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EFFECT OF COGNITIVE FUNCTIONAL THERAPY AND JACOBSON'S RELAXATION TECHNIQUE ON FUNCTIONAL STATUS , PAIN CATASTROPHISATION AND FEAR AVOIDANCE BELIEF IN MIDDLE-AGED ADULTS WITH CHRONIC NON SPECIFIC LOW BACK PAIN – A RANDOMIZED CONTROL TRIAL

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Abstract

Chronic non-specific low back pain is a common musculoskeletal disorder and one of the leading causes of disability worldwide affecting functional ability and quality of life and is often associated with pain catastrophization and fear avoidance beliefs. Cognitive Functional Therapy is a patient-centered intervention that targets movement patterns, cognitive beliefs, and behavioral factors, whereas Jacobson's Relaxation Technique primarily focuses on reducing muscle tension and psychological stress .Total 26 patients with chronic non specific low back pain underwent a 8-week intervention. Group A received Cognitive Functional Therapy(CFT) along with jacobson's relaxation technique while Group B received Lumbar stabilization exercise along with jacobson's relaxation technique. Stastical analysis was done using IBM SPSS32.1.The Shapiro-Wilk test revealed that most variables had a normal distribution ($p > .05$), with the exception of age ($p = .007$).All outcome measures showed significant within-group improvements in both the intervention and control groups ($p < .001$), with substantial effect sizes (ES = 0.60–6.65) indicating clinically significant improvement. Functional status ($p = .79$), pain catastrophisation ($p = .62$), fear avoidance beliefs ($p = .40$), corset effect ($p = .10$), and lumbar mobility parameters ($p = .53$–$.99$) were among the outcome measures for which between-group analysis revealed no significant differences between

groups, indicating comparable efficacy of both interventions.The study showed effect of Cognitive Functional Therapy was non significant. Cognitive Functional Therapy and Lumbar Stabilization Exercises both effectively improve functional mobility, psychological parameters, core strength, and lumbar range of motion in individuals with low back pain. Although each intervention exhibits distinct advantages, their overall effectiveness is comparable, supporting their implementation as evidence-based treatment options in clinical practice.

Key words: Cognitive functional therapy, Functional status ,pain catastrophisation ,corset strength.

I. INTRODUCTION

Low back pain (LBP) is still a musculoskeletal ailment that has a negative social impact. LBP is a major cause of disability and is quite common worldwide.[5]In addition to being unrelated to conditions like fractures, spondylitis, direct trauma, or neoplastic, infectious, vascular, metabolic, or endocrine-related processes, nonspecific lowback pain (NSLBP) is defined as pain between the costal margins and the inferior gluteal folds. It is typically accompanied by painful limitation of movement and is frequently influenced by physical activity and posture.[12] Chronic NSLBP is one that persists for at least 12 weeks, and this is typically the case in a substantial number of people with NSLBP.[12] The duration of acute and subacute NSLBP is six and twelve weeks, respectively. Both medical personnel and the healthcare system as a whole face difficulties in managing low back pain (LBP).[1] Given that between 62 and 85% of adults may have LBP at some point in their lives, this may be related to the high incidence and prevalence rates of the condition.[13] Up to 20% of people worldwide suffer from chronic nonspecific low back pain (CNSLBP), a multifactorial musculoskeletal condition.[21] With a lifetime prevalence of up to 84% and an estimated ~23% of the world's population suffering from chronic symptoms, chronic non-specific low back pain (CNSLBP) is a significant worldwide health concern.[2] Chronic Prevalence: 18 23% of the population is often considered to be affected. Gender and Age: Rises with age, reaching a peak between the ages of 50 and 55. Women are more likely to have it (19.8%) than males (15.9%). In order to treat LBP, international clinical guidelines 5–7 recommend using non pharmacological treatments, physical and psychological therapy, or a combination of these therapies. It is becoming more well acknowledged that LBP is a biopsychosocial condition that is impacted by a variety of interrelated circumstances. Pathoanatomical (e.g., disc degeneration), physical, psychological, lifestyle, and social factors can all be present.[12] To assist patients in self-managing chronic low back pain (CLBP), cognitive functional therapy (CFT), a physiotherapy-led individualized intervention, was created. It targets psychological, lifestyle, and physical barriers to healing.[12] CFT is a unique technique that includes two additional components: lifestyle modification and a biopsychosocial knowledge of pain, in addition to postural and movement behaviors.[1]Based on a comprehensive interview, examination, and clinical reasoning process, the intervention focuses on pain related thoughts, feelings, self-efficacy, and behaviors that are thought to contribute to an individual's persistent pain and impairment .[19] Pain sensitization is one theory that could be involved in the onset and persistence of CLBP. Increased responsiveness of central and/or peripheral nervous system circuits is known as pain sensitization, and it can lead to pain hypersensitivity (allodynia, hyperalgesia, etc.) and perhaps unfavorable pain-related outcomes.[9] For patients with Clbp, pain catastrophizing— a pattern of negative cognitive-emotional reactions to pain that includes rumination, magnification, and helplessness—has been linked to poor outcomes, pain severity, and disability.[9] Numerous groups, including those with acute or chronic LBP, have shown a link between catastrophizing and pain.[23] Measures of catastrophizing are substantially linked with both objective and subjective measures of impairment, according to several studies conducted in cultures other than Nigeria.[13] Noxious inputs cause the neurons in those pathways to become more excitable over time in central sensitization (CS). Because of this, the neurons become extremely sensitive to external stimuli and produce pain in reaction to motions or sensations that wouldn't typically induce pain. Therefore, rather than peripheral damage or especially unpleasant inputs, the pain is more likely to be caused by central sensitivity. Additionally, this pain usually increases cognitive-emotional sensitivity, which can lead to catastrophizing and fear avoidance behavior.[4]It is hypothesized that some people with LBP experience a catastrophizing reaction in which they imagine the worst potential consequence of an activity due to negative beliefs about pain and/or unfavorable knowledge about sickness. This reinforces the initial negative assessment in a

