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ORIGINAL PAPER

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Cognitive behavioural therapy and core stabilization exercise on pain-related disability and psychological status in patients with non-specific chronic low back pain

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Clinical Trial Registry number: PACTR201910791448143

ABSTRACT

Introduction. Exercises have been shown to relieve symptoms in non-specific chronic low back pain (NSCLBP) patients.

Aim. This study compared the effects of cognitive behavioural therapy (CBT) and core stabilization exercises (CSE) on pain-related disability, psychological status and sleep disturbance in patients with NSCLBP.

Material and methods. This randomized controlled trial involved a total of thirty-seven (37) participants. They were randomly allotted into three groups [CBT (11), CSE (14) and control (12)]. The intervention was done once per week for duration of 60 minutes for the CBT group, 30 minutes for CSE group and 10 minutes for the control group twice per week for 8 consecutive weeks. Assessment of outcome was done at baseline, 4 weeks and 8 weeks. Data were analyzed using statistical package for social science version 25 at alpha level of less than 0.05.

Results. The results of this study showed that there was significant improvement in the level of pain-related disability ($p= 0.001$), level of anxiety ($p =0.001$), depression ($p = 0.01$, $p = 0.001$, $p =0.001$) and sleep disturbance ($p = 0.001$) in all the groups (CBT, CSE, control) post treatment.

Conclusion. CBT and CSE are both effective in the treatment of pain-related disability, sleep disturbance, and psychological status of NSCLBP patients.

Keywords. chronic low back pain, cognitive behavioural therapy, disability, exercises, patient

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Participation of co-authors: A – Author of the concept and objectives of paper; B – collection of data; C – implementation of research; D – elaborate, analysis and interpretation of data; E – statistical analysis; F – preparation of a manuscript; G – working out the literature; H – obtaining funds

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Introduction

Low back pain (LBP) imposes a significant burden on individuals and society at large and it is one of the commonest reasons for seeking health care.[1] The self-limiting and challenging nature of chronic low back pain (CLBP) has forced the victims to be more and more doubtful about the variety of management techniques commonly promoted as the universal remedy to their ailments.[2] An increase in the body of public health research has suggested physical activity and an array of psychological risk factors as being relevant to the origin of CLBP.[3]

Cognitive behavioural therapy (CBT) is a form of psychotherapy that treats problems and boosts happiness by modifying dysfunctional emotions, behaviours, and thoughts.[4] Cognitive behavioural therapy has been found to be effective for a number of chronic pain conditions affecting children and older adult.[5]

Core stabilization exercises (CSE) are aimed at improving the neuromuscular control, strength, and endurance of the muscles that are central to maintaining the dynamic spinal and trunk stability.[6]

Back care education is another therapy used in the management of patients with low back pain. It entails health education on how to maintain proper posture while performing activities of daily living and behavioural modifications for the prevention of back pain.[7] Back care education has been found to be effective in treating low back pain in different population.[8]

Studies about the relative efficacy of CSE and CBT alone for alleviation of NSCLBP have been well reported.[9-11] However, it appears there is dearth of empirical data establishing the more effective of the two interventions (CBT and CSE) on individuals with NSCLBP.

Aim

This study compared the efficacy of CBT, CSE and back care (BC) with stretching on pain-related disability, psychological status and sleep disturbance in patients with NSCLBP.

Material and methods

This study is a single blinded randomized controlled trial, registered with the Pan African Clinical Trial Registry (PACTR201910791448143). Thirty-seven (37) patients with NSCLBP participated in this study. Sample size was calculated using the sample size determination for comparing proportions.[12] By assuming α value of 1.96, β value of 0.84 and prevalence of 0.85.[13] They were volunteers from a tertiary healthcare facility in Lagos, Nigeria. Participants with history of non-specific chronic LBP with or without pain radiating to one or both lower limbs, Participants who scored between 24-30 on mini mental scale.[14] were included into the study. Participants with previous spinal surgeries and participants with history of trauma to the back were excluded from this study.

Health Research and Ethics Committee of College of Medicine, University of Lagos (CMUL) gave approval for this study with approval number (CMUL/HREC/06/19/535). Informed consent was gotten from the participants before including them in the study. Socio-demographic variables (age, sex, height, and weight) of the participants were taken. Pre-intervention assessment of pain related disability, psychological status (depression and anxiety), insomnia were done with Pain disability Index (PDI), Hospital Anxiety and Depression Scale (HADS) and insomnia severity index.

