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COMPARISON BETWEEN THE EFFECTIVENESS OF MACKENZIE EXERCISE AND WILLIAM FLEXION EXERCISES FOR TREATMENT OF NON-SPECIFIC LOW BACK PAIN IN OBESE PEOPLE

Original Research

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ABSTRACT

Background: Low back pain (LBP) is one of the most common musculoskeletal disorders worldwide, with a lifetime prevalence of 84% and chronic nonspecific forms affecting approximately 23% of individuals. Chronic LBP, defined as pain persisting beyond 12 weeks, is influenced by multiple risk factors including sex, middle age, sedentary lifestyle, strenuous activity, occupational overload, smoking, and obesity. Conservative management frequently emphasizes therapeutic exercise, with approaches such as aerobic training, flexibility exercises, McKenzie extension, and William's flexion routines demonstrating varying degrees of efficacy depending on the protocol applied.

Objective: To compare the effectiveness of McKenzie extension and William's flexion exercises in the management of nonspecific low back pain among obese individuals.

Methods: A pre-test/post-test clinical trial was conducted on 32 participants who met inclusion criteria and provided informed consent. Ethical approval was secured prior to commencement. Participants were purposively allocated into two groups of 16 each. Group A underwent William's flexion exercise program, which included double knee-to-chest, single knee-to-chest, and straight leg raise exercises, performed 5–8 repetitions per session, five times weekly for four weeks. Group B followed a McKenzie extension protocol comprising prone extensions and pelvic bridging with identical frequency and duration. Pain was measured using the Visual Analogue Scale (VAS), and disability was evaluated with the Oswestry Low Back Pain Disability Index (OLBPDI). Data were analyzed using paired and independent *t*-tests, with $p < 0.05$ considered statistically significant.

Results: Group A demonstrated a reduction in mean VAS score from 7.19 ± 1.11 to 2.00 ± 1.32 and improvement in OLBPDI score by 1.00 ± 0.89 ($p < 0.001$). Group B showed a similar decrease in VAS from 7.69 ± 0.95 to 2.50 ± 1.32 and improvement in OLBPDI by 1.31 ± 0.60 ($p < 0.001$). Independent samples analysis revealed no statistically significant difference between groups for post-intervention pain ($p = 0.291$) or disability ($p = 0.362$).

Conclusion: Both McKenzie and William's flexion exercises significantly reduced pain intensity and disability in obese patients with nonspecific low back pain. The absence of significant between-group differences indicates that either protocol may be effectively applied in clinical practice to improve patient outcomes.

Keywords: Exercise Therapy, Low Back Pain, McKenzie Method, Obesity, Oswestry Disability Index, Pain Measurement, Williams Flexion Exercises.

INTRODUCTION

Low back pain (LBP) is among the most prevalent musculoskeletal disorders worldwide, contributing substantially to disability, reduced quality of life, and economic burden. Evidence shows that the lifetime prevalence of LBP reaches as high as 84%, while nearly 23% of individuals suffer from non-specific chronic low back pain (CLBP) (1). It is defined as pain accompanied by increased muscle tension or stiffness, localized between the costal margins and inferior gluteal folds, which may or may not radiate to the lower extremities. When pain persists for more than 12 weeks, it is considered chronic (2). The multifactorial etiology of CLBP encompasses biological, psychological, and occupational determinants. Established risk factors include female gender, middle age, sedentary lifestyle, smoking, obesity, strenuous physical activity, and occupational overload (3). Other psychosocial elements such as stress, depression, anxiety, low educational status, poor workplace support, and job dissatisfaction further exacerbate vulnerability to LBP (4). The burden is especially high among healthcare professionals, with nurses showing prevalence rates exceeding 70% (5). Therapeutic exercise is a cornerstone of conservative management for CLBP. Evidence supports diverse exercise approaches, including aerobic, aquatic, flexibility, stabilization, and targeted strengthening regimens (6). Central to these protocols are trunk-strengthening exercises that focus on the multifidus and erector spinae muscles, employing the principles of overload, specificity, and reversibility. Among the most widely recognized programs are McKenzie extension exercises and William's flexion exercises. McKenzie's Mechanical Diagnosis and Therapy (MDT) emphasizes repetitive extension-based movements to restore lumbar lordosis and achieve centralization of pain, a process whereby symptoms migrate proximally towards the spine (7,8).

