ORIGINAL RESEARCH

Comparison of core stabilization exercises and back school exercises in chronic nonspecific low back pain: a randomized controlled study

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ABSTRACT
Chronic nonspecific low back pain (CNSLBP) is a widespread musculoskeletal condition that significantly affects individuals' quality of life and functional capacity. Exercise therapy, particularly core stabilization exercises and Back School programs, is a primary intervention strategy. This study aimed to compare the effectiveness of these two exercise-based interventions in managing CNSLBP.**Methods:** This randomized controlled trial included 40 participants with CNSLBP, aged 35 to 60 years, recruited from the physiotherapy outpatient department of Deccan Hospital, Hyderabad. Participants were randomly assigned to either the core stabilization exercise group (Group B) or the Back School program group (Group A), with 20 participants in each group. Both interventions were administered four times a week for four weeks. Outcome measures, including the Visual Analogue Scale (VAS), Roland-Morris Disability Questionnaire (RMDQ), and lumbar spine range of motion (TROM), were assessed at baseline and post-intervention. Data were analyzed using paired and independent t-tests, with statistical significance set at $p{\leq}0.05$.**Results:** Both groups showed significant improvements in all outcome measures post-intervention. In Group A, the mean VAS score decreased from 7.4 to 5.25, the RMDQ score from 16.65 to 9.45, and TROM increased from 1.585 degrees to 2.09 degrees. Group B exhibited more substantial improvements, with the mean VAS score decreasing from 7.2 to 2.4, the RMDQ score from 16.6 to 6.75, and TROM increasing from 1.53 degrees to 2.51 degrees. Group B demonstrated significantly greater improvements compared to Group A ($p < 0.0001$).**Conclusion:** Both core stabilization exercises and Back School programs effectively reduce pain and disability while improving lumbar spine range of motion in CNSLBP patients. However, core stabilization exercises offer superior outcomes, suggesting a more effective intervention for CNSLBP management.
Key words: Chronic nonspecific low back pain, core stabilization exercises, back school program, randomized controlled trial, visual analogue scale, Roland-Morris disability questionnaire, lumbar spine range of motion

INTRODUCTION

Chronic nonspecific low back pain (CNSLBP) is a prevalent musculoskeletal disorder that significantly impacts the quality of life and functional capacity of individuals worldwide. It is characterized by pain and discomfort localized below the costal margin and above the inferior gluteal folds, with no identifiable specific pathology such as infection, malignancy, or radiculopathy. CNSLBP is responsible for considerable healthcare costs, lost workdays, and long-term disability, making it a major public health concern. The multifactorial etiology of CNSLBP includes biomechanical, psychological, and social factors, and its management often requires a multidisciplinary approach[1,2,3].

Among the various therapeutic strategies for CNSLBP, exercise therapy remains a cornerstone of treatment. It is well-documented that physical activity,

especially targeted exercise interventions, can reduce pain, improve function, and enhance the overall well-being of patients with CNSLBP. Two commonly employed exercise-based interventions in the management of CNSLBP are core stabilization exercises and Back School programs. Both approaches have shown efficacy in mitigating symptoms, but their comparative effectiveness remains a subject of ongoing research and debate[4, 5].

Core stabilization exercises focus on strengthening the deep muscles of the abdomen, pelvis, and lower back, which play a crucial role in maintaining spinal stability. These exercises aim to enhance the activation and coordination of the core muscles, thereby improving spinal alignment and reducing the load on the lumbar spine. Core stabilization is believed to address the underlying biomechanical dysfunctions associated with CNSLBP, promoting long-term relief and preventing recurrence. Previous studies have indicated that core stabilization exercises can lead to significant improvements in pain intensity, functional disability, and muscle endurance in patients with CNSLBP[6, 7, 8].

