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## Effects of Kendall versus Kabat Exercises in Patients with Chronic Low Back Pain

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### KEYWORDS

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### DECLARATIONS

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### ABSTRACT

**Background:** Chronic low back pain is not only a source of physical discomfort but also contributes to emotional distress, reduced productivity, and a diminished quality of life. **Objective:** To compare the effects of Kendall versus Kabat exercises in managing chronic low back pain. **Methodology:** This study was a single-blinded, randomised controlled trial. The sample size was calculated by G-Power 3.1.9.7, and 46 participants were recruited, using convenience sampling. Data were collected from Sehat Medical Complex, Lahore, Pakistan, over 10 months. Both genders, adults aged between 30-65 years, with complaints of idiopathic LBP persistent for more than 12 weeks, with a visual pain score of 3 or higher, were recruited in the study. Patients with back pain due to other neurological causes, use of pain medication, acupuncture, or physical therapy in the last 3 months, and anticipated inability to comply with study protocols or attend scheduled sessions were excluded. Group A was treated with the Kendall exercise protocol regimen 3 times a week. Each session lasted for about 35-45 minutes. Group B was given the Kabat exercise protocol regimen 3 times a week, for 35-45 minutes. Baseline treatment of TENS and a hot pack was given to both groups. These initial assessments included demographic information, pain intensity evaluation using a visual analogue scale, functional disability measurements using the Oswestry disability index, and range of motion using a universal goniometer for the lumbar spine. Parametric statistical tests were supported by normal data distributions measured by the Shapiro-Wilk test. A paired sample t-test was applied for within-group analysis and an independent t-test for between-group comparison. **Results:** Parametric statistical tests were supported by normal data distributions (Shapiro-Wilk test) and confirmed paired sample t-test for within-group analysis and an independent t-test for between-group analysis. **Conclusion:** The study shows significant improvements in pain level, range of motion, and functional ability in patients with chronic low back pain. Pain scores and the Oswestry disability index significantly declined, but the mobility of the lumbar spine increased. Both interventions were effective in improving patient outcomes, but Kabat exercises are more effective in improving pain intensity, functional ability, and mobility.

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## INTRODUCTION

Low back pain (LBP) is pain, muscle tension, or stiffness under the costal border and above the inferior gluteal folds, with or without leg pain.<sup>1</sup> There is no conventional or agreed-upon definition of persistent low back pain, and medical experts continue to debate its origins, nature, and treatments. This is important because disagreeing on the issue's source and nature may result in disparities in the advice and treatment provided to people suffering from back pain.<sup>2</sup> LBP may be acute, subacute, or chronic depending on severity.<sup>3</sup> When low back pain persists for more than 12 weeks, it is classified as chronic low back pain.<sup>4</sup> It affects persons of all ages,<sup>5</sup> from early adolescence to adults.<sup>6</sup> People of all ages and gender faces spinal and functional abnormalities.

Around 15% to 20% of individuals have back discomfort annually. Chronic low back pain (CLBP) is a widespread yet difficult-to-manage and treat public health condition with a significant treatment failure rate.<sup>7,8</sup> PNF is a stretching technique that utilises muscle contractions to increase flexibility and range of motion. Kabat exercises apply proprioceptive neuromuscular facilitation (PNF) principles to target specific muscle groups, including those in the lower back. By stimulating proprioceptors in muscles and joints, Kabat exercises can help improve muscle function, reduce pain, and enhance overall mobility. The Kabat method, also known as PNF, is a physical therapy approach that improves musculoskeletal system responses by using precise diagonal and spiral movement patterns in all three body planes, as well as stimulation to the neuromuscular trigger potential.

PNF stretching can increase flexibility and reduce stiffness in the lower back. Kabat exercises can help strengthen the muscles supporting the spine, reducing strain on the lower back. By improving flexibility, strength, and proprioception, Kabat exercises can help reduce lower back pain and discomfort. Good posture can reduce strain on the lower back, and Kabat exercises can help improve posture by strengthening core muscles and utilising proprioceptors to stimulate muscle contractions and improve flexibility. Incorporating diagonal movements to target specific muscle groups. Applying resistance to enhance muscle contractions and strengthening.<sup>9</sup> This technique is founded on the concepts of maximal neuromuscular activation, followed by support

from auditory, visual, tactile, and proprioceptive cues. Kabat exercises offer a comprehensive approach to managing lower back pain. By incorporating these exercises into a routine, individuals can improve flexibility, strength, and proprioception, reducing strain on the lower back and alleviating pain.