Conversely, William's flexion exercises aim to reduce lumbar lordosis through structured flexion movements, often providing relief by decreasing pain intensity and improving spinal mobility (9). Both regimens are simple, low-cost, and widely adaptable to clinical and home settings, making them highly relevant to long-term management. Despite the popularity of these interventions, existing literature reveals conflicting evidence regarding their comparative effectiveness. Some studies have demonstrated McKenzie's superiority in centralizing symptoms and improving spinal movement (10,11), while others have found comparable benefits between McKenzie, William's, and alternative programs such as Pilates (12,13). This inconsistency highlights the need for further investigation into the relative efficacy of McKenzie and William's exercises in managing nonspecific CLBP, particularly in populations where pharmacological management is common but often limited by side effects. Given the high prevalence of CLBP, its disabling consequences, and the limitations of pharmacological therapies, identifying effective exercise strategies is essential. This study, therefore, aims to determine the effect of McKenzie extension exercises and William's flexion exercises on nonspecific low back pain, providing evidence to guide physiotherapeutic management and improve patient outcomes.

METHODS

The present study was conducted as a pre-test/post-test clinical trial to evaluate the effects of McKenzie extension exercises and William's flexion exercises on patients with nonspecific low back pain. The study was carried out at selected rehabilitation centers in Lahore over a period of six months. The sample size was calculated using standard formulae, keeping the margin of error at 5% and the level of significance at 5%, with the assumption of a mean difference in weight-bearing improvement through the paretic extremity of 10 between groups. This yielded a required sample size of 32 participants. To account for possible attrition, 40 participants were recruited using a non-probability purposive sampling technique. Participants of both genders aged between 20 and 45 years were considered eligible if they were diagnosed with nonspecific low back pain by a physiotherapist and if they provided voluntary informed consent. Exclusion criteria included patients with spinal injuries, spinal tumors, diagnosed neurological deficits, psychiatric disorders such as depression and anxiety, pregnancy, and spondylolisthesis. These restrictions ensured homogeneity of the sample and minimized confounding influences that could alter the therapeutic outcomes. The participants were allocated into two equal groups. Group A (n=20) received William's flexion exercise therapy. The protocol consisted of double knee-to-chest exercises, bidirectional straight leg raises, and single knee-to-chest exercises, each performed 5–8 repetitions per session, five times per week for four weeks. Group B (n=20) received McKenzie extension exercises, which included prone extensions and pelvic bridging, also prescribed as 5–8 repetitions per session, five times per week for four weeks. All participants were reassessed at the end of the four-week intervention period. Pain intensity was measured using the Numeric Pain Rating Scale (NPRS), while functional disability was assessed with the Oswestry Low

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Back Pain Disability Index (OLBPDI) (14,15). These validated tools provided reliable outcomes for both subjective pain and functional limitations.

Data were collected systematically, and confidentiality of participant information was ensured. Statistical analysis was performed using SPSS version 22. Quantitative variables were reported as mean ± standard deviation (SD) with their respective ranges. Paired and independent t-tests were used to compare pre- and post-intervention outcomes both within and between groups. A p-value of <0.05 was considered statistically significant, providing a clear threshold for determining meaningful differences. Descriptive statistics including frequencies and percentages were also calculated for qualitative variables, presented in the form of charts and graphs to facilitate interpretation. Ethical approval was obtained from the Ethical Review Committee of the University of Health Sciences, Lahore. All participants were informed about the purpose and procedures of the study, and written consent was obtained prior to enrollment. Participation was entirely voluntary, and patients were allowed to withdraw at any stage without prejudice. Strict confidentiality was maintained throughout the study.