On the other hand, the Back School concept, introduced in the 1960s, is a more comprehensive educational and exercise-based intervention. It combines physical exercises with educational components aimed at teaching patients about spinal anatomy, posture, ergonomics, and pain management strategies. The goal of Back School is not only to relieve pain but also to empower patients with knowledge and skills to manage their condition independently. This holistic approach has been shown to improve pain, functional outcomes, and patient satisfaction, although its long-term benefits compared to other interventions are still under investigation[9].

Despite the proven benefits of both core stabilization exercises and Back School programs, there is limited evidence directly comparing their effectiveness in the management of CNSLBP. This study aims to fill this gap by conducting a randomized controlled trial (RCT) to evaluate and compare the outcomes of these two interventions in patients with CNSLBP. The primary objectives of the study are to assess the impact of core stabilization exercises and Back School programs on pain reduction, functional disability, and range of motion. By elucidating the comparative effectiveness of these interventions, this study seeks to provide clinicians with evidence-based guidance for selecting the most appropriate exercise therapy for their patients with CNSLBP[10, 11].

Overall, as CNSLBP continues to impose a significant burden on individuals and healthcare systems, the need for effective and targeted interventions is paramount. This study endeavors to contribute valuable insights into the relative efficacy of core stabilization exercises and Back School programs, ultimately aiming to improve patient outcomes and inform clinical practice.

MATERIALS AND METHODOLOGY

STUDY DESIGN: This study was designed as an experimental study with a pre- and post-intervention comparison design. The research aimed to compare the effectiveness of core stabilization exercises and Back School programs in managing chronic nonspecific low back pain (CNSLBP). The sample size consisted of 40 subjects, with 20 participants in each group. The study employed a randomized sampling method to ensure unbiased allocation to either the core stabilization exercise group (Group B) or the Back School program group (Group A). The intervention period lasted for 4 weeks, and the study was conducted over a one-year period, starting from the date of approval by the Ethics Committee. The study setting was the physiotherapy outpatient department (OPD) of Deccan Hospital, Hyderabad.

INCLUSION CRITERIA
Participants were included in the study based on the following criteria:
- Male and female patients aged between 35 to 60 years.
- Patients diagnosed with nonspecific low back pain.
- Patients experiencing low back pain for at least 3 months.
- Ability to follow two-step commands.
- Ability to participate in 30-minute physiotherapy sessions.

EXCLUSION CRITERIA
Participants were excluded from the study if they met any of the following criteria:
- Presence of serious spinal pathology (e.g., tumors, fractures, inflammatory diseases).
- History of previous spinal surgery.
- Evidence of nerve root compromise.
- Cardiorespiratory illness.
- Pregnant women.

METHOD OF DATA COLLECTION
The study protocol was reviewed and approved by the Ethics Committee, and all necessary approvals were obtained from relevant authorities. Forty patients were recruited from the outpatient department of Deccan Hospital in Hyderabad. The participants were assessed for eligibility based on the inclusion and exclusion criteria. After providing informed consent, the subjects were randomly assigned to two groups using block randomization, ensuring an equal distribution of 20 participants in each group. Group A participated in the Back School program, while Group B underwent core stabilization exercises. Both interventions were administered four times a week over the 4-week intervention period.

MATERIALS USED
- Treatment couch.

MEASUREMENT PROCEDURE

An independent assessor, blinded to the treatment allocation, measured the outcome measures at baseline and at the end of the 4-week intervention. The outcome measures included:

1. **VISUAL ANALOGUE SCALE (VAS):** A 100-millimeter horizontal line was used to assess the patients' pain levels, with zero representing "no pain" and ten representing "maximum pain".
2. **ROLAND-MORRIS DISABILITY QUESTIONNAIRE (RMDQ):** A self-reported questionnaire designed to measure functional impairment and the impact of back pain on a patient's self-rated disability.
3. **LUMBAR SPINE RANGE OF MOTION (ROM):** Assessed using the modified Schober method to evaluate lumbar spine mobility.