Fifty-three participants volunteered to be part of the study, eight were ineligible based on the exclusion criteria. Forty five qualified participants were randomly assigned into 3separate groups (CBT, CSE, BC) through a computer generated random number sequence, which was created prior to meeting each participant. This allowed them to be distributed into any of the three groups according to their mode of presentation. Fifteen participants were allocated into CBT group; fifteen participants into CSE group while 15 participants into Back care (BC) group. But 8 participants dropped off in the course of the study. Participants in CBT group were treated for a duration of 1-hour with a frequency of one session per week for 8 weeks.[10] Participants in CSE group were treated for a duration of 30 minutes with a frequency of two treatment sessions per week for 8 consecutive weeks, while participants in BC group which is the control were treated with back care advice and stretching exercises of lower limbs for 15 to 20 seconds duration on each group of muscles with a frequency of two treatment sessions per week for 8 consecutive weeks.[7,9,15]

Though only 37 participants completed this study, 4 participants did not receive allocated intervention while another from the study and 4 did not complete the study due to different reasons ranging from illness, and movement to another state (Figure 1). These exercises were done twice weekly for 2 months. Assessment of pain related disability, psychological status (depression and anxiety) and insomnia was done at baseline, end of 4th and 8th weeks.

Protocol for Cognitive behavioural therapy (CBT)

CBT intervention consists of eight weekly 1-hour sessions that provide:

1. Education about the role of maladaptive automatic thoughts (e.g., catastrophizing) and beliefs (e.g., one's ability to control pain, hurt equals harm) in chronic pain, depression, and anxiety.

2. Instruction and practice in identifying and challenging negative thoughts, thought- stopping techniques, use of positive coping self-statements,

goal-setting, relaxation techniques, and coping with pain flare-ups.

3. Education about activity pacing and scheduling, and about relapse prevention and maintenance of gains.[10]

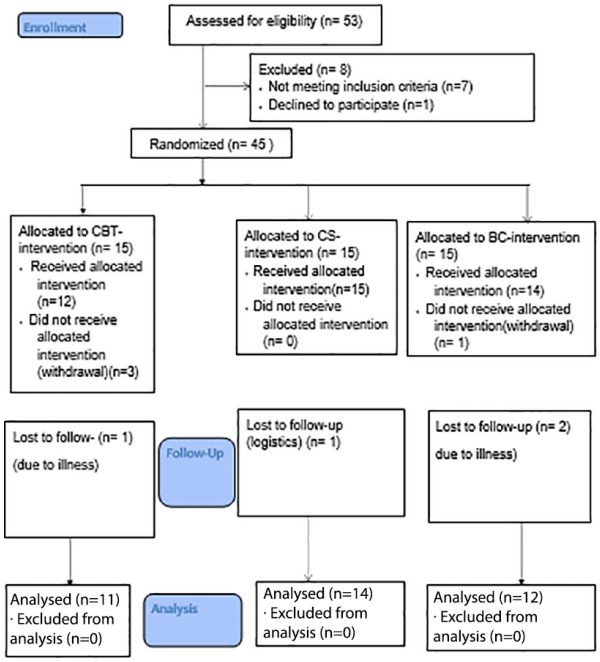

Fig. 1. Flow chart for the study

Protocol for Core stabilization exercises (CSE)

This comprise of abdominal bracing, Heel slides while bracing the abdomen, Leg Lift with abdominal bracing, Bridging with abdominal bracing, Bridging and leg lift with abdominal bracing, abdominal bracing in standing position, Arm lift with bracing in quadruped position, Leg lift with bracing in quadruped position, Alternate arm and leg lift with bracing in quadruped position.[9]

Protocol for Back care (BC) Advice

It was educational package comprising of instructions and diagrams showing proper safe lifting and carrying techniques, maintaining good posture while standing, avoiding prolonged sitting, bending, stooping and squatting and proper sweeping technique.[7]

Protocol for Stretching Exercises to the Lower Extremities

Lying Quadriceps Stretch, Sitting Hamstring Stretch, Calf Muscles stretch, Hip Adductors, Hip Abductors, Hip Flexors/Extensors stretch, Gluteal muscle stretch.[15]