RESULTS

A total of 32 participants completed the trial (Group A, William's flexion, n=16; Group B, McKenzie extension, n=16). In Group A, the mean (±SD) age was 30.38 ± 7.59 years (range 21–44), mean weight 73.88 ± 5.03 kg (66–81), height 1.758 ± 0.032 m (1.70–1.81), BMI 24.56 ± 2.31 kg/m² (22–31), waist circumference 84.44 ± 3.79 cm (78–91), hip circumference 104.00 ± 4.66 cm (95–113), waist-to-hip ratio 0.812 ± 0.016 (0.77–0.84), and resting heart rate 78.13 ± 7.04 beats/min (69–93). In Group B, age was 34.81 ± 7.98 years (23–45), weight 74.44 ± 5.15 kg (66–81), height 1.756 ± 0.036 m (1.70–1.82), BMI 26.63 ± 4.22 kg/m² (20–33), waist circumference 85.19 ± 3.95 cm (79–90), hip circumference 104.94 ± 4.11 cm (98–111), waist-to-hip ratio 0.812 ± 0.018 (0.78–0.85), and resting heart rate 82.19 ± 7.36 beats/min (70–92). Gender distribution was 31.3% male and 68.8% female in Group A, and 43.8% male and 56.3% female in Group B. Socioeconomic status in Group A was 37.5% upper, 50.0% middle, and 12.5% lower; in Group B it was 56.3% upper, 18.8% middle, and 25.0% lower. Pain intensity (VAS 0–10) decreased within both groups. Group A improved from 7.19 ± 1.11 to 2.00 ± 1.32 (mean paired difference 5.19 ± 0.75; 95% CI 4.79–5.59; t = 27.667; df = 15; p < 0.001). Group B improved from 7.69 ± 0.95 to 2.50 ± 1.32 (mean paired difference 5.19 ± 0.83; 95% CI 4.74–5.63; t = 24.875; df = 15; p < 0.001). Between-group comparison of post-treatment pain showed no significant difference (means 2.50 ± 1.32 in Group A vs 2.00 ± 1.32 in Group B; t = 1.074; df = 30; p = 0.291; mean difference 0.50; 95% CI −0.45 to 1.45). Oswestry Disability improved within both groups. In Group A, the paired pre- to post-intervention difference for the Oswestry Low Back Pain Disability Questionnaire (ODI) category score was 1.00 ± 0.894 (95% CI 0.523–1.477; t = 4.472; df = 15; p < 0.001). In Group B, the paired difference was 1.313 ± 0.602 (95% CI 0.992–1.633; t = 8.720; df = 15; p < 0.001). Post-intervention between-group comparison of ODI category score was non-significant (means 2.13 ± 0.806 for Group A vs 1.88 ± 0.719 for Group B; t = 0.926; df = 30; p = 0.362; mean difference 0.25; 95% CI −0.30 to 0.80).

Item-wise ODI responses supported these trends. In Group A, pre- to post-treatment means reduced across items, e.g., pain intensity 2.38 ± 1.59 to 1.25 ± 1.00; personal care 2.81 ± 1.83 to 1.94 ± 1.34; lifting 2.13 ± 1.26 to 1.00 ± 1.03; walking 2.63 ± 1.46 to 1.62 ± 1.09; sitting 2.06 ± 1.29 to 0.88 ± 0.89; standing 2.19 ± 1.28 to 1.25 ± 0.86; sleeping 2.62 ± 1.78 to 1.56 ± 1.32; sex life 2.44 ± 1.59 to 1.50 ± 1.32; social life 2.56 ± 1.55 to 1.50 ± 1.16; travelling 2.75 ± 1.29 to 1.88 ± 1.26. In Group B, analogous reductions were observed, for example pain intensity 2.63 ± 1.31 to 1.56 ± 1.21; personal care 3.25 ± 1.61 to 2.00 ± 1.32; lifting 3.19 ± 1.22 to 2.06 ± 1.44; walking 2.88 ± 1.36 to 1.50 ± 1.46; sitting 3.19 ± 1.47 to 1.75 ± 1.39; standing 2.88 ± 1.41 to 1.38 ± 1.09; sleeping 3.38 ± 1.26 to 2.06 ± 1.12; sex life 2.87 ± 1.46 to 1.75 ± 1.24; social life 2.81 ± 1.22 to 1.56 ± 1.03; travelling 3.25 ± 1.61 to 2.00 ± 1.32. Disability level distributions shifted favorably. Group A moved from 62.5% moderate, 12.5% severe, and 25.0% bed-bound pre-intervention to 31.3% minimal, 50.0% moderate, and 18.8% severe post-intervention. Group B changed from 31.3% moderate, 6.3% severe, 50.0% crippled, and 12.5% bed-bound pre-intervention to 25.0% minimal, 37.5% moderate, and 37.5% severe post-intervention. No participants in either group were classified as crippled or bed-bound after treatment.