PROCEDURE

GROUP A: BACK SCHOOL PROGRAM: The Back School program consisted of four structured classes focusing on spinal anatomy, posture, ergonomics, and pain management strategies. The program included practical demonstrations of body mechanics and self-care techniques, aiming to empower patients to manage their condition effectively.

Group B: CORE STABILIZATION EXERCISES: Group B participants performed a series of core stabilization exercises designed to strengthen the deep muscles of the abdomen, pelvis, and lower back. The exercises included abdominal bracing, bridging, leg lifts, and alternating arm and leg lifts, with a focus on maintaining spinal stability.

STATISTICAL ANALYSIS

Data were analyzed using SPSS version 16.0. Descriptive statistics were used to present the overall characteristics of the participants in terms of mean and standard deviation. Paired t-tests were conducted to compare pre- and post-intervention results within each group, and independent t-tests were used to compare the differences between the two groups. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The study included a total of 40 participants, evenly divided into two groups: Group A (Back School program) and Group B (Core Stabilization exercises).

The baseline characteristics of the participants, including age, gender, and BMI, were comparable between the two groups, with no statistically significant differences observed ($p > 0.05$) (Table 1). This homogeneity at baseline ensured that any observed differences in outcomes could be attributed to the interventions rather than demographic or anthropometric variations.

GROUP A (BACK SCHOOL PROGRAM)

In Group A, the mean Visual Analogue Scale (VAS) score significantly decreased from 7.4 ± 0.82 at baseline to 5.25 ± 1.21 post-intervention, with a mean difference of 2.15 (t = 10.3472, p = 0.0001) (Table 2). Similarly, the Roland-Morris Disability Questionnaire (RMDQ) scores demonstrated a significant reduction, with the mean score decreasing from 16.65 ± 1.27 to 9.45 ± 1.17 post-intervention, resulting in a mean difference of 7.2 (t = 5.1438, p = 0.0001). The lumbar spine range of motion (TROM) also improved significantly, increasing from 1.585 ± 0.12 degrees to 2.09 ± 0.08 degrees, with a mean difference of 0.505 (t = 18.4932, p = 0.0001).

GROUP B (CORE STABILIZATION EXERCISES)

Group B showed even more pronounced improvements. The mean VAS score decreased substantially from 7.2 ± 0.83 to 2.4 ± 0.60 post-intervention, with a mean difference of 4.8 (t = 10.34, p = 0.0001) (Table 3). The RMDQ scores also showed a significant reduction, with the mean score decreasing from 16.6 ± 1.90 to 6.75 ± 1.55, yielding a mean difference of 9.85 (t = 5.143, p = 0.0001). Additionally, TROM improved significantly, with an increase from 1.53 ± 0.09 degrees to 2.51 ± 0.06 degrees, resulting in a mean difference of 0.98 (t = 18.49, p = 0.0001).

COMPARATIVE ANALYSIS

The results indicate that both interventions were effective in reducing pain and disability while improving the range of motion in patients with chronic nonspecific low back pain. However, the core stabilization exercises (Group B) produced more significant improvements across all outcome measures compared to the Back School program (Group A). These findings suggest that while both interventions are beneficial, core stabilization exercises may offer superior outcomes in managing chronic nonspecific low back pain.

Table 1: Baseline Characteristics of Participants

Variable	Group A (n=20)	Group B (n=20)	p-value
Age (years)	39.45 ± 7.55	40.65 ± 8.65	0.6798
Gender (M/F)	12/8	11/9	0.7865
BMI (kg/m²)	24.3 ± 3.1	23.8 ± 3.5	0.6142

