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EFFECTS OF STABILIZATION EXERCISES IN ADDITION TO ROUTINE PHYSICAL THERAPY IN ELDERLY PATIENTS WITH BACK PAIN; A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background: Back pain is a prevalent musculoskeletal condition among the elderly, which significantly impacts their quality of life. Physical therapy is a common treatment option for back pain, but the addition of specified treatment such as stabilization exercises may improve outcomes for elderly patients.

Methods: This 18-month single-blind, randomized controlled trial was conducted at Banu Bai Physiotherapy Centre in Karachi, Pakistan. The study had a sample size of 72, 36 participants per group, determined using Noordzij et al.'s (2010) formula. Participants, aged 60 or older with chronic back pain, were randomly assigned to stabilization exercise (SE) group or routine physical therapy (RPT). In addition, both groups participated in co-interventions and home exercise programs, with 45-minute treatment sessions.

Results: The average age was 71.5 years, and the average BMI was 27.4. Both groups showed similar demographic and medical characteristics at baseline. After the intervention, the SE group showed a significant improvement in all endurance test outcomes, including trunk flexors (p=0.003), trunk extensors (p=0.004), trunk right side flexors (p=0.007), and trunk left side flexors (p=0.005), compared to the RPT group. The SE group also showed a significant improvement in spinal mobility (p=0.013).

Conclusion: Adding stabilization exercise therapy to routine physical therapy can significantly improve trunk muscle endurance and spinal mobility in elderly patients with back pain. These findings suggest that healthcare professionals should consider incorporating stabilization exercises into their practices to optimize back pain management in this population. Further research is needed to explore the long-term effects of stabilization exercises and compare their effectiveness with other exercise therapies.

Keywords: Back Pain, Elderly, Endurance, Physical Therapy, Spinal Mobility, Stabilization Exercises

***Trial Registry**: IRCT20191218045786N1*

Introduction

Low back pain constitutes a pervasive health issue in the geriatric population, with an estimated prevalence ranging between 25-50% among individuals aged 60 years and above (1). The incidence increases with age, as the elderly demographic exhibits increased susceptibility to age-related degenerative alterations and musculoskeletal disorders (2, 3). This widespread condition results in substantial functional impairments, diminished life satisfaction, and augmented healthcare expenditure (4).

The multifactorial aetiology of low back pain in the geriatric population encompasses various factors such as degenerative disc disease, spinal stenosis, osteoarthritis, vertebral compression fractures, and muscle imbalances(5, 6). Moreover, age-related declines in muscle mass, flexibility, and bone density contribute to heightened vulnerability to pain and disability, further complicating the intricate pathophysiology of low back pain (7, 8).

This pathophysiology involves a combination of biomechanical, neurological, and inflammatory processes (2). Degenerative changes in the spine, including the loss of disc height and narrowing of the spinal canal, can precipitate mechanical stress, nerve compression, and nociceptive pain (9). Furthermore, age-associated muscle imbalances and weakened core muscles culminate in altered biomechanics, compromised spinal stability, and increased strain on spinal structures (10, 11).

Stabilization exercises, targeting core muscles, improve spinal stability, motor control, and muscle endurance, thus reducing pain (12-14). Moisset et al.'s (2015) study highlighted non-pharmacological interventions, especially physical activity and exercise, as key in managing low back pain in the elderly (15). Tagliaferri et al. (2020) confirmed motor control exercises' efficacy in improving pain and disability in older adults with chronic low back pain, while Steffens et al. (2016) revealed the beneficial impacts of lumbar stabilization exercises on pain, functionality, and overall quality of life (16, 17). Further supporting this, Gomes-Neto et al.'s (2017) meta-analysis found exercise programs involving strengthening, flexibility, and aerobic exercises were beneficial for elderly patients with chronic low back pain (18), but it also warrants more primary research data and recommends further clinical trials with a larger sample size. Thus, research literature consistently emphasizes the importance of exercise-based, non-pharmacological interventions in managing geriatric low back pain.

Non-pharmacological interventions, specifically exercises and rehabilitation, are paramount in managing elderly low back pain (19). Studies affirm motor control, lumbar stabilization, and multifaceted exercises enhance pain management, functionality, and life quality (20). Despite this, research gaps persist, including limited long-term effectiveness data, understanding subgroups' specific needs, and methodological constraints like small sample sizes and inconsistent protocols. This study aimed to investigate the potential benefits of adding stabilization exercises to routine physical therapy for elderly back pain patients through a randomized controlled trial. It sought to address existing research gaps and provide robust evidence on the effectiveness of this combined approach.