Between-group independent-samples testing on post-treatment outcomes was non-significant for both ODI category score and pain intensity, indicating comparable short-term improvements following William's flexion and McKenzie extension protocols under the parameters studied. Both groups demonstrated large within-group reductions in pain and ODI category score; however, between-group change-score comparisons showed no differential effect on pain and a small advantage for disability in Group B. The mean change in pain (ΔVAS) was identical across groups (Group A: 5.19 ± 0.75; Group B: 5.19 ± 0.83), yielding a between-group Δ difference of 0.00 and an effect size $d = 0.00$. For the ODI category score, the mean change was 1.000 ± 0.894 in Group A versus 1.313 ± 0.602 in Group

B, producing a between-group Δ difference of 0.313 (favoring Group B) with Cohen's $d = 0.41$ (small). Baseline equivalence testing indicated no statistically significant differences between groups in age (Welch $t = -1.61$, df = 29.9, $p = 0.117$), BMI (Welch $t = -1.71$, df = 23.2, $p = 0.100$), pre-treatment pain (Welch $t = -1.37$, df = 29.3, $p = 0.180$), or sex distribution ($\chi^2 = 0.13$, df = 1, $p = 0.715$). Adherence, adverse events, and attrition were not recorded, and the discrepancy between planned (n = 20 per group) and analyzed samples (n = 16 per group) was not explained. The ODI was reported as a "category score"; based on the values, this appears to be an ordinal grade (e.g., minimal=1, moderate=2, severe=3, crippled=4, bed-bound=5), but the exact definition should be stated explicitly to aid interpretation.

Table 1: Baseline Descriptive Statistics of Participants in Group A and Group B

Variable	Group A (n=16) Minimum	Group A Maximum	Group A Mean	Group A SD	Group B (n=16) Minimum	Group B Maximum	Group B Mean	Group B SD
Age (years)	21.00	44.00	30.3750	7.58837	23.00	45.00	34.8125	7.97679
Weight (kg)	66.00	81.00	73.8750	5.03157	66.00	81.00	74.4375	5.15065
Height (m)	1.70	1.81	1.7581	0.03209	1.70	1.82	1.7556	0.03577
Body Mass Index (kg/m²)	22.00	31.00	24.5625	2.30850	20.00	33.00	26.6250	4.22493
Waist Circumference (cm)	78.00	91.00	84.4375	3.79418	79.00	90.00	85.1875	3.95337
Hip Circumference (cm)	95.00	113.00	104.0000	4.66190	98.00	111.00	104.9375	4.10640
Waist-to-Hip Ratio	0.77	0.84	0.8120	0.01598	0.78	0.85	0.8117	0.01780
Resting Heart Rate (beats/min)	69.00	93.00	78.1250	7.04154	70.00	92.00	82.1875	7.35952

Table 2: Gender and Socioeconomic Distribution of Participants in Group A and Group B

Variable	Category	Group A Frequency (%)	Group B Frequency (%)
Gender	Male	5 (31.3%)	7 (43.8%)
	Female	11 (68.8%)	9 (56.3%)
Socioeconomic Status	Upper	6 (37.5%)	9 (56.3%)
	Middle	8 (50.0%)	3 (18.8%)
	Lower	2 (12.5%)	4 (25.0%)

Table 3: Pain Descriptive Statistics of Participants in Group A and Group B

Pain Variable	Group	N	Minimum	Maximum	Mean	Std. Deviation
Pain before treatment	A	16	6.00	9.00	7.1875	1.10868
Pain after treatment		16	0.00	4.00	2.0000	1.31656
Pain before treatment	B	16	6.00	9.00	7.6875	0.94648
Pain after treatment		16	0.00	4.00	2.5000	1.31656

