
BMI	1 (14) *
Comorbidities	Not reported
General Interest in doing exercise	Not reported
Difficulty of exercise	4 (57) *
Complexity of exercise	2 (29) #
Number of exercises	Not reported
Confidence in the correctness of doing exercise	2 (29) #
Enjoyment	1 (14) *
Motivation from benefit of exercise (Example: Increase or decrease in pain, range or functional activity)	Not reported

Availability of Space	Not reported
Availability of Time	Not reported
Availability of accessories	Not reported
Encouragement from family members	1 (14)

*Interaction of exercise-related and individual factors
Interaction with in exercise-related factors.

Clinical outcome: Table-2 shows the analysis of pain intensity, functional ability and quality of life at the end of 3 weeks and 6 weeks of the training. The mean difference (95% CI) from baseline to end of III week and VI week for pain intensity were 2.57 (1.08 – 4.07) and 5.71 (4.55 – 6.87), for functional ability were -13.14 (-19.89 – -6.40) and -26.71 (-32.18 – -21.25) and for Quality of life were -8.86 (-17.17 – -0.54) and -16.71 (-24.6 – -8.81). Within group analysis showed significant difference in pain intensity, functional ability and quality of life at $p < 0.001$, 0.000, 0.007 respectively.

Table - 2 Analysis of clinical outcome of the participants

Outcome measures	At baseline (Mean±SD)	At the end of III week of training (Mean±SD)	At the end of VI week of training (Mean±SD)	Mean difference between Baseline & at end of III week (Mean±SD)	Mean difference between Baseline & at end of VI week (Mean±SD)	*p*-value (Baselinevs III week vs VI week)
Pain intensity (NPRS)	7.29±1.38	4.71±1.8	1.57±0.79	2.57±1.61	5.71±1.25	0.001
Functional abilities (PSFS)	48.71±5.56	61.9±6.67	75.43±2.51	-13.14±7.29	-26.71±5.91	0.000
Quality of Life (WHOQOL-BREF)	44.29±7.02	53.14±10.89	61±9.52	-8.86±8.99	-16.71±8.54	0.007

DISCUSSION

The findings of the study provide significant insights into the impact of a simple and graded home exercise program on patients suffering from CNLBP. The reported improvements in pain intensity, functional ability, and quality of life over the six-week intervention period suggest practical implications for managing chronic back pain in a home setting, especially in terms of accessibility and feasibility. Previous research supports the idea that structured exercise programs can lead to enhancements in health outcomes among individuals with CNLBP. For example, Akodu et al. illustrated that adherence to stabilization exercises led to substantial reductions in pain and improvements in quality of life, aligning well with the results observed in this study [11].

The high adherence rate of 98.41% in the discussed program indicates that patients found the home exercise regimen acceptable and manageable, given the lack of equipment and space requirements. High adherence rates have been associated with positive clinical outcomes in other studies as well, suggesting that simplifying intervention requirements can foster greater patient engagement and compliance. Furthermore, the majority reported receiving positive support from family members, underscoring the role of social support in enhancing adherence to exercise programs. This aspect is crucial since social encouragement often correlates with better health behaviors and compliance within rehabilitative contexts [12].

While the study revealed only mild adverse effects, it is notable that such occurrences are common in exercise programs targeting chronic pain. One participant's experience of muscle soreness suggests the need for careful monitoring and potentially adaptive exercise recommendations for certain individuals. This observation fits within a broader framework of rehabilitation literature which consistently emphasizes the importance of balancing exercise intensity with patient tolerance to minimize discomfort and encourage long-term participation in physical activity [13,14].

The statistically significant improvements in pain intensity ($p < 0.001$), functional ability ($p < 0.000$), and quality of life ($p = 0.007$) highlight the clinical efficacy of the home exercise program, demonstrating that structured physical activity can be a viable option for managing CN

LBP. Such improvements resonate with findings across various studies which advocate for the integration of physical exercise as a central element of pain management in chronic conditions [15,16].

Together, these findings advocate for further exploration of home-based exercise programs as effective interventions for chronic low back pain, potentially offering cost-effective strategies that could be implemented widely. As chronic low back pain remains a major public health challenge, promoting accessible exercise alternatives could play a pivotal role in alleviating the burden of this condition on healthcare systems and improving patient quality of life [17,18].

Conclusion and Recommendations

A simple and graded HEP appears safe, feasible and effective in improving pain, functional activities and quality of life in patients with CNLBP. Further, evaluation of this simple and graded home-based exercise programme has to be done by adequately powered study with a control group to determine its long-term effect on these parameters and in preventing recurrence.

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Ethical approval: The study was approved by the Institute Ethics Committee (Human Studies) of Indira Gandhi Medical College and Research Institute, Government of Puducherry Institution (No. 425/IEC-35/IGMC&RI/PP-30/2022, and registered in the Clinical Trials Registry-India, Indian Council of Medical Research (ICMR)-National Institute of Medical Statistics (No. CTRI/2022/10/046841).

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