Statistical analysis

Statistical package for Social Sciences (SPSS Inc., Armonk, New York, USA) 25.0 version for windows package program was used to perform data analysis. Mean ± standard deviation was used in summarizing demographic data. Friedman test was used to compare baseline, end of 4th and 8th week post treatment changes in outcome variables in each group. Least significant difference post hoc analysis was used to determine where the significant lies across the weeks. Kruskal-Wallis test was used for across group comparison. Mann Whitney U test was used to compare the outcome measure between CBT and CSE groups. All statistical tests were performed at 0.05 level of significance (i.e. $p<0.05$).

Results

Forty-one participants with NSCLBP participated in this study. However, thirty-seven completed the study; with 11 (29.7%) participants in CBT group, 14 (37.8%) participants in CSE group and 12 (32.4%) participants in the control group. The distribution of physical characteristics of the participants is shown in table 1.

The mean age of the participants in all the groups is 52.30±9.07 years. Twenty-three (62.2%) of the participants were females and 14 (37.8%) were males.

The mean body mass index (BMI) of the participants in all the groups is 27.05± 2.58 Kg/m^2. The groups did not differ significantly in age and BMI (Table 1).

Table 2 shows a detailed comparison of mean within group using Friedman test. At 8th week post-intervention there was significant difference in pain-related disability (p=0.001), psychological status (anxiety and depression p=0.001), and sleep disturbance (p=0.001) within each group. Least significant difference post hoc analysis revealed that the significant ($p<0.05$) lies between baseline and 8th week in all the outcome parameters assessed in all the three groups.

The result showed that there was no statistically significant difference in pain-related disability (p=0.16), psychological status (anxiety, p=0.24; depression p=0.14) and sleep disturbance (p=0.13) across the three groups post-intervention (Table 3).

The Mann Whitney U test showed that there was no statistically significant difference in pain-related disability, (p=0.15, 0.14], psychological status [anxiety; p=0.06, 0.13; depression; p=0.14, 0.08) and sleep disturbance; (p=0.11, 0.07] between CBT group [Median (Interquartile range) = 16.0 (24.0), 12.0 (20.0) ; 8.0 (10.0), 5.0(9.0); 7.0(9.0), 4.0(6.0);10.0(10.0), 6.0 (13.0)] and CSE group [13.0(14.0), 4.0(13.5); 2 (7.5), 1(7.5);1.5 (12.0), 1.0(5.5); 3.5(8.5), 1.0(4.8)] for pain-related disability, anxiety, depression and sleep disturbance at the end of 4th and 8th week.

Discussion

The aim of this study was to compare the efficacy of CBT and CSE on pain-related disability, sleep disturbance, and psychological status in patients with NSCLBP.

In this randomized controlled study, there was marked improvement in clinical outcomes (pain-related disability, sleep disturbance, and psychological status) in

Table 1. Physical characteristics of the participants*

Variables	All Groups	CBT Group Mean ±SD n=11	CSE Group Mean ±SD n=14	Control Group Mean ±SD n=12	f-value	p-value
Age (years)	52.30±9.07	48.90± 11.59	54.36 ± 5.65	53.00 ± 9.60	1.18	0.32
Weight (Kg)	78.95±7.20	75.46± 8.35	80.57 ± 6.17	80.25 ± 6.65	1.94	0.16
Height (m)	1.71±0.04	1.70± 0.04	1.72 ± 0.04	1.70 ± 0.03	0.46	0.64
BMI (Kg/m²)	27.05±2.58	26.07± 3.25	27.41 ± 2.58	27.51 ± 1.71	1.14	0.33

* significant at p<0.05, BMI: Body Mass Index, CBT Group: Cognitive Behavioural Therapy group, CSE Group: Core Stabilization Exercise group, Control Group: Back Care and Stretching group, F: Analysis of Variance

Table 2. Friedman results of outcome variables of participants in the three groups at baseline, end of 4th week and 8th week post-intervention*

