# A controlled trial to evaluate the effect of magnesium with exercises and electrotherapy in low back pain

**[1]Dr. Shreya Anil Padave (PT), [2]Dr. Renuka Pal (PT), [3]Dr. Jafar Khan (PT), [4]Dr. Vardhman Jain (PT), [5]Dr. Rahat Khan, [6]Dr. Sudhir Dubey (PT)**

[1]MPTh Scholar, Department of Physiotherapy, Pacific College, Pacific Medical University, Udaipur, Rajasthan, India
[2]Associate Professor, Pacific College of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan, India
[3]Dean & HOD, Pacific College of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan, India
[4]PhD Scholar, Department of Physiotherapy, Malwanchal University, Indore, Madhya Pradesh, India
[5]Tutor, Department of Pharmacology, Pacific Medical University, Udaipur, Rajasthan, India
[6]MPTh Scholar, Department of Physiotherapy, Pacific College, Pacific Medical University, Udaipur, Rajasthan, India

**Corresponding Author:** Dr. Shreya Anil Padave
**Email:** shreyapadave2@gmail.com

## Abstract

**Introduction:** Low back pain is a common health problem and caused by various risk factors such as lack of exercises, smoking, changing lifestyle and poor quality of life. Remedies include pharmacotherapy, surgery and exercise therapy. Magnesium is an important nutrient that plays a major role in pain management by regulating the NMDA receptors in turn causing the muscles to relax.
**Methodology:** This is a comparative study with and without transdermal Magnesium oils sprays along with exercises and electrotherapy are used in low back pain patients. The sample size is 30 participants aged 24-40 years, and the outcome measures include pain, Mg RBC levels, activities of daily living.
**Results:** The results showed a significant improvement in pain and activities of daily living from day 0 to 45$^{th}$ day and 45$^{th}$ day to 90$^{th}$ day in both Group A and Group B.
**Discussion and Conclusion**: Both treatment protocols significantly improved patients, with a greater improvement observed in Group A.

**Keywords:** Low back pain, transdermal magnesium, N-methyl-D-aspartate (NMDA) receptors , exercise

## Introduction

Low Back pain is a common health problem that affects a large portion of the population worldwide. Low back pain whether or not it extends into the leg, is any soreness, muscle tension, or stiffness that is situated below the costal boundary and above the inferior gluteal fold. According to the studies of epidemy, it is considered that the risk factors that starts backache are normally three dimensionally interrelated: lifestyle and personal factors, psychosocial factors and physical factors. It can be minor to severe, acute or chronic, and it can range in intensity. Low back pain (LBP) is divided into three subcategories based on how long it lasts: acute (less than 6 weeks), subacute (between 6 weeks and 3 months), and chronic (more than 3 months). Back pain can be caused by many factors, including muscle strain, ligament strain, disc herniation, degenerative disease, and spinal abnormalities. Epidemiological studies have shown that back pain is a common medical condition. Back pain is the leading cause of long-term disability worldwide, according to the 2019 Global Burden of Disease Survey. It affects people of all ages, but a higher incidence in the elderly has been reported. LBP is long-term chronic health condition which might occur with an unpredictable pattern. According to a statistical report 60% of people experiencing an acute episode of LBP recovers within 3 months. While 50-70% people experience a recurring episode. This recurring and fluctuating nature of the LBP is a major cause of socio-economic and global burden. Magnesium is an essential mineral with a significant role in various bodily functions, including pain management. It participates in over 300 enzymatic reactions that contribute to muscle and nerve function, energy production, immune system health, and protein synthesis. Magnesium also possesses properties that can influence pain perception and provide relief in specific pain conditions. One of the primary ways magnesium affects pain management is by regulating the N-methyl-D-aspartate (NMDA) receptors. Mg block their activation and reduce sensitivity to pain stimuli. This antagonistic effect helps alleviate pain and modulate pain perception.

## Aim of study

To compare the efficacy of magnesium with exercises and electrotherapy vs only exercises and electrotherapy in low back pain.