With proper guidance and instruction, Kabat exercises can be a valuable tool in maintaining spinal health and overall well-being.<sup>10</sup> The primary goals of this strategy are to improve learning and motor coordination, enhance performance, restore or increase flexibility and range of motion, strengthen weaker muscles or muscle groups, and eliminate muscular imbalances.<sup>11</sup> Using sensory and motor talents is the main goal of the Kabat style of physiotherapy. Use circular and diagonal movement patterns since they will enhance your ability to perform in daily tasks over time. Kendall exercises a series of stretches and strengthening exercises developed by physical therapists to target the muscles and structures of the lower back.

The core muscles, including the abdominals and back muscles, play a crucial role in supporting the spine and maintaining good posture. Weak or imbalanced core muscles can contribute to lower back pain, as the spine is not adequately supported. Kendall exercises offer a comprehensive approach to managing lower back pain. Kendall exercises are based on the principles of muscle stretching, strengthening, and posture correction. These exercises are designed to identify and address physical imbalances by activating and strengthening weak muscles while stretching tight or hyperactive ones.<sup>12</sup>

Kendall exercises focus on strengthening the core muscles, improving posture, and reducing strain on the lower back. Regular stretching and exercise can help increase flexibility and reduce stiffness in the lower back. Strengthening the core muscles can help support the spine and reduce strain on the lower back. Good posture can reduce strain on the lower back, and Kendall exercises can help improve posture by strengthening the core muscles. Kendall exercises help to enhance alignment, core stability, and balance in the musculoskeletal system, leading to pain reduction and better functioning.<sup>13</sup> This controlled trial is designed to compare the effects of Kendall versus Kabat exercises in patients having chronic low back pain.

## METHODOLOGY

This study was a single-blinded, randomised controlled trial. This was calculated by G-Power 3.1.9.7, sample size 46 (23 in each group), using a convenience sampling technique. Data were collected from Sehat Medical Complex, Lahore, Pakistan, over 10 months. Both genders, adults aged between 30-65 years, with complaints of idiopathic LBP persistent for more than 12 weeks, with a visual pain score of 3 or higher, were recruited in the study.<sup>14</sup> Patients with LBP due to other neurological causes, persistent use of pain medication, patients who had undergone any other treatments, such as acupuncture or physical therapy, in the last 3 months, and anticipated inability to comply with study protocols or attend scheduled sessions were excluded.<sup>14</sup>

Group A was treated with the Kendall exercise protocol regimen 3 times a week. Each session lasted for about 35-45 minutes. Group B was given the Kabat exercise protocol regimen 3 times a week, for 35-45 minutes. Baseline treatment of TENS and a hot pack was given to both groups. The intensity of the exercise was adjusted according to the participant's ability. These initial assessments included demographic information, pain intensity evaluation using a visual analogue scale (VAS), functional disability measurements using the Oswestry disability index (ODI), and range of motion using a universal goniometer for the lumbar spine.

Data was analyzed using SPSS v 26. Parametric statistical tests were supported by normal data distributions measured by the Shapiro-Wilk test. A paired sample t-test was applied for within-group analysis and an independent t-test for between-group comparison. The p-value  $\leq 0.05$  was considered statistically significant.