harmful cycle by causing dread of exercise and avoidance, which in turn leads to disuse and the ensuing misery. According to the fear avoidance model, individuals who do not have fear-avoidant beliefs (FABs) are more likely to deal with pain issues and take an active role in their coping mechanisms.Interventions for individuals with high FABs have been developed using this kind of "good" coping.[23] Among the most well-established movement therapy regimens for treating low back pain are interventions to repair neuromuscular deficiencies. The benefits of sensorimotor movement therapies have been emphasized by a number of meta-analyses: core-stability exercises, motor control, and stabilization all demonstrated better outcomes than control therapy. When compared to limited therapies, more thorough motor control and stabilization exercises have been demonstrated to produce better results on pain and impairment in chronic low back pain [10]. Sensorimotor training is at least one of the most effective treatment regimens for non-specific low back pain, according to the existing meta-analyses and a summarizing network meta-analysis on more than 5000 patients with chronic low back pain.[10] For the treatment of persistent LBP, relaxation techniques have proven to be quite successful. By using relaxation techniques, cortisol levels were lowered, which is a sign of decreased inflammatory processes and less discomfort. One simple and affordable way to relieve chronic pain is through relaxation techniques.[8] Exercises for lumbar coordination and stabilization are intended to restore the lumbar spine's neuromuscular control.[3]
The purpose of this study is to ascertain if individuals with persistent, non-specific low back pain benefit from cognitive functional therapy. We postulated that CFT could lessen fear avoidant beliefs, lessen pain catastrophizing, and improve pain.

II.MATERIALS & METHODS

The study was designed as a double-blinded randomized control trial conducted at Malla Reddy Health City, Hyderabad.The study population consists of middle aged adults with chronic non specific low back pain.The study period was of 8 months with treatment duration of 12 weeks.
The sample size was calculated by using G*power 3.1.The calculation is based on previous work by Mary O'Keeffe et al.
The p value was 0.05 , power 0.95 and effect size 2.25, with the drop out percentage was 20% the proposed sample size is 26.The samples were divided into group A and group B 13 each using randomized sampling.