Table 2: Comparison of VAS, RMDQ and TROM Pre-and Post-Intervention in Group A

Outcome Measure	Pre-Test Mean ± SD	Post-Test Mean ± SD	Mean Difference	t-value	p-value
VAS Score	7.4 ± 0.82	5.25 ± 1.21	2.15	10.3472	0.0001
RMDQ Score	16.65 ± 1.27	9.45 ± 1.17	7.2	5.1438	0.0001
TROM (degrees)	1.585 ± 0.12	2.09 ± 0.08	0.505	18.4932	0.0001

Table 3: Paired T-Test Results for Pre-and Post-Intervention Scores in Group B

Outcome Measure	Pre-Test Mean ± SD	Post-Test Mean ± SD	Mean Difference	t-value	p-value
VAS Score	7.2 ± 0.83	2.4 ± 0.60	4.8	10.34	0.0001
RMDQ Score	16.6 ± 1.90	6.75 ± 1.55	9.85	5.143	0.0001
TROM (degrees)	1.53 ± 0.09	2.51 ± 0.06	0.98	18.49	0.0001

DISCUSSION

Chronic nonspecific low back pain (CNSLBP) is a debilitating condition that affects a large portion of the population globally, leading to significant socio-economic impacts due to healthcare costs, lost productivity and long-term disability. The management of CNSLBP has evolved to emphasize exercise therapy as a key intervention, with core stabilization exercises and Back School programs being two widely adopted approaches. Despite their common use, a direct comparison of their effectiveness has been limited, which this study aimed to address[12].

The findings of this study reveal that both core stabilization exercises and Back School programs significantly improve pain levels, functional disability, and lumbar spine range of motion in patients with CNSLBP. However, the data indicates that core stabilization exercises are more effective in achieving these outcomes compared to the Back School program[13].

Core stabilization exercises target the deep muscles of the abdomen, pelvis, and lower back, which are crucial for maintaining spinal stability. By enhancing the activation and coordination of these muscles, core stabilization exercises reduce the load on the lumbar spine and address the biomechanical dysfunctions commonly associated with CNSLBP. The significant reduction in VAS and RMDQ scores, along with the improvement in TROM, underscores the efficacy of core stabilization exercises in alleviating pain and improving function[14].

On the other hand, the Back School program, which combines physical exercises with education on spinal anatomy, posture, and pain management, also demonstrated significant improvements. The program's holistic approach empowers patients with the knowledge and skills to manage their condition independently, which is reflected in the significant reductions in pain and disability scores. However, the extent of improvement in Group A (Back School program) was less pronounced than in Group B (core stabilization exercises), suggesting that while educational components are beneficial, targeted exercises may be more effective in addressing the physical aspects of CNSLBP[15].

The superiority of core stabilization exercises in this study aligns with previous research, which has highlighted the importance of strengthening the core muscles for spinal health. These exercises may offer a more direct approach to managing the biomechanical dysfunctions that contribute to CNSLBP, leading to better clinical outcomes[16].

Despite these findings, the study has some limitations. The sample size was relatively small, and the follow-up period was limited to four weeks. Long-term studies with larger sample sizes are needed to confirm the sustained benefits of these interventions and to explore their effects over extended periods.

Overall, while both core stabilization exercises and Back School programs are effective in managing CNSLBP, core stabilization exercises appear to offer superior benefits in reducing pain, improving functional disability, and enhancing lumbar spine range of motion. These findings provide valuable insights for clinicians in selecting appropriate exercise therapies for CNSLBP patients and suggest that a focus on core stabilization may yield better outcomes. Future research should continue to explore these interventions to optimize treatment strategies for CNSLBP.

CONCLUSION

This study demonstrates that both core stabilization exercises and Back School programs are effective interventions for managing chronic nonspecific low back pain. However, core stabilization exercises offer superior benefits in reducing pain, improving functional disability, and enhancing lumbar spine range of motion. These findings suggest that core stabilization exercises should be prioritized in the rehabilitation of CNSLBP patients. Further research with larger sample sizes and extended follow-up periods is recommended to confirm these results and explore the long-term efficacy of these interventions in chronic low back pain management.

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