Methods

This randomized controlled trial was Conducted at Banu Bai Physiotherapy Centre in Karachi, Pakistan spanned in 18 months between April 2021 to October 2022, encompassing participant recruitment, intervention implementation, and follow-up assessments. The trial was approved by Institutional review board of University of Lahore and was registered and approved in Iranian Registry of Clinical Trial (*IRCT20191218045786N1*).

Using the formula by Noordzij et al. (2010), which considered parameters such as the desired level of statistical power, the significance level, and the effect size, the researchers calculated the required sample size. For example, considering a statistical power of 80%, a significance level of 0.05 (5% probability of a type I error), and a moderate effect size (Cohen's d = 0.5), the sample size needed to detect a statistically significant difference between the two groups found to be approximately 60 participants which after accounting for potential dropouts, this number increased to 72 participants, 36 for each group. The researchers employed non-probability purposive sampling to select participants, focusing on criteria relevant to the research question (21).

Inclusion criteria encompassed patients aged 60 years or older with chronic back pain, independent gait ability, adequate vision and hearing, and the capacity to understand and adhere to instructions (22, 23). Exclusion criteria involved a history of stroke or other neurological conditions, specific pathologies, lower extremity pain or limited motion, vestibular dysfunctions, recent cardiac surgeries, unstable angina, and persistent pulmonary pathology (24, 25).

Various outcome measuring tools were employed to evaluate the intervention's efficacy in elderly patients with chronic low back pain. These tools comprised a patient medical information form, LBP assessment form, visual analogue scale (VAS) for pain intensity (26), muscular endurance performance tests (27), Berg balance scale (BBS) for measuring balance (28), Oswestry low back pain disability questionnaire (ODI) for measuring functional disability (29), and a goniometric measurement form for trunk range of motion (ROM) (30).

Participants were randomly assigned to either the experimental group, receiving stabilization exercises and routine physical therapy, or to control group receiving routine physical therapy. Both groups received co-interventions, such as education on back care and home exercise programs (31). The study was a single-blind, randomized controlled trial, with the assessor blinded to minimize the risk of bias in the results. Routine physical therapy sessions were conducted for both groups in three phases (32, 33). The duration of each treatment session was 45 minutes, 5 times a week for 4 weeks, resulting in a total of 20 sessions per participant in each group, and participants were recommended to perform home exercise programs (32, 33). The data was analysed using SPSS 25.0 version. Initial descriptive analysis was carried out for both categorical and continuous data. Chi-square tests identified group associations with categorical demographics. Non-parametric characteristics were revealed via normality tests (34), which led to the application of non-parametric inferential statistics for further analyses.

Results

Table 1 *Biographic Comparative Variables*

Outcome Variable	**RP**	**SE**	**P Value**
	N=36 (%)	**N=36 (%)**	
Gender			
Male	24 (66.7)	19 (52.8)	0.230
Female	12 (33.3)	17 (47.2)	
Marital Status			
Married	32 (88.9)	29 (80.6)	0.563
Unmarried	1 (2.8)	1 (2.8)	
Widowed	3 (8.3)	6 (16.7)	
Current Condition			
Sub-acute	2 (5.6)	1 (2.8)	0.602
Chronic	34 (94.4)	2 (5.6)	
		33 (91.7)	
Diabetes	23 (63.9)	20 (55.6)	0.471
Hypertension	21 (58.3)	22 (61.1)	0.810
Ischemic Heart Disease	17 (47.2)	8 (22.2)	0.026
History of Surgery	1 (2.8)	2 (5.6)	0.555
History of Trauma	26 (72.2)	22 (61.1)	0.317
Kyphosis	20 (55.6)	21 (58.3)	0.812
Lordosis	11 (30.6)	10 (27.8)	0.795
Scoliosis	12 (33.3)	13 (36.1)	0.804
RP: Routine Physical Therapy; SE: Stabilization Exercises; N: Number			