## Objectives of the study

The know the difference in effectiveness of magnesium with exercises and electrotherapy vs only exercises and electrotherapy in low back pain.

1. To assess, using the Visual Analogue Scale (VAS), the effects of Mg supplementation in conjunction with physical therapy and electrotherapy in participants with low back pain.
2. To assess the impact of Mg supplementation in conjunction with traditional physiotherapy management on participants with low back pain's daily activities of living (ADLs) using the Back Pain Functional Scale (BPFS).
3. To examine the impact of magnesium supplementation combined with physical activity and electrotherapy on participants with low back pain's serum levels of the mineral.

## Methodology

The participants with LBP in the current study will be divided into two groups: The experimental Group A and the control Group B. Group A will receive the transdermal application of Mg oils along with exercises & electrotherapy, whereas Group B will

receive only exercises & electrotherapy. Because of this, the current investigation is a randomized controlled experiment.

**Obtaining consent and ethical issues**

The intended study requested ethical approval to be carried out at the Pacific College of Physiotherapy in Udaipur.

**Study Population**

All adults with persistent low back pain, aged 24 to 40, were included in the study. Participants were drawn from Udaipur and its neighboring cities hospitals, rehabilitation facilities, and neighborhoods.

**Sample Size**

The sample size for the study is chosen using the power analysis and the impact of the outcome measure from prior research used in this investigation.
30 patients with low back pain, residing in Udaipur, Rajasthan.
15- Treatment with transdermal application of Magnesium along with exercises and electrotherapy.
15- Treatment with exercises and electrotherapy.

**Sampling Method**

For this experiment we have selected a random sampling method.

**Inclusion criteria**

- Male and female patients in the age group 24- 40 years.
- Patients having low back pain more than 3 weeks.
- Ability to walk independently on even and uneven surfaces without assistive devices.
- Willing participants with no serious cognitive issues and ability to comprehend commands.

**Exclusion criteria**

- Patients with previous history of spine surgery and any pathology of muscle, bone, ligaments
- Patients who received steroid injections within last six months & those who have recently become ill, systemic or infectious disease
- Patients with a history of a pathological conditions like malignancy, infection, rheumatoid arthritis, osteomyelitis & skin conditions.
- Patients with pacemaker.
- Pregnant women.
- Epilepsy or seizures in the past.
- Other serious illnesses or neuropsychiatric conditions, such as claustrophobia or severe depression.
- A history of drug or alcohol abuse

**Procedure**

**Exercises**: 10 repetitions of each exercise, thrice daily.

1. Cat and cow
2. Cobra stretch

3. Bridging
4. Child's pose
5. Supine spine twist

**Magnesium** – 20 sprays of Dr Mg
**TENS** (Transcutaneous Electrical Nerve Stimulation) for 15 minutes.
Burst TENS- Carrier frequency of 70-100Hz packaged in burst of about 7 bursts per second.

**Pulse width:** High 100-200 micro seconds.

**Pulse rate:** 70-100pps modulated to 1-5 bursts/sec

**Intensity:** Strong but comfortable.

**Note**: Pacific Medical University, Institute's ethical approval obtained date 06/09/22, PMU/PMCH/IEC/2022/242. All participants completed information and consent form at recruitment.

**Data Analysis**
Nominal data from patient's demographic data i.e., age, sex, BMI, height, weight distribution were analyzed using t-test. Comparison of the pre intervention and post intervention outcome measures such as VAS, Magnesium RBC levels and Back Pain Functional Scale was done. The descriptive statistics were expressed in the median [interquartile range (IQR)].

**Results**
The demographic dimension (age) of the sample recruited was detailed with the median (IQR) in Table 1, while comparisons were made in Table 2 between groups. There exists no significant difference between them. Differences between the outcome scores, VAS, Serum Magnesium, and BPFS at pre-post intervention changes in $45^{th}$ day and $90^{th}$ day within and between the groups were tabulated in Table3 with statistical significance differences.