Registration and approval:
Ethics consideration**:** Institutional ethics committee permission was taken certificate no - MRIMS/DHR-IEC-MPT/2025/150.
Ethical Approval: EC/NEW/INST/2023/TE/0235
CTRI Approval: CTRI/2026/01/10044

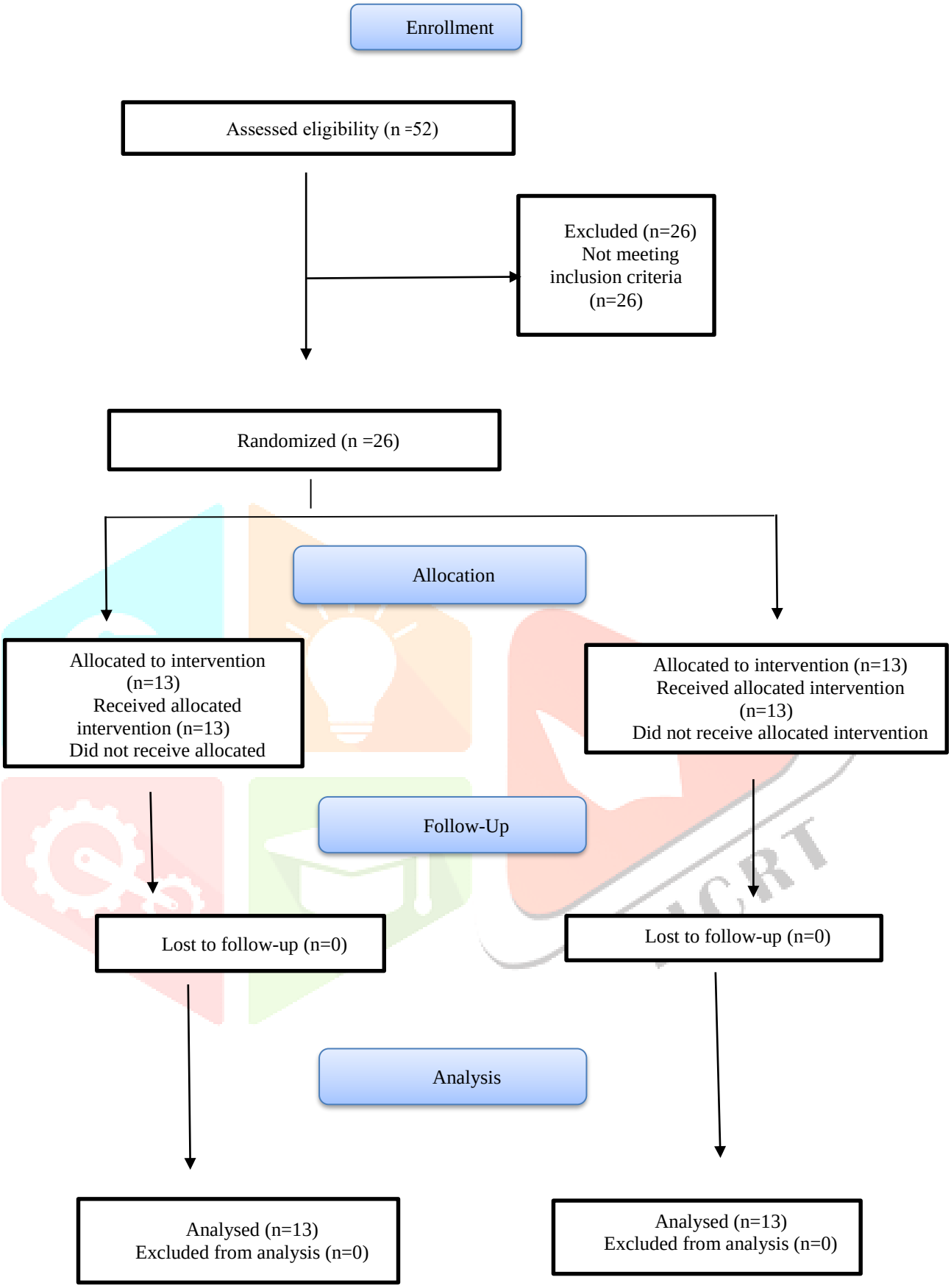

fig.no 1:- consort flow diagram

METHODOLOGY

Total 26 participants were selected according to inclusion criteria in which both male and female having age group 25-40 year with chronic non specific low back pain with NPRS 4 or equal to 8 and independtly mobile were included.Participants with low back pain which is acute or radiates to lower limb, history of lumbar spine surgery or fracture, neurological disorders such as condition affecting motor control (eg: parkinsons disease , Multiple sclerosis , stroke),Systemic Inflammatory conditions – diagnosed Autoimmune disorder,Metabolic or hormonal condition were excluded.
The participants were randomised into two groups of 13.Group A received Cognitive Functional Therapy(CFT), Group B received Lumbar Stabilization Exercises in addition to Jacobson's Relaxation.The blinding was done for assessor and patient.