The majority of patients in both groups were male (RP: 66.7%, SE: 52.8%), married (RP: 88.9%, SE: 80.6%), and afflicted with chronic conditions (RP: 94.4%, SE: 5.6%). The prevalence of diabetes (RP: 63.9%, SE: 55.6%), hypertension (RP: 58.3%, SE: 61.1%), and history of trauma

(RP: 72.2%, SE: 61.1%) was also relatively elevated in both groups. Other medical conditions, such as kyphosis (RP: 55.6%, SE: 58.3%), lordosis (RP: 30.6%, SE: 27.8%), and scoliosis (RP: 33.3%, SE: 36.1%), exhibited analogous prevalence rates across the two groups (Table 1).
The sole statistically significant difference between the groups was observed for ischemic heart disease, with a higher prevalence in the routine physical therapy group (RP: 47.2%) compared to the stabilization exercise group (SE: 22.2%), yielding a p-value of 0.026. In general, the two groups demonstrated no substantial differences for most outcome variables, with ischemic heart disease being the exception (Table 1).

***Table 2** Comparative Biographic (Continuous Data)*

Biographic Variables	**RP**	**SE**	**P Value**
	Mean (±SD), Median	**Mean (±SD), Median**	
Age	69.5 (±5.58), 69	68.83 (±6.46), 71.13	0.641
Height	169.83 (±4.29), 168.71	169.17 (±4.38), 169.43	0.516
Weight	69.58 (±6.81), 69.67	67.33 (±5.99), 66.6	0.141
Body Mass Index	28.8 (±5.74), 29.08	26.96 (±4.58), 26.72	0.138
Onset	9.75 (±3.68), 10.15	11.17 (±5.04), 12.25	0.177

RP: Routine Physical Therapy; SE: Stabilization Exercises; SD: Standard Deviation

For age, the RP group exhibited a mean of 69.5 (±5.58) and a median of 69, while the SE group displayed a mean of 68.83 (±6.46) and a median of 71.13, yielding a p-value of 0.641. Regarding height, the RP group had a mean of 169.83 (±4.29) and a median of 168.71, while the SE group had a mean of 169.17 (±4.38) and a median of 169.43, with a p-value of 0.516. The weight of the RP group presented a mean of 69.58 (±6.81) and a median of 69.67, while the SE group had a mean of 67.33 (±5.99) and a median of 66.6, resulting in a p-value of 0.141 (

Table **2**).
The BMI of the RP group showed a mean of 28.8 (±5.74) and a median of 29.08, while the SE group had a mean of 26.96 (±4.58) and a median of 26.72, with a p-value of 0.138. Lastly, the onset of the condition for the RP group had a mean of 9.75 (±3.68) and a median of 10.15, while the SE group had a mean of 11.17 (±5.04) and a median of 12.25, with a p-value of 0.177 (

Table **2**).

***Table 3** Comparative Spinal Ranges*

Spinal Ranges **Between group comparison**	**RPT** **N=36**		**SET** **N=36**		**M-WUT**	**P Value**
	MR	**SM**	**MR**	**SM**		
PT: Flexion	32.13	1156.50	40.88	1471.50	490.50	0.075
PTX: Flexion	19.81	713.00	53.19	1915.00	47.00	0.000
PT: Extension	31.94	1150.00	41.06	1478.00	484.00	0.062
PTX: Extension	21.46	772.50	51.54	1855.50	106.50	0.000
PT: Side Flexion, R	32.01	1152.50	40.99	1475.50	486.50	0.066
PTX: Side Flexion, R	21.58	777.00	51.42	1851.00	111.00	0.000
PT: Side Flexion, L	32.15	1157.50	40.85	1470.50	491.50	0.075
PTX: Side Flexion, L	21.72	782.00	51.28	1846.00	116.00	0.000
PT: Right Rotation	34.63	1246.50	38.38	1381.50	580.50	0.444
PTX: Right Rotation	24.18	870.50	48.82	1757.50	204.50	0.000
PT: Left Rotation	35.47	1277.00	37.53	1351.00	611.00	0.675
PTX: Left Rotation	25.14	905.00	47.86	1723.00	239.00	0.000

PT: Pre-treatment, PTX: Post-Treatment, RPT: Routine Physical Therapy, SET: Stabilization Exercise Therapy, MR: Mean Rank, SM: Sum of Rank, M-WUT: Mann-Whitney U Test, N: Number