**Table 1:** Demographic dimensions of the sample recruited (n=30)

| Demographic dimensions | Median (IQR) | Range |
|---|---|---|
| Age (Years) | 31 (28.8, 33.3) | 24 to 40 |

**Note:** Demographic dimensions does not follow normal distribution. Hence, expressed in median with interquartile range and range

**Table 2:** Demographic dimensions between Group A (n=15) and Group B (n=15)

| Demographic dimensions | Group A | Group B | p-value |
|---|---|---|---|
| Age (Years) | 31 (27, 36) | 31 (29, 35) | 0.935 |

**Note:** Demographic dimensions does not follow normal distribution. Hence, expressed in median with interquartile range.

**Table 3:** Patient gender distribution between Groups A and B

| Gender | Group A | | Group B | | Total | |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % |
| Male | 5 | 33.33% | 9 | 60.00% | 14 | 46.67% |
| Female | 10 | 66.67% | 6 | 40.00% | 16 | 53.33% |
| Total | 15 | 100.00% | 15 | 100.00% | 30 | 100.00% |

**Table 4:** Patient distribution between Groups A and B according to education

| Demographic variables | | A Patients(n=15) | | B Patients(n=15) | |
|---|---|---|---|---|---|
| | | Frequency | % | Frequency | % |
| Education | No Formal Education | 7 | 46.7% | 2 | 13.3% |
| | Primary Education | 3 | 20% | 2 | 13.3% |
| | Sec. & high sec. Education | 0 | 0% | 2 | 13.3% |
| | Graduation & Above | 5 | 33.3% | 9 | 60% |

**Table 5:** Distribution of Patients by Occupation Between Groups A and B

| Demographic variables | | A Patients(n=15) | | B Patients(n=15) | |
|---|---|---|---|---|---|
| | | Frequency | % | Frequency | % |
| Occupation | Unemployed | 0 | 0% | 1 | 0.067% |
| | Employee | 8 | 53% | 6 | 40% |
| | Business | 7 | 46.7% | 8 | 53.3% |

**Table 6:** Family Income in Rs. wise Patient Distribution Between Groups A & B

| Demographic variables | | A Patients(n=15) | | B Patients(n=15) | |
|---|---|---|---|---|---|
| | | Frequency | Percentage | Frequency | Percentage |
| family income in Rs | Rs. 5000-1000 | 0 | 0% | 1 | 0.06% |
| | Rs. 10001-15000 | 0 | 0% | 2 | 13.3% |
| | Rs. 15001-20000 | 9 | 60.0% | 7 | 46.67% |
| | Rs. 20001-Above | 6 | 40% | 5 | 60% |

**Table 7: Area-wise Patient Distribution in Groups A and B**

| Demographic variables | | A Patients(n=15) | | B Patients(n=15) | |
|---|---|---|---|---|---|
| | | Frequency | Percentage | Frequency | Percentage |
| Area | Rural | 9 | 60% | 6 | 40% |
| | Urban | 6 | 40% | 9 | 60% |

**Table 8:** Comparison of VAS score, Mg RBC and BPFS at pre-post intervention changes in 6th week and 12th week within and between the Group A & Group B (n=30)

| Outcome scores | Group A (n=15) | Group B (n=15) | p-value# |
|---|---|---|---|
| VAS- Pre | 7 (6, 8) | 5 (5, 7) | 0.002 |
| VAS -6wk | 4 (3, 5) | 5 (4, 5) | 0.174 |
| VAS -12wk | 1 (0, 1) | 4 (3, 4) | <0.001 |
| P-value* | <0.001 | <0.001 | |
| Mg RBC -Pre | 0.8 (0.7, 1.4) | 1.4 (0.9, 2.0) | 0.148 |
| Mg RBC -45th day | 1.7 (1.5, 2.0) | 1.5 (0.9, 2.0) | 0.325 |
| Mg RBC -90th day | 2 (1.9, 2.3) | 1.5 (1.0, 2.0) | 0.011 |
| P-value* | <0.001 | 0.249 | |
| BPFS-Pre | 26 (15, 34) | 29 (26, 34) | 0.325 |
| BPFS -45th day | 44 (36, 47) | 37 (30, 42) | 0.013 |
| BPFS -90th day | 56 (48, 58) | 43 (37, 48) | <0.001 |
| P-value* | <0.001 | <0.001 | |