Every participant underwent a pre-test evaluation before to the intervention. Functional status, pain catastrophization, fear-avoidance attitudes, lumbar range of motion (ROM), and corset impact were all assessed.

The Timed Up and Go (TUG) Test was used to evaluate functional status. A line was drawn at a distance of three meters, and a chair was placed firmly. "On the word GO, stand up, walk to the line, turn around, and sit down" was the instruction given to the participants. Timing started on "GO" and ended after the participant was properly seated. The results were interpreted as follows: ≤10 seconds showed normal mobility, ≤20 seconds indicated good mobility, <30 seconds indicated mobility issues requiring help, and ≥14 seconds indicated a high risk of falls.

The Pain Catastrophizing Scale (PCS) was used to assess pain catastrophization. Thirteen items make up this questionnaire, which evaluates the patient's feelings and beliefs about pain. The degree of catastrophization was determined by calculating the overall score, which ranged from 0 (not at all) to 4 (all the time) on a 5-point scale.

The Fear-Avoidance Beliefs Questionnaire (FABQ) was used to measure fear-avoidance beliefs. This measure assesses how much a patient avoids activities because they are afraid of discomfort or worsening symptoms. It is made up of two parts: work-related beliefs and ideas about physical exercise.

A Pressure Biofeedback Unit (PBU) was used to quantify the corset impact using the abdominal draw-in test. The participants were placed with their arms by their sides in a prone position on a stable surface. The PBU was positioned beneath the abdomen, in line with the anterior superior iliac spines, and centered at the navel. After being inflated to 70 mmHg, the device was left to stabilize. In order to measure deep abdominal muscle activation, the investigator measured pressure changes while participants performed an abdominal drawing in motion without changing their breathing patterns.

An inclinometer was used to quantify lumbar range of motion (ROM). Participants stood upright, their knees stretched but not locked, and their feet shoulder-width apart. Prior to movement, the inclinometer was positioned at the T12–L1 level and set to zero. By giving the participant instructions to bend forward, backward, and sideways, respectively, lumbar flexion, extension, and lateral flexion were measured and recorded.

Both groups received the corresponding interventions after the baseline evaluation. After the intervention period was over, a post-test evaluation was carried out to determine how all outcome measures had changed.

Intervention:

Jacobson’s relaxation technique : Each session lasts 20 minutes for both groups A and B. to sit as comfortable as possible in a chair. Maintain a loose, light, and free body. Remain composed and at ease. Do not open your eyes. Steer clear of wandering thoughts. Steer clear of excessive physical motions. Tighten your muscles and hold them for a slow count of five seconds throughout this portion of the exercise cycle. The muscle is rapidly and fully relaxed during the exercise cycle's relationship phase.For ten seconds, let your mind unwind and enjoy how the muscle feels relaxed.

While working out a particular muscle group, try to maintain all other muscles relaxed. while working out from head to toe. Keep an eye out for changes such as stiffness and the emergence of bright and calming sensations. After each step, take three deep breaths with your nose and exhale through your mouth to help you relax. Now let your body feel entirely free, light, and loose.

Cognitive functional therapy : Twelve direct sessions and twelve on-call sessions make up the eight-week training intervention, which takes place three days a week and lasts 60 minutes each.The following three primary phases comprise the intervention:[1] Making purpose of pain that is entirely reflective, where a physical therapist could challenge the patient's preconceived notions and offer a fresh perspective on their

condition by using the patient's own narrative. Exposure with control is intended to normalize maladaptive or provocative movement and posture related to activities of daily living that are integrated into each patient's functional impairments. This includes teaching how to relax trunk muscles, how to have normal body posture while sitting, lying, bending, lifting, moving, and standing, and how to avoid pain behaviors, which aims to break bad postural habits; and lifestyle change, which looks into the impact of unhealthy lifestyles in the context of the patient's pain.

Lumbar stabilization exercises : Patients with low back pain (LBP) may improve from an eight-week stabilization exercise program on lumbar proprioception. Three sessions every week for eight weeks; each session lasts thirty minutes. The transversus abdominis, lumbar multifidi, and internal obliques are the deep lumbar stabilizing muscles that are targeted by the 16 lumbar stabilization exercises. Each of the 16 stability exercises will be done once, sequentially, and in the same sequence.Prior to every exercise, the start and finish positions will be explained verbally and visually. Each exercise will be done ten times, with the final static posture being maintained for ten seconds. Between each workout, there will be a 60-second break and a 3-second wait in between repetitions.