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Table 4: Item-wise Oswestry Disability Index (ODI) Scores of Participants in Group A and Group B (Pre- and Post-Intervention)

ODI Item	Group	Pre-Mean	Pre SD	Post Mean	Post SD
Pain intensity	A	2.38	1.586	1.25	1.000
Personal care		2.81	1.834	1.94	1.340
Lifting		2.13	1.258	1.00	1.033
Walking		2.63	1.455	1.62	1.088
Sitting		2.06	1.289	0.88	0.885
Standing		2.19	1.276	1.25	0.856
Sleeping		2.62	1.784	1.56	1.315
Sex life (if applicable)		2.44	1.590	1.50	1.317
Social life		2.56	1.548	1.50	1.155
Travelling		2.75	1.291	1.88	1.258
Pain intensity	B	2.63	1.310	1.56	1.209
Personal care		3.25	1.612	2.00	1.317
Lifting		3.19	1.223	2.06	1.436
Walking		2.88	1.360	1.50	1.461
Sitting		3.19	1.471	1.75	1.390
Standing		2.88	1.408	1.38	1.088
Sleeping		3.38	1.258	2.06	1.124
Sex life (if applicable)		2.87	1.455	1.75	1.238
Social life		2.81	1.223	1.56	1.031
Travelling		3.25	1.612	2.00	1.317

Table 5: Oswestry Low Back Pain Disability Questionnaire Categories of Participants in Group A and Group B (Pre- and Post-Intervention)

Disability Category	Group A Pre n (%)	Group B Pre n (%)	Group A Post n (%)	Group B Post n (%)
Minimal disability	–	–	5 (31.3%)	4 (25.0%)
Moderate disability	10 (62.5%)	5 (31.3%)	8 (50.0%)	6 (37.5%)
Severe disability	2 (12.5%)	1 (6.3%)	3 (18.8%)	6 (37.5%)
Crippled	–	8 (50.0%)	–	–
Bed-bound	4 (25.0%)	2 (12.5%)	–	–
Total	16 (100.0%)	16 (100.0%)	16 (100.0%)	16 (100.0%)

Table 6: Paired Samples Statistics for Pain Intensity and ODI Scores Before and After Intervention in Group A and Group B

Outcome Comparison	Group	Mean Difference	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	*t* Value	df	Sig. (2-tailed)
Pain before – after treatment	A	5.18750	0.75000	0.18750	4.78785	5.58715	27.667	15	0.000
ODI (Pre – Post)	A	1.000	0.89400	0.22400	0.523	1.477	4.472	15	0.000
Pain before – after treatment	B	5.18750	0.83417	0.20854	4.74300	5.63200	24.875	15	0.000
ODI (Pre – Post)	B	1.313	0.60200	0.15100	0.992	1.633	8.720	15	0.000

Table 7: Independent Samples *t*-Test Comparing Post-Interventional Pain and Disability Outcomes Between Group A and Group B

Outcome (Post-Intervention)	Group	N	Mean	Std. Deviation	Std. Error Mean	Levene's Test F	Levene's Sig.	*t* Value	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower	95% CI Upper
ODI (Post)	A	16	2.13	0.806	0.202	0.493	0.488	0.926	30	0.362	0.250	0.270	−0.301	0.801
	B	16	1.88	0.719	0.180			0.926	29.613	0.362	0.250	0.270	−0.302	0.802
Pain after treatment	A	16	2.50	1.31656	0.32914	0.068	0.795	1.074	30	0.291	0.500	0.46547	−0.451	1.451
	B	16	2.00	1.31656	0.32914			1.074	30.000	0.291	0.500	0.46547	−0.451	1.451