**Note:** Outcome scores does not follow normal distribution. Hence, expressed in median with interquartile range. * - Friedman test; # - Mann-Whitney U test

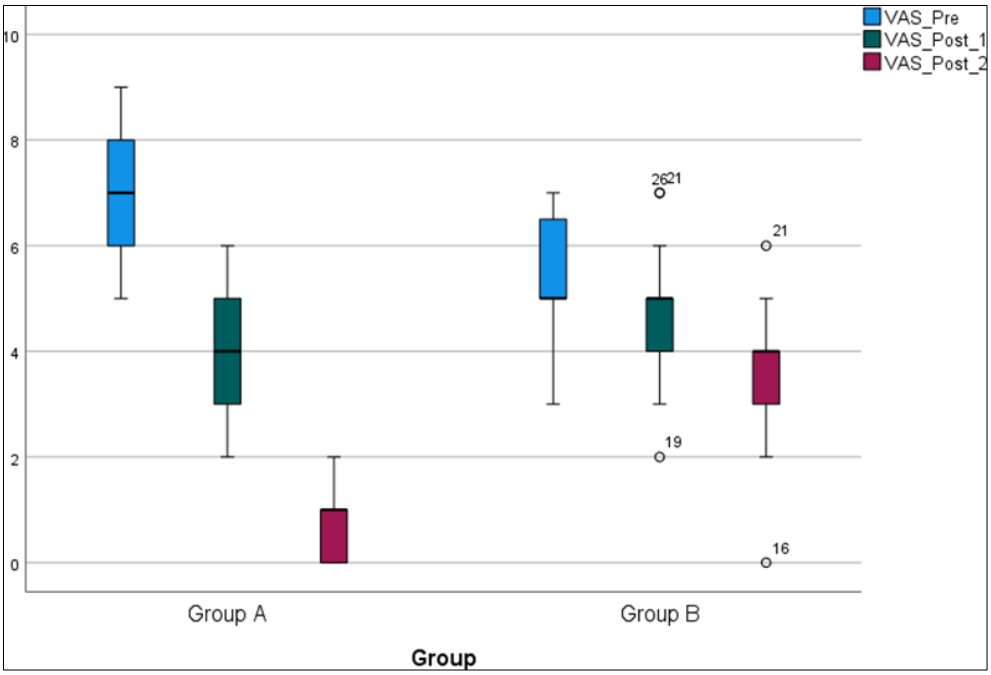


**Fig 1:** Pain score changes (median) between the groups

This graph up top compares the median VAS score between Group A and Group B at three distinct time periods. At day 0, post 1, and post 2, Group A's median was 7, 4, and 1, whereas Group B's was 5, 5, and 4, respectively.