III.Statistical analysis

Descriptive statistics were computed to compare demographic variables, including age and gender, between the groups. Independent t-tests were used to compare baseline statistics between the randomized groups, while a chi-square test was employed for categorical variables such as gender. To determine the degree of significance within and between groups for each variable (NPRS, LEFS), paired and unpaired t-tests were applied, respectively. The statistical significance level was established at $p < 0.05$, and the results were presented as means and standard deviations (SD). The statistical analysis was carried out utilising IBM SPSS version 32.1.

IV.Results

Table no.1- Descriptive statistics of baseline data for age, numerical pain rating scale(nprs), timed up and go test (tug), pain catastrophisation scale(pcs), fear avoidance belief's questionnaire(fabq), corset strength (mmhg), lumbar flexion, lumbar extension, lumbar lateral flexion right, lumbar lateral flexion left

Variable	Mean	Median	Mode	SD	Skewness	Kurtosis
Age	33.19	32.00	40.00	4.68	0.37	-1.34
NPRS	5.12	5.00	4.00	1.03	0.23	-1.33
TUG Test (sec)	11.93	11.85	11.50	1.15	0.14	-0.48
PCS	16.12	14.50	13.00	3.58	0.38	-1.52
FABQ	58.81	57.00	45.00	9.81	0.33	-0.85
Corset Strength (mmHg)	1.14	1.25	1.33	0.60	0.37	-0.64
Lumbar Flexion	44.88	46.00	48.00	7.46	-1.05	2.24
Lumbar Extension	16.87	17.00	18.00	2.01	-0.02	-0.82
Lumbar Lateral Flexion Right	17.88	19.00	19.00	2.06	-0.36	-0.90
Lumbar Lateral Flexion Left	18.33	18.75	19.00	1.54	-0.32	-0.28

SD- Standard deviation

This table presents the mean and standard deviation (SD) of baseline variables, indicating central tendency and variability.The mean age is 33.19 ± 4.68 years, showing a moderately homogeneous sample, while NPRS is 5.12 ± 1.03, indicating moderate pain levels with low variability.Skewness and kurtosis suggest slight deviation from normal distribution in some variables.

Table no.2- normality test using shapiro-wilk of baseline data

Variable	z-value	p-value
Age	0.884	0.007
Pain intensity	0.828	0.050
TUG Test (sec)	0.949	0.219
PCS	0.869	0.050
FABQ	0.955	0.298
Corset Strength (mmHg)	0.934	0.094
Lumbar Flexion	0.894	0.051
Lumbar Extension	0.944	0.167
Lumbar Lateral Flexion Right	0.911	0.052
Lumbar Lateral Flexion Left	0.950	0.229

P<0.05*
Timed up and Go test (TUG), Pain catastrophisation scale (PCS), Fear Avoidance Belief's Questionnaire (FABQ)

The table presents the results of the Shapiro-Wilk test used to assess the normality of all study variables. The analysis showed that some variables followed a normal distribution, while others did not.
All variables excluding AGE ,NPRS and PCS had p-values greater than 0.05, indicating that these data were normally distributed.The variables Age (p = 0.007) showed p-value less than 0.05, indicating non-normal distribution, while NPRS (p = 0.050) and PCS (p = 0.050) were borderline, suggesting slight deviation from normality.

Table no.3 – within group analysis for primary and secondary outcomes in interventional group

Outcome	Mean difference	SD difference	Effect size	t-value	p-value
Functional status	1.93	0.59	3.29	11.870	0.001
Pain catastrophisation	5.85	2.12	2.76	9.965	0.001
Fear avoidance belief's	30.54	7.98	3.83	13.806	0.001
Corset Effect	0.64	0.31	2.06	7.415	0.001
Lumbar flexion	7.73	1.81	4.27	15.401	0.001
Lumbar extension	7.00	1.70	4.13	14.885	0.001
Lumbar lateral flexion Rt.	4.25	1.20	3.53	12.731	0.001
Lumbar lateral flexion Lt.	3.91	1.09	3.59	12.957	0.001

SD- Standard deviation, Timed up and Go test (TUG), Pain catastrophisation scale (PCS), Fear Avoidance Belief's Questionnaire (FABQ)

This table shows mean difference and SD difference before and after intervention, reflecting improvement. All outcomes have high t-values and p = 0.001, indicating statistically significant changes.Large effect sizes suggest strong clinical improvement in the interventional group.