## RESULTS

Table 1 shows VAS, ODI, and lumbar spine range of motion (ROM) before and after treatment. The pre-treatment value of the VAS test was  $7.17 \pm 1.5$ , and post-treatment was  $3.33 \pm 1.9$ . The mean difference was 3.84, which shows a significant difference in VAS values and suggests a decrease in pain. This table shows the mean comparison of ODI. The pre-treatment value was  $72.85 \pm 12.7$ , and the post-treatment value was  $28.22 \pm 12.11$ . The mean difference was 44.63, which shows a significant difference in ODI values, and a greater decrease in

post-treatment values suggests functional disability. This table also shows the mean comparison of lumbar spine ROM. The pre-treatment value of lumbar flexion was  $26.80 \pm 6.6$ , lumbar extension  $18.63 \pm 4.3$ , lumbar lateral flexion  $7.74 \pm 1.99$  and lumbar rotation  $4.22 \pm 1.8$  and post treatment value of lumbar flexion was  $43.24 \pm 6.7$ , lumbar extension  $26.80 \pm 5.0$ , lumbar lateral flexion  $12.78 \pm 3.8$  and lumbar rotation  $12.11 \pm 2.9$ , mean differences was -16.43, -8.17, -5.04, -7.88 of lumbar flexion, extension, lateral flexion and rotation that shows significant difference in lumbar spine range of motions values and suggest increase in lumbar spine mobility. The p-value is less than 0.05, which shows there is a significant difference. Table 2 shows the mean comparison of VAS, ODI, and lumbar spine ROM for both the Kendall exercise group and the Kabat exercises group.

Mean score of VAS of Kendall exercise before the treatment was  $6.50 \pm 1.4$ , and after the treatment was  $4.52 \pm 1.6$ . The mean difference of VAS was -1.35. This table shows that the mean score of VAS of the Kabat exercises group before treatment was  $7.85 \pm 1.2$ , after the treatment was  $2.14 \pm 1.4$ , while the mean difference was 2.38. The p-value is less than 0.05, which shows there is a significant difference between the Kendall exercise group and the Kabat exercise group, but the Kabat exercises show greater improvement in pain relief.

This table shows that the mean score of ODI of the Kendall exercise group before the treatment was  $65.17 \pm 9.5$  and after the treatment was  $37.35 \pm 8.8$ ; the mean difference in ODI was 15.34. This table shows that the mean score of ODI of the Kabat exercises group before the treatment was  $80.52 \pm 10.96$  and after the treatment was  $19.09 \pm 6.8$ ; the mean difference in ODI was 18.26, p-value is less than 0.05, which shows there is a significant difference between the Kendall exercise group and the Kabat exercise group, but the Kabat exercise group shows greater improvement in lumbar spine functional disability.

This table also shows that the mean score of lumbar spine range of motion of the Kendall exercise group before treatment was  $28.87 \pm 5.4$  for flexion,  $20.48 \pm 4.7$  for extension,  $8.34 \pm 2.2$  for lateral flexion, and  $2.97 \pm 1.3$  for rotation. After the treatment were  $40.61 \pm 6.1$ ,  $23.70 \pm 4.3$ ,  $9.96 \pm 2.5$ , and  $9.87 \pm 2.02$  for flexion, extension, lateral flexion, and rotation. This table shows that the mean score of lumbar spine ROM of the Kabat exercise group before the treatment was  $24.74 \pm 7.1$  for flexion,

Table 1: Within-group analysis

| Within-group analysis |                             | Mean  | Mean Difference | Std. Deviation | p-value |
|-----------------------|-----------------------------|-------|-----------------|----------------|---------|
| Pair 1                | Pre-VAS                     | 7.17  | 3.84            | 1.52           | 0.00    |
|                       | Post-VAS                    | 3.33  |                 | 1.94           |         |
| Pair 2                | Pre-ODI                     | 72.85 | 44.63           | 12.79          | 0.00    |
|                       | Post-ODI                    | 28.22 |                 | 12.11          |         |
| Pair 3                | Pre-Lumbar Flexion          | 26.80 | -16.43          | 6.65           | 0.00    |
|                       | Post-Lumbar Flexion         | 43.24 |                 | 6.73           |         |
| Pair 4                | Pre-Lumbar Extension        | 18.63 | -8.17           | 4.34           | 0.00    |
|                       | Post-Lumbar Extension       | 26.80 |                 | 5.01           |         |
| Pair 5                | Pre-Lumbar Lateral Flexion  | 7.74  | -5.04           | 1.99           | 0.00    |
|                       | Post-Lumbar Lateral Flexion | 12.78 |                 | 3.88           |         |
| Pair 6                | Pre-Lumbar Rotation         | 4.22  | -7.88           | 1.86           | 0.00    |
|                       | Post-Lumbar Rotation        | 12.11 |                 | 2.96           |         |