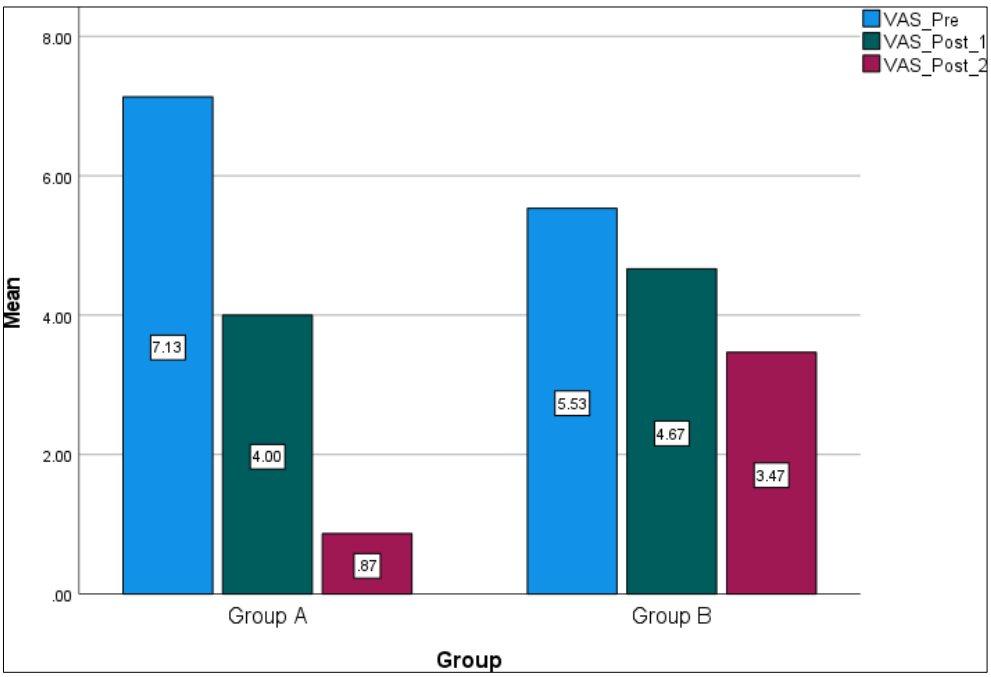


**Fig 2:** Pain score changes (mean) between the groups

The graph up top compares Group A and Group B's VAS scores and means at three separate time points. The mean for Group A was 7.13, 4.00, and 0.87 respectively at day 0, post 1, and post 2, while it was 5.53, 4.67, and 3.47 for Group B.

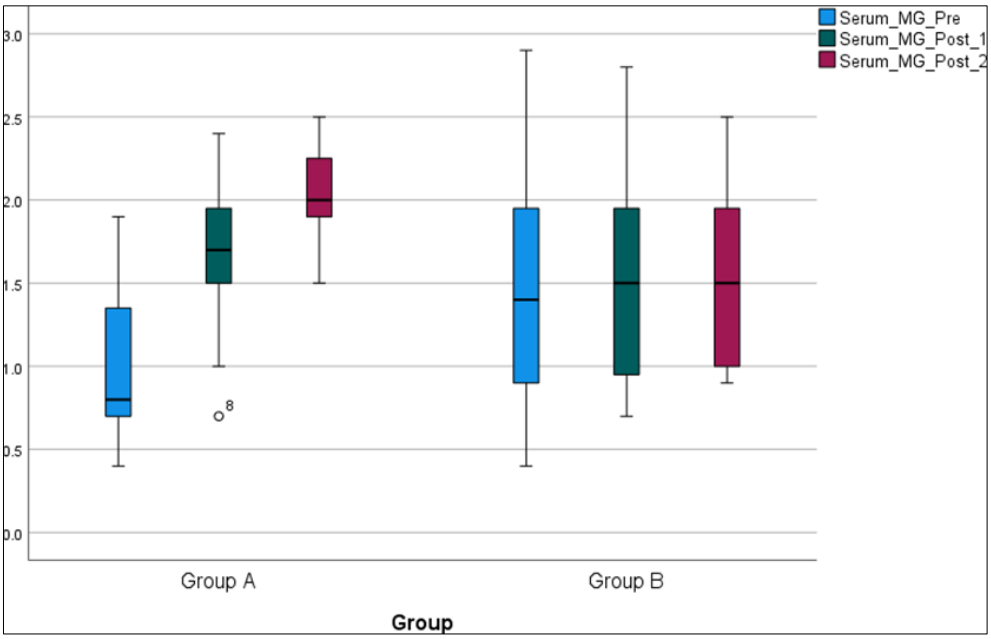


**Fig 3:** MgRBC changes (median) between the groups

The above graph displays the comparison of Mg RBC value and median among Group A and Group B at three different intervals. At day 0, post 1 and post 2 the

median of Group A were 0.8,1.7 and 2 respectively while that of Group B were 1.4, 1.5 and 1.5 respectively.