Table no.4 – within group analysis for primary and secondary outcomes in control group

Outcome	Mean difference	SD difference	Effect size	t-value	p-value
Functional status	2.22	1.11	2.00	7.203	0.001
Pain catatrophisation	6.77	3.03	2.23	8.050	0.001
Fear avoidance belief's	30.92	8.45	3.66	13.194	0.001
Corset Effect	1.40	0.60	2.32	8.379	0.001
Lumbar flexion	4.88	8.17	0.60	2.156	0.001
Lumbar extension	6.73	1.01	6.65	23.963	0.001
Lumbar lateral flexion Rt.	5.23	1.35	3.88	13.990	0.001
Lumbar lateral flexion Lt.	5.04	1.36	3.70	13.347	0.001

SD- Standard deviation,Timed up and Go test (TUG), Pain catastrophization scale (PCS), Fear Avoidance Belief's Questionnaire (FABQ)

This shows mean and SD differences within the control group. All variables also show significant improvement (p = 0.001), indicating treatment effect. However, variability (SD) is higher in some variables, indicating less consistency compared to the interventional group.

Table no.5 – between group analysis for primary and secondary outcomes

Outcomes	MD	SDD	t-value	p-value
Functional status	0.1	0.08	0.275	0.786
Pain catastrophisation	0.38	0.07	0.509	0.615
Fear avoidance belief's	-1.01	0.6	0.854	0.402
Corset effect	-0.46	0.08	1.739	0.095
Lumbar flexion	0.15	0.27	0.069	0.945
Lumbar extension	0.7	0.63	0.638	0.529
Lumbar lateral flexion Rt.	0	0.23	0.001	0.999
Lumbar lateral flexion Lt.	-0.32	0.09	0.414	0.682

P<0.05*

SD- Standard deviation SDD- Standard deviation difference,Timed up and Go test (TUG), Pain catastrophisation scale (PCS), Fear Avoidance Belief's Questionnaire (FABQ)

This compares both groups using mean difference (MD) and SD difference (SDD). All p-values > 0.05, indicating no statistically significant difference between groups. Even though both groups improved individually, neither intervention proved superior over the other.

V. Discussion

Functional status: This study found that there was no significant improvement in functional status between the groups after 8 weeks of intervention. However, in comparison within the groups, analysis showed statistically significant improvement in both groups(p= 0.001), indicating that both groups were effective in improving functional mobility. According to certain research, persons with persistent, incapacitating low back pain experienced long-lasting benefits from CFT treatment sessions after three years.[6] If the technique can be broadly adopted, these novel long-term consequences offer the chance to significantly lessen the impact of persistent back pain. In order to improve accessibility and replication studies in various health-care systems, implementation necessitates increasing clinician training. [6] Additionally, systematic reviews have reported that interventions targeting both motor control and behavioral components result in superior functional improvements compared to conventional approaches.[7] Exercise-based interventions, such as Lumbar Stabilization Exercises, have also demonstrated improvements in functional mobility through enhanced neuromuscular coordination and spinal stability.

Pain catastrophisation: The study found that both groups showed significant reduction in pain catastrophisation (p=0.001), indicating improvement in psychological perception of pain.Group B (MD=6.77)showed slightly higher improvement as compared to group A(MD=5.85).Between -group analysis not significant (p=0.615), indicating that both interventions were equally effective in reducing pain related to negative through process.Recent meta-analyses have confirmed that CFT significantly reduces pain catastrophizing and disability by addressing maladaptive beliefs and promoting adaptive coping strategies[7].However, the improvement seen in Group B indicates that structured physical exercise can also positively influence psychological outcomes by enhancing confidence and reducing perceived disability.[18] These findings align with contemporary research suggesting that psychological improvements are not exclusive to cognitive therapies but can also occur through physical rehabilitation when it improves functional capacity and self-efficacy [17].