16.78±2.9 for extension, 7.14±1.4 for lateral flexion, 5.48±1.4 for rotation and after the treatment was 45.87±6.3 for flexion, 29.91±3.4 for extension, 15.61±2.7 for lateral flexion, 14.35±1.8 for rotation. There is a greater increase in lumbar spine range of motion Kabat exercise group than Kendall exercise group. The p-value is less than 0.05, which shows there is a significant difference between the Kendall exercise group and the Kabat exercise group, but the Kabat exercises show greater improvement in lumbar spine range of motion.

## DISCUSSION

The purpose of our study was to compare the effect of the Kendall and Kabat Exercises to reduce pain, improve functional disability, and Range of motion in chronic lower back pain patients. For this purpose, VAS and ODI, and the Lumbar ROM scales were used. Kendall and Kabat Exercises were applied. In addition, subjects completed post post-intervention questionnaire to determine the difference between patients' levels of comfort between the groups. The results of this study have shown that both of Kendall and Kabat Exercise groups had significant differences in post-treatment values of pain intensity, Oswestry

Disability Index (ODI), and Lumbar range of motion (ROM) paired t-test was applied for within-group analysis.

The mean values indicate that there is an increase in lumbar range of motion and a decrease in both pain and ODI after the treatment session. The result of this study reveals that there is a significant difference between post-treatment values of pain intensity, ODI, and lumbar ROM ( $p < 0.05$ ) across the group analysis. An important goal of improvement in functional ability and prevent any trauma-like posture-related issues.

This study focused on two types of interventions used to improve pain intensity: the ODI and Lumbar ROM. The results of the current study suggested that Kabat Exercises showed improvement after the treatment more than Kendall exercises. Within-group analysis showed a mean of Pre-VAS is 7.17±1.5 and a mean of Post-VAS is 3.33±1.9, Pre of ODI is 72.85±12.7 and Post of ODI is 28.22±12.11, Pre of lumbar flexion is 26.80±6.6 and Post of flexion is 43.24±6.7. Pre of lumbar extension is 18.63±4.34 and Post of extension is 26.80±5.01. Pre of lumbar lateral flexion is 7.74±1.9, and Post of lateral flexion is 12.7±3.8. Pre of lumbar rotation is 4.22±1.8, and

Table 2: Between-groups analysis

| Between-groups analysis     |   | Mean Difference | Mean  | Std. Deviation | p-value |
|-----------------------------|---|-----------------|-------|----------------|---------|
| Pre-VAS                     | A | -1.35           | 6.50  | 1.47           | 0.002   |
|                             | B |                 | 7.85  | 1.26           |         |
| Post-VAS                    | A | 2.38            | 4.52  | 1.66           | 0.000   |
|                             | B |                 | 2.14  | 1.40           |         |
| Pre-ODI                     | A | -15.34          | 65.17 | 9.57           | 0.000   |
|                             | B |                 | 80.52 | 10.96          |         |
| Post-ODI                    | A | 18.26           | 37.35 | 8.87           | 0.000   |
|                             | B |                 | 19.09 | 6.85           |         |
| Pre-Lumbar Flexion          | A | 4.13            | 28.87 | 5.49           | 0.034   |
|                             | B |                 | 24.74 | 7.18           |         |
| Post-Lumbar Flexion         | A | -5.26           | 40.61 | 6.13           | 0.007   |
|                             | B |                 | 45.87 | 6.37           |         |
| Pre-Lumbar Extension        | A | 3.69            | 20.48 | 4.73           | 0.003   |
|                             | B |                 | 16.78 | 2.99           |         |
| Post-Lumbar Extension       | A | -6.21           | 23.70 | 4.39           | 0.000   |
|                             | B |                 | 29.91 | 3.45           |         |
| Pre-Lumbar Lateral Flexion  | A | 1.19            | 8.34  | 2.27           | 0.041   |
|                             | B |                 | 7.14  | 1.49           |         |
| Post-Lumbar Lateral Flexion | A | -5.65           | 9.96  | 2.58           | .000    |
|                             | B |                 | 15.61 | 2.74           |         |
| Pre-Lumbar Rotation         | A | -2.51           | 2.97  | 1.32           | .000    |
|                             | B |                 | 5.48  | 1.43           |         |
| Post-Lumbar Rotation        | A | -4.47           | 9.87  | 2.02           | .000    |
|                             | B |                 | 14.35 | 1.84           |         |