	Baseline Median(IQR)	End of 4th week Median(IQR)	End of 8th week Median(IQR)	Friedman	P-value
CBT Grp					
PD	24.00 (18.00)	14.50 (16.00)	21.50 (13.50)	18.73	0.001*
Anxiety	12.00 (5.00)	4.00 (11.00)	8.50 (7.80)	15.21	0.001*
Depression	9.00 (10.00)	6.00 (11.30)	10.00 (8.00)	11.76	0.001*
SD	18.00 (10.00)	6.50 (6.50)	14.00 (10.50)	19.19	0.001*
CSE Grp					
PD	16.00 (24.00)	13.00 (14.00)	16.50 (8.80)	26.14	0.001*
Anxiety	8.00 (10.00)	2.00 (7.50)	5.00 (5.80)	21.14	0.001*
Depression	7.00 (9.00)	1.50 (12.00)	7.50 (7.00)	19.60	0.001*
SD	4.00 (6.00)	1.00 (5.50)	10.00 (8.80)	21.15	0.001*
Control Grp					
PD	12.00 (20.00)	4.00 (13.50)	11.00 (4.00)	23.17	0.001*
Anxiety	5.00 (9.00)	1.00 (7.50)	2.50 (2.50)	21.17	0.001*
Depression	4.00 (6.00)	1.00 (5.50)	4.00(4.00)	23.13	0.001*
SD	6.00 (13.00)	1.00 (4.80)	5.00(8.30)	23.13	0.001*

* PD: Pain-related Disability, SD: Sleep Disturbance, IQR: Interquartile range, CBT Grp: Cognitive Behavioural Therapy group, CSE Grp: Core Stabilization Exercise group, Control Grp: Back Care advice and Stretching group

Table 3. Kruskal-Wallis results of outcome variables of participants in the three groups at baseline, end of 4th week and 8th week post-intervention

Variables	CBT group Median (IQR)	CSE group Median (IQR)	Control group Median (IQR)	H-value	*p*-value
Baseline					
PD	24.00 (18.00)	14.50 (16.00)	21.50 (13.50)	2.22	0.33
Anxiety	12.00 (5.00)	4.00 (11.00)	8.50 (7.80)	3.12	0.21
Depression	9.00 (10.00)	6.00 (11.30)	10.00 (8.00)	2.54	0.28
SD	18.00 (10.00)	6.50 (6.50)	14.00 (10.50)	5.12	0.08
End of 4th week					
PD	16.00 (24.00)	13.00 (14.00)	16.50 (8.80)	1.85	0.39
Anxiety	8.00 (10.00)	2.00 (7.50)	5.00 (5.80)	4.58	0.10
Depression	7.00 (9.00)	1.50 (7.50)	7.50 (7.00)	3.14	0.21
SD	10.00 (10.00)	3.50 (8.50)	10.00 (8.80)	3.50	0.17
End of 8th week					
PD	12.00 (20.00)	4.00 (13.50)	11.00 (4.00)	3.62	0.16
Anxiety	5.00 (9.00)	1.00 (7.50)	2.50 (2.50)	2.89	0.24
Depression	4.00 (6.00)	1.00 (5.50)	4.00 (4.00)	3.88	0.14
SD	6.00 (13.00)	1.00 (4.80)	5.00 (8.30)	4.05	0.13

* significant at p<0.05, PD: Pain-related Disability, SD: Sleep Disturbance, IQR: Interquartile range, CBT Group: Cognitive Behavioural Therapy, CSE Group: Core Stabilization Exercise, Control Group: Back Care and Stretching, H: Kruskal-Wallis Test

the three groups (CBT, CSE groups, and the back care combined with stretching group).

The finding of this study revealed that CSE are efficacious in the management of pain-related disability in patients with NSCLBP. This was supported by previous studies.[16,17] Who in their own studies reported that CSE was effective in reducing pain and disability in patients with NSCLBP.