Fear avoidance belief: There was significant improvement in confidence and reduced work or physical activity related fear (p=0.001).Between groups comparison showed no significant difference, which says that both interventions have similar effect. Recent high-quality evidence from randomized trials supports the effectiveness of CFT in reducing fear and improving confidence in movement.[11] On the other hand, Lumbar Stabilization Exercises contribute indirectly by improving physical capacity and providing graded exposure to movement. This supports the fear-avoidance model, which highlights that gradual exposure to movement plays a critical role in reducing disability.[22,20]

Corset strength: Significant improvement were observed in both groups p(=0.001), which means that core muscle strength was improved individually by both groups. Group A improvement may be due to reduced protective muscle gaurding whereas Group Showed higher effect size,which could be result of specific focus on stabilization exercises on deep trunk musculature.Between groups analysis showed no significant improvement.Recent literature continues to support that stabilization exercises enhance spinal stability and muscular endurance, leading to improved functional outcomes in low back pain patients.[16] Meanwhile, improvements observed in Group A may be explained by enhanced motor control and reduced muscle guarding following cognitive and behavioral changes.

Range of motion :Both groups showed significant improvement but Group A showed highly significant improvement for flexion and Group B showed slightly greater effect than group A ,indicates the effectiveness of stabilization exercises in enhancing spinal control and mobility.The Between group analysis was not significant.Recent evidence suggests that stabilization exercises improve spinal mobility through enhanced neuromuscular control, while cognitive interventions improve movement patterns by addressing behavioral restrictions.[19]

VI.Conclusion

The study showed effect of Cognitive Functional Therapy was non significant. Cognitive Functional Therapy and Lumbar Stabilization Exercises both effectively improve functional mobility, psychological parameters, core strength, and lumbar range of motion in individuals with low back pain. Although each intervention exhibits distinct advantages, their overall effectiveness is comparable, supporting their implementation as evidence-based treatment options in clinical practice.

VII.References

1.Ahmad, S. N. S., Letafatkar, A., Brewer, B. W., & Sharifnezhad, A. (2023). Comparison of cognitive functional therapy and movement system impairment treatment in chronic low back pain patients: A randomized controlled trial. *BMC Musculoskeletal Disorders, 24*, 684. https://doi.org/10.1186/s12891-023-06815-x

2.Balagué, F., Mannion, A. F., Pellisé, F., & Cedraschi, C. (2012). Non-specific low back pain. *The Lancet, 379*(9814), 482–491. https://doi.org/10.1016/S0140-6736(11)60610-7

3.Boucher, J.-A., Preuss, R., Henry, S. M., Dumas, J.-P., & Larivière, C. (2016). The effects of an 8-week stabilization exercise program on lumbar movement sense in patients with low back pain. *BMC Musculoskeletal Disorders, 17*, Article 23. https://doi.org/10.1186/s12891-016-0880-4

4.Brown, C. (2018). *Exercise and central sensitization*. Educational publication.

5.George, S. Z., Fritz, J. M., Silfies, S. P., Schneider, M. J., Beneciuk, J. M., Lentz, T. A., Gilliam, J. R., Hendren, S., & Norman, K. S. (2021). Interventions for the management of acute and chronic low back pain: Revision 2021. *Journal of Orthopaedic & Sports Physical Therapy, 51*(11), CPG1–CPG60. https://doi.org/10.2519/jospt.2021.0304

6.Hancock, M., Smith, A., O'Sullivan, P., Schütze, R., Caneiro, J. P., Laird, R., Maher, C. G., Ferreira, M. L., McAuley, J. H., & Kent, P. (2024). Cognitive functional therapy with or without movement sensor biofeedback versus usual care for chronic, disabling low back pain (RESTORE): 3-year follow-up of a randomised controlled trial. *Physical Therapy, 104*(12), pzae128. https://doi.org/10.1093/ptj/pzae128

7.Kandeel, M., Morsy, M. A., Al Khodair, K. M., & Alhojaily, S. (2025). Cognitive functional therapy for lower back pain: A meta-analytical assessment of pain and disability outcomes in randomized controlled trials. *Bio-Medical Materials and Engineering, 38*(3), 462–472. https://doi.org/10.3233/BMR-240230

8.Manolaki, S., Gkiatas, I., Sioutis, S., Georgoulis, J., Mavrogenis, A. F., Sapkas, G. S., Alexopoulos, E., & Darviri, C. (2021). Relaxation techniques in low back pain patients: A randomized controlled trial. *Journal of Long-Term Effects of Medical Implants, 31*(2), 39–44. https://doi.org/10.1615/JLongTermEffMedImplants.2021037026