Post of rotation is  $12.11 \pm 2.9$ . The result of this study reveals that there is a significant difference between the groups ( $p < 0.05$ ). Kabat exercises mean at 1<sup>st</sup> day, VAS before treatment was  $7.85 \pm 1.2$ , after the treatment was  $2.14 \pm 1.4$ . while the mean difference was 2.38. Kendall exercises mean on the 1<sup>st</sup> day of ODI before the treatment was  $80.52 \pm 10.96$ , and after the treatment was  $19.09 \pm 6.8$ , the mean difference in ODI was 18.26.

Kabat exercises mean that on the 1<sup>st</sup> day of lumbar spine ROM before the treatment were  $24.74 \pm 7.1$  for flexion,  $16.78 \pm 2.9$  for extension,  $7.14 \pm 1.4$  for lateral flexion,  $5.48 \pm 1.4$  for rotation, and after the treatment were  $45.87 \pm 6.3$  for flexion,  $29.91 \pm 3.4$  for extension,  $15.61 \pm 2.7$  for lateral flexion,  $14.35 \pm 1.8$  for rotation. While Kendall exercises mean on the 1<sup>st</sup> day of VAS was  $6.50 \pm 1.4$  and after

the treatment was  $4.52 \pm 1.6$ . The mean difference of VAS was -1.35. Kendall exercises mean on the 1<sup>st</sup> day of ODI before the treatment was  $65.17 \pm 9.5$  and after the treatment was  $37.35 \pm 8.8$ .

The mean difference in ODI was 15.34. Kendall exercises mean at 1<sup>st</sup> day of lumbar spine range of motion of Kendall exercise group before treatment was  $28.87 \pm 5.4$  for flexion,  $20.48 \pm 4.7$  for extension,  $8.34 \pm 2.2$  for lateral flexion,  $2.97 \pm 1.3$  for rotation after the treatment was  $40.61 \pm 6.1$ ,  $23.70 \pm 4.3$ ,  $9.96 \pm 2.5$ ,  $9.87 \pm 2.02$  for flexion, extension, lateral flexion and rotation, p-value is less than 0.05 that shows there is significant difference between Kendall exercise group and Kabat exercises group but Kabat exercises shows greater improvement in pain intensity, functional ability and lumbar spine range of motion. Results of our study also matched

the previous study on the Kabat method versus the Williams method in the conservative treatment of patients suffering from lower back pain. The study was conducted on 44 patients having discopathies of the lower lumbar spine, divided into two groups. In each group, 22 patients followed the treatments, and all patients were assessed at baseline and after one month of treatment. The study concluded that the Kabat method used in the conservative treatment of lumbar discopathies showed good results. This method is also adapted for different musculoskeletal disorders, as the proprioceptive neuromuscular facilitation helps obtain better functional outcomes.<sup>15</sup>

## CONCLUSION

The study comparing the effects of Kendall versus Kabat exercises in patients with chronic low back pain on pain and functional disability in patients and lumbar spine mobility shows significant improvements in pain level, range of motion, and functional ability over time for all participants. Pain scores and the Oswestry disability index significantly declined, but the range of motion of the lumbar spine scores increased throughout the study. Both interventions were effective in improving patient outcomes, but Kabat exercises are more effective in improving pain intensity, functional ability, and mobility.

## DECLARATIONS

**Consent to participate:** Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

**Availability of Data and Materials:** Data will be made available upon request. The corresponding author will submit all dataset files.

**Competing interests:** None

**Funding:** No funding source involved.

**Authors' contributions:** All authors had read and approved the final manuscript.

**CONSORT Guidelines:** All methods were performed following the relevant guidelines and regulations.

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