The reduction in pain can be attributed to muscular contraction during spinal stabilization exercises which provides sensory input to trigger different pain inhibitory mechanisms in the central nervous system. These lead to a rise in the plasma serotonin level, as a likely means of the spinal stabilization exercises-induced analgesia.[18]

The result of this study also revealed that CBT improved pain and disability in patients with NSCLBP. This finding is in line with previous study by Jalali et al., who reported that CBT was effective in reducing pain and disability level.[19] Best practices in biopsychosocial management of NSCLBP involve behavioural prescriptions for increasing activity and overcoming avoidance associated with fear or irrational cognitions.[20]

A systematic review by Hajihasani et al., reported that CBT is a beneficial treatment for NSCLBP, leading to improvements in pain and disability.[21] A study by O'Keeffe et al., reported that CBT did not lead to greater improvements in pain but with disability.[22]

In explaining the reduction in pain, Van Ryckeghem et al., described that we can point to the impressionability of the individual's cognitive evaluations in the area of bodily information, attention diversion from potentially threatening bodily information, increased battle against worrying bodily feedback, changes in explanation and interpretation of body sensations and thus, improved pain self-efficacy.[23] A study by Devan et al., also indicated that the pain-related thoughts and feelings played a very important role in pain self- management education and enhanced self-compassion in patients which might explain a reduction in pain-related disability in this individual.[24]

This study showed that back care plus stretching was effective in the reduction of pain which is in agreement with works done by Paolucci et al., and Garcia et al., that showed in their studies that back care was effective in improving pain and disability.[25,26] Pain relief can be as a consequence of improvement in lifting techniques, standing, sitting and sleeping postures.[27]

The result of this study revealed that CSE are effective in improving the psychological status (depression and anxiety) of patients with NSCLBP. This is in line with findings of Akodu and Akindutire, which reported that CSE are very useful in the management of depression and anxiety in NSCLBP patients.[9] This could be as a result of decline in the pain sensation of the participants' post-treatment.[9] This also supports the claim of Balasubramaniam et al.,[28] who reported that when there is a reduction in the level of perception of pain and disability the level of depression reduces.

The result of this study equally demonstrated an improvement in psychological status with CBT as supported by previous study.[29] The improvement could possibly be due to a bidirectional and potentially causative influence of pain and depression on one another.[28] A study by Wenzel et al., also postulated that depressed patients engaging in activities that give them a sense of pleasure and accomplishment help patients re-engage in their environment, become more active, and attend to the fact that they are engaging in pleasurable activities, all of which can be associated with a significant improvement in mood and depressive symptoms.[30]

This study also showed that back care plus stretching was effective in improving the psychological status (depression and anxiety) of patients with NSCLBP. This is in line with a study done by Paolucci et al., which concluded that back care has positive effects on the psychological status of patients with NSCLBP.[25] This improvement could be due to the reduction in pain and disability level of the participants.[28]

The result of this study revealed an improvement in sleep disturbance of patient with NSCLBP post treatment after CSE. This finding agreed with Akodu and Akindutire who investigated the effects of core stabilization exercises on sleep disturbance in patients with NSCLBP and concluded that CSE are effective in improving sleep disturbance.[7] The improvement could be as a result of decline in pain and disability which in turn improves their sleep quality.[7] Pain is correlated with sleep which in turn disturbs sleep. Sleep disturbance also increases pain intensity and reduces the ability to tolerate pain.[31] Evidence has shown that sleep disturbance is associated with the development of anxiety disorder.[32] A study by Lee et al., also reported that patients who had subjective sleep disturbance were more likely to develop moderate to severe depression.[33]

The outcome of this study revealed an improvement in the sleep disturbance of patient with NSCLBP post treatment after CBT. This is supported by the report of previous study who reported meaningful improvements in insomnia severity after treatment with CBT.[34] The improvement in sleep disturbance is probably due to the reduction in pain and practice of proper sleep hygiene and relaxation techniques that was acquired while undergoing the CBT program.[35]

The outcome of this study also showed that back care advice plus stretching was effective in improving sleep disturbance in patients with NSCLBP. A possible explanation might be the association between CLBP and sleep. Chronic low back pain has been found to be related to several dimensions of sleep including sleep disturbance.[31]

All the interventions (CBT, CSE, Back care advice plus stretching) have proven to be effective in the treat-

ment of patient with NSCLBP and one is not superior to the other. This may simply be due to the multimodal effects of exercise on symptoms of patients with NSCLBP. This finding shows the effectiveness of most modalities commonly used in the treatment of patients with NSCLBP in physiotherapy.[36]

The study was limited due to small sample size and participants were lost to follow up.

Conclusion

There were no significant differences found in outcomes across the three groups. So none of the 3 interventions is superior to the other. It is therefore worthy of note that physiotherapists can use any of the interventions in the treatment of patients with NSCLBP.

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