9.Meints, S. M., Mawla, I., Napadow, V., Kong, J., Gerber, J., Chan, S.-T., Wasan, A. D., Kaptchuk, T. J., McDonnell, C., Carriere, J., Rosen, B., Gollub, R. L., & Edwards, R. R. (2019). The relationship between catastrophizing and altered pain sensitivity in patients with chronic low back pain. *Pain, 160*(4), 833–843. https://doi.org/10.1097/j.pain.0000000000001467

10.Niederer, D., Engel, T., Vogt, L., & Arampatzis, A. (2020). Motor control stabilisation exercise for patients with non-specific low back pain: A prospective meta-analysis with multilevel meta-regressions on intervention effects. *Journal of Clinical Medicine, 9*(9), 3058. https://doi.org/10.3390/jcm9093058

11.Cognitive functional therapy improves low back pain. (2023). *Nature Reviews Rheumatology, 19*(7), 397. https://doi.org/10.1038/s41584-023-00988-4

12.O'Keeffe, M., O'Sullivan, P., Purtill, H., Bargary, N., & O'Sullivan, K. (2020). Cognitive functional therapy compared with a group-based exercise and education intervention for chronic low back pain: A multicentre randomised controlled trial. *British Journal of Sports Medicine, 54*(13), 782–789. https://doi.org/10.1136/bjsports-2019-100780

13.Ogunlana, M. O., Odole, A. C., Adejumo, A., & Odunaiya, N. (2015). Catastrophising, pain, and disability in patients with nonspecific low back pain. *Hong Kong Physiotherapy Journal, 33*(2), 73–79. https://doi.org/10.1016/j.hkpj.2015.03.001

14.O'Sullivan, P. B., Caneiro, J. P., O'Keeffe, M., Smith, A., Dankaerts, W., Fersum, K., & O'Sullivan, K. (2018). Cognitive functional therapy: An integrated behavioral approach for the targeted management of disabling low back pain. *Physical Therapy, 98*(5), 408–423. https://doi.org/10.1093/ptj/pzy022

15.1O'Sullivan, P., Dankaerts, W., O'Sullivan, K., & Fersum, K. (2015). Multidimensional approach for the targeted management of low back pain. In D. A. Grieve (Ed.), *Grieve's modern musculoskeletal physiotherapy* (4th ed., pp. 465–469). Elsevier.

16.Richardson, C. A., Jull, G. A., Hodges, P. W., & Hides, J. A. (1999). *Therapeutic exercise for spinal segmental stabilization in low back pain*. Churchill Livingstone.

17.Smeets, R. J. E. M., Vlaeyen, J. W. S., Kester, A. D. M., & Knottnerus, J. A. (2006). Reduction of pain catastrophizing mediates the outcome of both physical and cognitive-behavioral treatment in chronic low back pain. *Pain, 124*(1–2), 77–86. https://doi.org/10.1016/j.pain.2006.03.011

18.Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: Development and validation. *Psychological Assessment, 7*(4), 524–532. https://doi.org/10.1037/1040-3590.7.4.524

19.Thiveos, L., Kent, P., Pocovi, N. C., O'Sullivan, P., & Hancock, M. J. (2024). Cognitive functional therapy for chronic low back pain: A systematic review and meta-analysis. *Physical Therapy, 104*(12), pzae128. https://doi.org/10.1093/ptj/pzae128

20.Vlaeyen, J. W. S., & Linton, S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain, 85*(3), 317–332. https://doi.org/10.1016/S0304-3959(99)00242-0

21.Verbrugghe, J., Agten, A., Stevens, S., Vandenabeele, F., Timmermans, A., Meirte, J., Danneels, L., Nijs, J., & Dolphens, M. (2023). High intensity training improves symptoms of central sensitization at six-month follow-up in persons with chronic nonspecific low back pain: Secondary analysis of a randomized controlled trial. *Brazilian Journal of Physical Therapy, 27*(2), 100496. https://doi.org/10.1016/j.bjpt.2023.100496

22.Waddell, G. (2004). *The back pain revolution* (2nd ed.). Churchill Livingstone.

23.Wertli, M. M., Rasmussen-Barr, E., Held, U., Weiser, S., Bachmann, L. M., & Brunner, F. (2014). Fear-avoidance beliefs—A moderator of treatment efficacy in patients with low back pain: A systematic review. *The Spine Journal, 14*(11), 2658–2678. https://doi.org/10.1016/j.spinee.2014.02.033