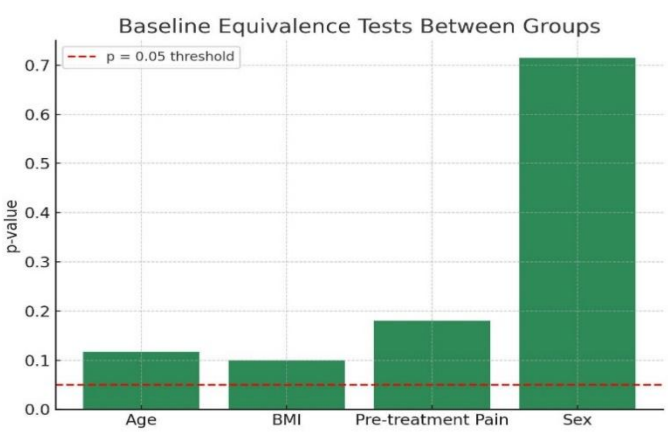

Figure 1 Baseline Equivalence Tests Between Groups

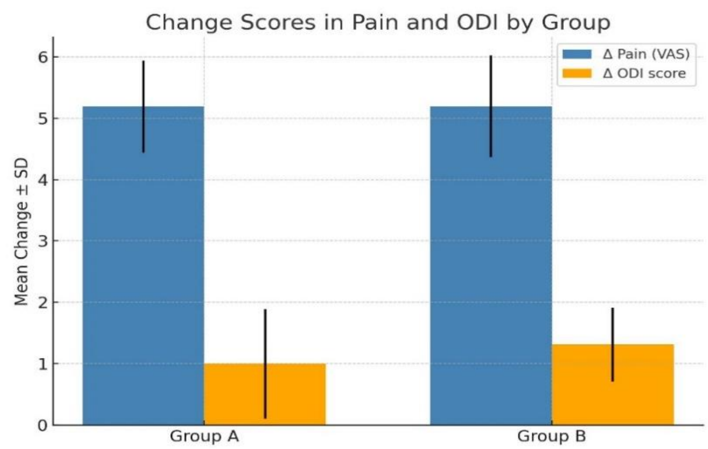

Figure 2 Change Score in Pain and ODI by Group

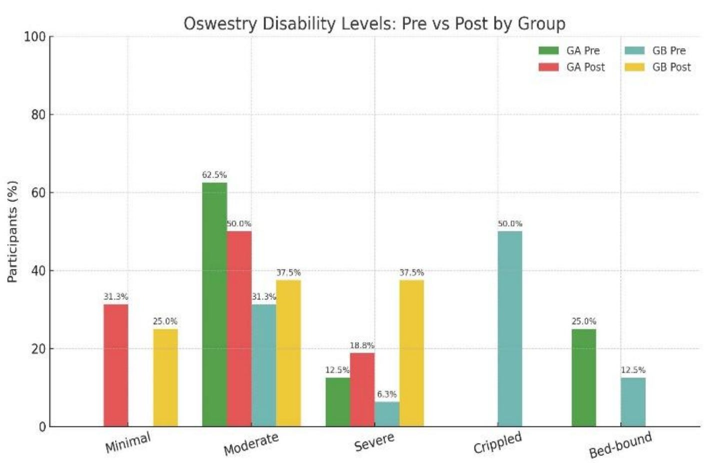

Figure 3 Oswestry Disability Level: Pre vs Post by Group

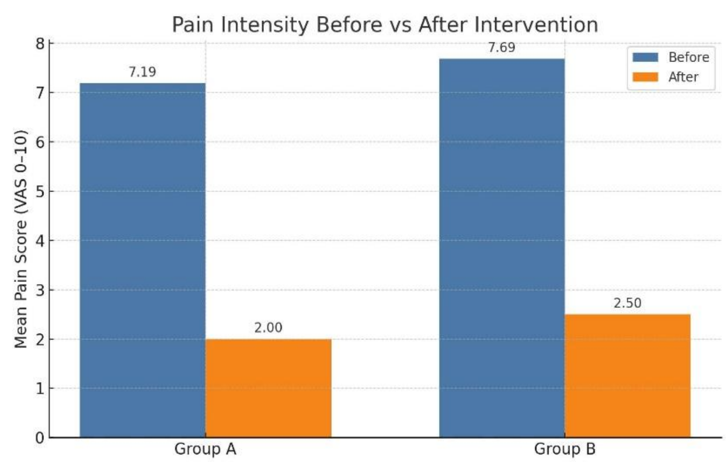

Figure 4 Pain Intensity Before vs After Intervention

DISCUSSION

The present study explored the comparative effectiveness of William's flexion and McKenzie extension exercises in managing chronic low back pain among obese individuals, with outcomes assessed through VAS and OLBPDI scores. Both interventions demonstrated significant within-group improvements in pain reduction and functional disability, indicating that structured exercise therapy remains a cornerstone for conservative management of chronic low back pain. The between-group analysis showed comparable improvements in pain, while a modest advantage was observed in disability reduction with McKenzie-based routines, aligning with earlier evidence that emphasizes the centralization and mobility benefits of this approach (16,17). These findings suggest that while both methods are beneficial, the McKenzie technique may offer an incremental advantage in improving functional outcomes in certain patient populations. Comparison with previous literature highlights the consistency of these findings with earlier reports that McKenzie-based therapy enhances spinal flexibility, centralization of symptoms, and long-term outcomes in chronic cases. Conversely, William's flexion exercises have long been recognized for their role in reducing lumbar lordosis, strengthening abdominal musculature, and providing symptomatic relief, which aligns with the improvements observed in this study (18,19). Evidence also indicates that motor control and dynamic stabilization strategies targeting deep stabilizing muscles, such as the multifidus and transverse abdominis, can enhance spinal stability and endurance, further supporting the rationale for exercise-based rehabilitation (20). The results add to the growing body of evidence advocating exercise as a safe, non-pharmacological, and sustainable strategy for chronic low back pain management.

The implications of these findings extend to the design of individualized rehabilitation programs for obese patients with chronic low back pain. Since obesity contributes to mechanical overload, muscle imbalance, and heightened disability risk, exercise protocols that combine flexion and extension elements may provide superior benefits by addressing both spinal alignment and muscular strength. Personalized interventions that consider age, BMI, and occupational demands may further optimize outcomes, highlighting the importance of tailoring exercise regimens rather than relying on a one-size-fits-all approach (21,22). Education and adherence strategies are essential, as regular practice and correct technique significantly influence long-term benefits. Several strengths are notable in this study. It directly compared two commonly prescribed and clinically accessible interventions in a controlled setting, using standardized and validated assessment tools to measure both pain and disability outcomes. The study also emphasized non-pharmacological management, underscoring the importance of conservative interventions that minimize the risks associated with long-term medication use.