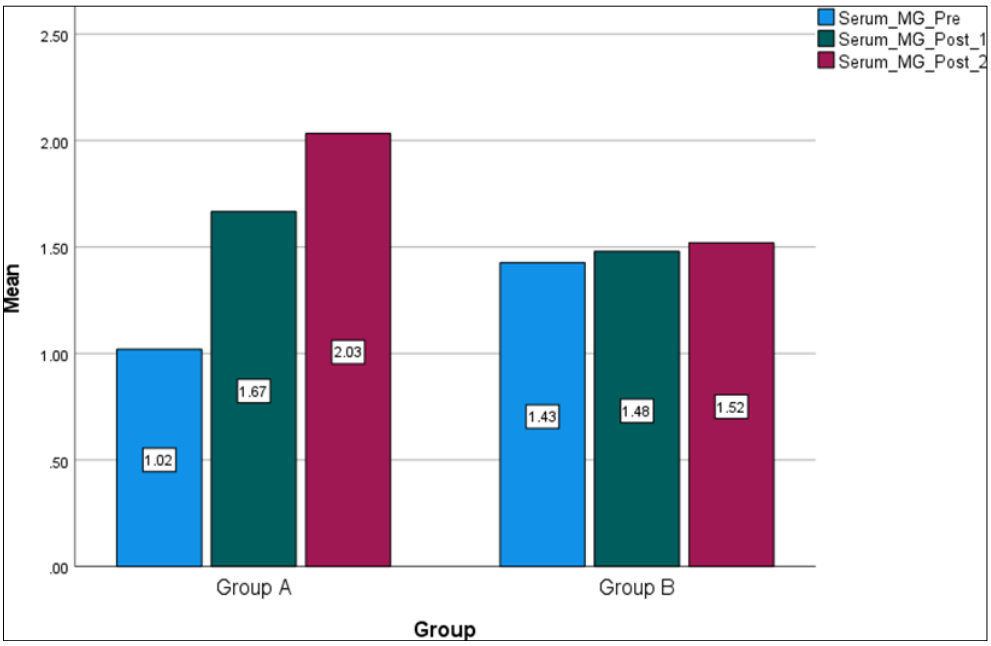


**Fig 4:** MgRBC changes (mean) between the groups

The graph up top compares the mean and value of the Mg RBC in Group A and Group B at three different time points. The means for Group A at day 0, post 1, and post 2 were 1.02, 1.67, and 2.03 respectively, while they were 1.43, 1.48, and 1.52 for Group B

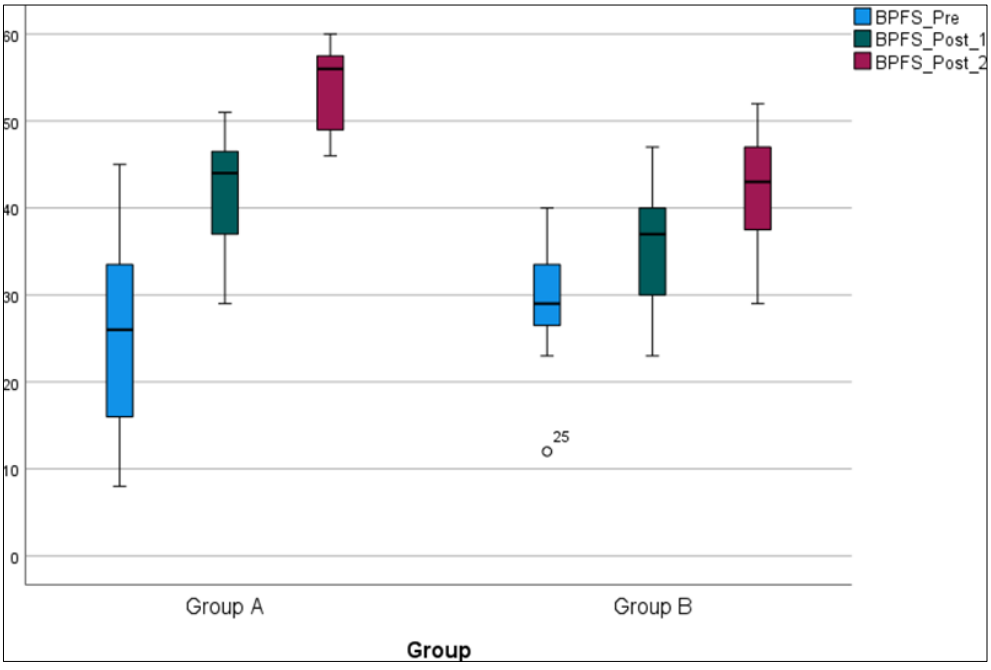


**Fig 5:** BPFS score changes (median) between the groups

The graph up top compares the median BPFS score between Group A and Group B at three different time points. The median values for Group A at day 0, post 1, and post 2

were 26, 44, and 56, respectively, while they were 29, 37, and 43, respectively, for Group B