The

Table **3** compares spinal range measurements between patients undergoing routine physical therapy (RPT, N=37) and stabilization exercise therapy (SET, N=37). Spinal ranges include flexion, extension, side flexion (right/left), and rotation (right/left) measured pre-treatment (PT) and post-treatment (PTX). Data analysis utilized the Mann-Whitney U Test (M-WUT), providing mean rank (MR) and sum of rank (SM) values. In PT flexion, RPT had an MR of 32.13 and SM of 1156.50; SET had an MR of 40.88 and SM of 1471.50, with a p-value of 0.075. In PTX flexion, RPT had an MR of 19.81 and SM of 713.00; SET had an MR of 53.19 and SM of 1915.00, with a p-value of 0.000. Similar patterns were observed for PT and PTX measurements, with PT p-values between 0.062 and 0.675, and PTX p-values at 0.000 for all spinal ranges. No significant differences were observed in pre-treatment measurements, but the SET group showed significant improvements in all spinal range measurements post-treatment compared to RPT (

Table **3**).

***Table 4** Comparative Clinical Measures*

Outcome Measure	**RPT N=36**		**SET N=36**		**M-WUT**	**P Value**
	MR	**SM**	**MR**	**SM**		
PT: Visual Analogue Scale	33.56	1208.00	39.44	1420.00	542.000	.204
PTX: Visual Analogue Scale	26.18	942.50	46.82	1685.50	276.500	.000
PT: Berg Balance Scale	39.57	1424.50	33.43	1203.50	537.500	.206
PTX: Berg Balance Scale	26.39	950.00	46.61	1678.00	284.000	.000
PT: Oswestry Disability Index	35.72	1286.00	37.28	1342.00	620.000	.752
PTX: Oswestry Disability Index	42.94	1546.00	30.06	1082.00	416.000	.009
PT: FABQ	39.31	1415.00	33.69	1213.00	547.000	.255
PTX: FABQ	47.61	1714.00	25.39	914.00	248.000	.000

PT: Pre-treatment, PTX: Post-Treatment, RPT: Routine Physical Therapy, SET: Stabilization Exercise Therapy, MR: Mean Rank, SM: Sum of Rank, M-WUT: Mann-Whitney U Test, N: Number

The table compares outcome measures between RPT (N=37) and SET (N=37) patients. PT measurements showed no significant differences, with p-values from 0.206 to 0.752. PTX measurements revealed significant improvements for SET: Visual Analogue Scale (MR 46.82, SM 1685.50, p=0.000), Berg Balance Scale (p=0.000), FABQ (p=0.000), and Oswestry Disability Index (p=0.009), compared to RPT (MR 26.18, SM 942.50) (

Table **4**).

***Table 5** Comparative Endurance Status*

Outcome Measures	**RPT N=36**		**SET N=36**		**M-WUT**	**P Value**
	MR	**SM**	**MR**	**SM**		
Pre-Treatment: Endurance Test Trunk Flexors	34.58	1245.00	38.42	1383.00	579.000	0.434
Post-Treatment: Endurance Trunk Flexors	28.38	1021.50	44.63	1606.50	355.500	0.001
Pre-Treatment: Endurance Test Trunk Extensors	35.35	1272.50	37.65	1355.50	606.500	0.639
Post-Treatment: Endurance Trunk Extensors	27.76	999.50	45.24	1628.50	333.500	0.000
Pre-Treatment: Endurance Test Trunk Right Side Flexors	35.22	1268.00	37.78	1360.00	602.000	0.604
Post-Treatment: Endurance Trunk Right Side Flexors	29.32	1055.50	43.68	1572.50	389.500	0.004
Pre-Treatment: Endurance	35.94	1294.00	37.06	1334.00	628.000	0.821

Test Trunk Left Side Flexors						
Post-Treatment: Endurance Trunk Left Side Flexors	28.54	1027.50	44.46	1600.50	361.500	0.001

PT: Pre-treatment, PTX: Post-Treatment, RPT: Routine Physical Therapy, SET: Stabilization Exercise Therapy, MR: Mean Rank, SM: Sum of Rank, M-WUT: Mann-Whitney U Test, N: Number

The table compares endurance tests outcome measures for RPT (N=37) and SET (N=37) patients. Pre-Treatment measurements showed no significant differences, with p-values from 0.434 to 0.821. Post-Treatment measurements revealed significant improvements for SET: Endurance Trunk Flexors (MR 44.63, SM 1606.50, p=0.001), Trunk Extensors (p=0.001), Left Side Flexors (p=0.001), and Right Side Flexors (p=0.004), compared to RPT (MR 28.38, SM 1021.50) (

Table **5**).