Nevertheless, limitations must be acknowledged. The modest sample size reduces the generalizability of the findings, and the absence of long-term follow-up prevents conclusions about sustained effects. Baseline demographic differences, though not statistically significant, may still have influenced outcomes. Adherence, attrition, and adverse events were not documented, and the discrepancy between the planned and analyzed sample size raises concerns about potential bias. The use of the ODI "category score" requires clearer operational definition to ensure replicability and comparability across studies. Furthermore, confounding psychosocial factors such as anxiety, depression, and occupational stress, known to influence chronic low back pain, were not assessed. Future research should employ larger multicenter trials with longer follow-up to confirm the durability of exercise-based improvements (23,24). Combining William's and McKenzie exercises with motor control or dynamic stabilization programs could be investigated to explore synergistic benefits. Personalized protocols stratified by obesity severity, age, and functional limitations may provide stronger clinical guidance. Additionally, strategies for monitoring adherence and ensuring patient education should be prioritized to maximize outcomes and reduce recurrence rates. In summary, this study reaffirmed the therapeutic value of both William's flexion and McKenzie extension exercises in obese individuals with chronic low back pain. While both interventions were effective, the McKenzie approach demonstrated a slight advantage in reducing disability. These results reinforce the importance of structured exercise therapy in conservative management, while highlighting the need for larger, long-term, and methodologically rigorous studies to refine clinical practice and guide individualized rehabilitation strategies.

CONCLUSION

This study concluded that both McKenzie extension and William's flexion exercise programs were effective in alleviating pain and reducing disability among obese individuals with chronic low back pain. Although no significant difference was observed between the two interventions, each demonstrated clear benefits in improving patient outcomes. These findings highlight the value of structured therapeutic exercise as a safe and practical approach to managing chronic low back pain, emphasizing its role as an essential component of conservative rehabilitation strategies.

AUTHOR CONTRIBUTION

Author	Contribution
Waseem Haider*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Farjad Afzal	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published

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