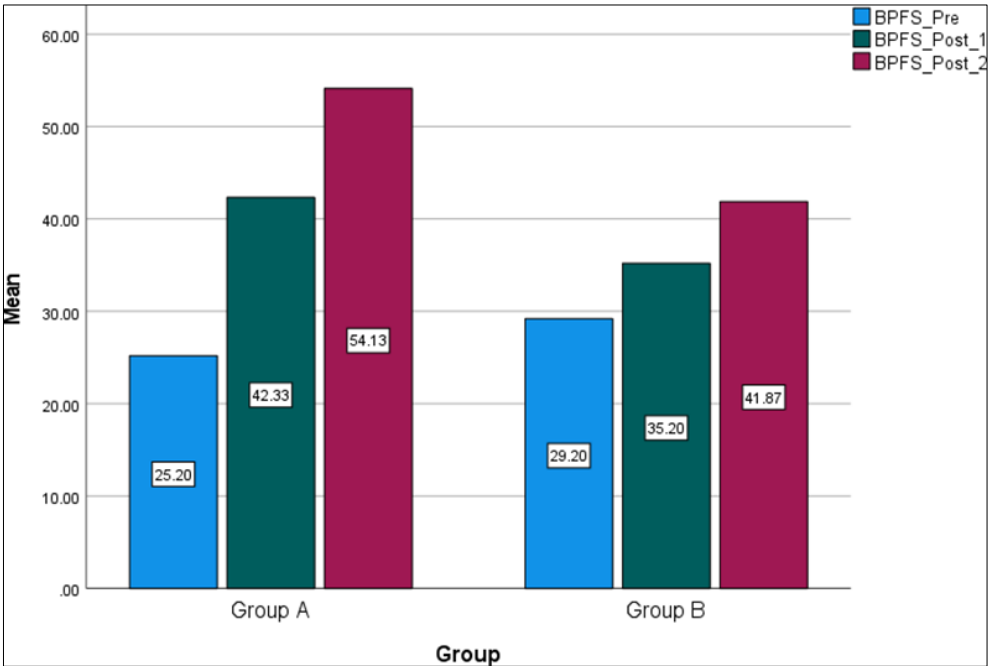


**Fig 6:** BPFS score changes (mean) between the groups

The graph up top compares the average BPFS score between Group A and Group B at three distinct times. At day 0, post 1, and post 2, Group A's mean values were 25.20, 42.33 and 54.13, respectively, whereas Group B's values were 29.20, 35.20, and 41.87.

**Discussion and Conclusion**

Rehabilitation for LBP is a challenging topic because there are many different types of rehabilitation and the doctor may need to guide the patient to the most appropriate rehabilitation programme. The three main categories of rehabilitation are symptomatic, motor control, and functional. Symptomatic LBP refers to fresh or repeated episodes that have distinct symptoms. Patients with moderate discomfort and disabilities who can manage their movement. According to studies, patients with refractory persistent low back pain experienced a decrease in pain intensity and an increase in lumbar spine mobility after using MgSO4 supplements. Furthermore, magnesium exhibits anti-inflammatory properties, which are beneficial for pain relief. By promoting muscle relaxation, magnesium helps alleviate pain associated with muscles and reduces the frequency and intensity of spasms. While TENS can provide temporary pain relief, it does not treat the underlying cause of the pain. We deduced from the current study that patients who got transdermal magnesium oil application experienced substantial differences in pain, back impairment, and magnesium RBC levels compared to patients who received simply exercises and electrotherapy.

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