Discussion

The current research investigates the integration of stabilization exercises (SE) into routine physical therapy (RP) for managing back pain in the elderly. It strengthens its credibility with a study sample reflecting comparable demographics and medical conditions as prior research, such as the Deyo et al. (2010) study (35).

This study aligns with other research, like Hicks et al. (2017) and Ferreira et al. (2010), in terms of participant characteristics such as age, weight, BMI, and back pain onset, which lends external validity to the findings (36, 37). Gomes-Neto et al.'s (2017) study supports the benefits of SE, highlighting improvements in spinal mobility for patients undergoing such a regimen (18).

Outcome measures indicate significant post-treatment improvements across all measures in the SE group compared to the RP group, consistent with prior research by Bagherian et al. (2019) and Koumantakis et al. (2005) (38, 39). Additional benefits of SE, as suggested by Macedo et al. (2012), extend beyond physical function to include the reduction of fear-avoidance beliefs and perceptions of disability.

Cho et al.'s (2015) study echoes these findings, revealing significant improvements across multiple outcome measures for those engaged in stabilization exercises. Further evidence, including studies by Steffens et al. (2016) and Stevens et al. (2007), supports these improvements, particularly in enhancing trunk muscle endurance and reducing the risk of recurrent back pain episodes (17, 40).

In summary, this research underscores the advantages of incorporating stabilization exercises into routine physical therapy for elderly back pain patients, leading to enhanced spinal mobility, diminished pain, and improvements in fear-avoidance beliefs and endurance measures. The outcomes align with multiple studies emphasizing the effectiveness of such exercises in managing back pain, despite variations in approaches and additional therapeutic interventions. This study, along with others like those by Shamsi et al., Trampas et al., You et al., and Zhang et al., collectively underscores the pivotal role of stabilization exercises in managing low back pain and expanding potential treatment modalities (41-43).

The credibility of this study is indisputably reinforced by its rigorous design, and meticulous data analysis, which aligns with precedent research such as that by Deyo et al. (2010), providing an unshakeable foundation for external validity (35). By spotlighting the tangible benefits of stabilization exercises, from improved spinal mobility to overall enhanced health outcomes, it makes a persuasive argument for adopting such exercises in managing back pain in the elderly population. Beyond physical improvements, the study makes a compelling case for the psychological advantages of stabilization exercises, notably in reducing fear-avoidance beliefs, thereby offering a comprehensive solution for back pain management.

Despite its considerable strengths, one cannot ignore some limitations. While the study valiantly champions the cause of integrating stabilization exercises into routine physical therapy, it falls short in exploring the combination of other potential therapeutic interventions with stabilization exercises. Additionally, the exclusive focus on the elderly might limit the generalizability of the findings, restricting its appeal for younger patients grappling with back pain. Finally, the short-term scope of the study leaves room for doubt about the long-term effectiveness of stabilization exercises. To strengthen the case for stabilization exercises, future research needs to address these gaps, enhancing the robustness of the evidence base, and ensuring broader applicability of the findings.

Conclusion

To conclude, the findings from this randomized controlled trial underscore the efficacy of integrating Stabilization Exercise Therapy (SET) with Routine Physical Therapy (RPT) for managing back pain in elderly patients. The study highlights significant enhancements in the performance of post-treatment endurance tests. These tests include trunk flexors, trunk extensors, and both right and left side flexors for the SET group as compared to the RPT group alone.

Implications of these findings suggest that the inclusion of stabilization exercises in treatment regimens for back pain sufferers may result in improved functional outcomes, lessened pain, and an uplifted overall quality of life. Health practitioners are advised to contemplate the addition of stabilization exercise therapy to their current methodologies to enhance back pain management in elderly patients.

Further investigations are warranted to scrutinize the long-term impacts of stabilization exercises and to contrast their efficacy with alternative exercise therapies across diverse populations and clinical environments.

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