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# Comparative Effects of Stabilization and Aerobic Exercises on Pain and Disability in Patients with Non-Specific Chronic Low Back Pain

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A B S T R A C T

**Background:** Back pain is a disease of the back that threatens the human race with pain and functional disability, resulting into inability to perform activities of daily living.

**Objectives:** This study compared the effect of stabilization and aerobic exercises on pain severity and functional disability (FD), in non-specific chronic low back pain (NSCLBP) patients.

**Methodology:** A total of 48 individuals with NSCLBP (9 males, 14 females) participated in this study. They were allocated into three different groups using computer generated random numbers sequence: Group A performed stabilization exercise, group B performed aerobic exercise while group C was the control group and received transcutaneous electrical nerve stimulation (TENS) therapy with back care education. Subjects were assessed for pain severity, Functional Disability (FD) using Visual analogue scale (VAS) and Oswestry disability questionnaire before treatment, at the end of 4 weeks and 8 weeks post-treatment. Data were analyzed using statistical package for social sciences version 22 and the significant level was set at $p \leq 0.05$.

**Results:** Subjects in all the three groups (A, B and C) recorded significant improvement in functional disability and pain severity post treatment ($P \leq 0.05$). But no significant difference was observed in the outcome parameters when across group comparison was done.

**Conclusion:** This study provides evidence that all the interventions (stabilization exercise, aerobic exercise and back care) are effective in managing the severity of pain and functional disability in patients with NSCLBP. However, stabilization exercise has shown better effect.

## Introduction

Chronic low back pain (CLBP) is a key public health concern, with increase socioeconomic costs, career loss and disablement in many societies.[1-2] Over 70 percent of people living in under developed countries do have complain of low back pain at a particular time in their life time.[3] Annually, every third of the adults suffer low back pain, while 5 percent of them present to the hospital with recurrent episode and about 10 percent remained incapacitated and about 20 percent had constant symptoms in a year.[3]

Low back pain patients not only complain of discomfort, but also suffer functional limitation, that can cause disability and thereby interfere with their overall health-related quality of life.[4] Low back pain can hinder an individual from performing fundamental activities of daily living like walking and dressing, and many occupation-related responsibilities. It is evident that pain is a

determinant of functional disability in patients with LBP, but previous researches have shown that the level of pain intensity and the extent of functional disability are not associated with different risk factors.[5-6]

Due to this fact, emphasis has been made on rehabilitation with the use of therapeutic exercises in the management of low back pain.[7] Exercises such as spinal stabilization exercise could be utilized because studies have shown that it relieves pain, improve functional ability[8] and increases spine control.[9] Previous study reported that core stability exercise program may alter the central motor program and enable feed forward recruitment of deep core muscles.[10] These therapeutic exercise programs are more efficacious than conventional treatments to relieve pain and improve functional disability in individuals with CLBP.[11, 12, 13]

General exercises can also demonstrate the similar effect of pain reduction and improvement of functional disability in subjects with CLBP.[14-15] Another exercise intervention is aerobic exercise which uses sustained postures or repeated movements.[16-17] Aerobic exercise is a physical activity of low to high intensity that depends mainly on the aerobic energy-generating process.[18] Generally, light-to-moderate intensity exercise that is adequately supported by aerobic metabolism can be performed for unlimited periods.[18]

Aerobic exercise is noted for improving physical fitness and well-being in healthy individuals, cardiac, orthopedic, and other health conditions.[19] Low to moderate aerobic exercise has been shown to improve psychological states and work status and decrease the need for physical therapy referrals and pain medication prescriptions for low back pain patients under the care of a neurosurgeon. [19] Although aerobic exercises could reduce pain severity in acute, subacute and chronic LBP[20], there is dearth of literature on the comparative efficacy of stabilization exercise and aerobic exercise in patients with non-specific CLBP in Nigeria.

Therefore, this study compared the effect of stabilization and aerobic exercises on pain and functional disability of patients with non-specific chronic low back pain (NSCLBP).

## Methodology

This study was a single blinded randomized controlled study involving a total of 48 subjects (22 males and 26 females) selected on the base of inclusion and exclusion criteria. The subjects were recruited from the Physiotherapy Outpatient Clinic of the Lagos University Teaching Hospital, Idi-Araba, Lagos and National Orthopedic hospital, Igbobi, Lagos. Included in this study were subjects with age range of 17-75 years diagnosed of non-specific chronic low back pain with and without pain radiating to one or both lower limbs and subject's participants with low back pain not less than 3 months. Excluded from this study were patients with health conditions that could hamper exercise performance, patients with chronic low back pain with symptoms or signs at presentation that suggest a particular underlying condition. Before the commencement of the study, the subject's demographic characteristics (age, sex, marital status, height, weight, physical activity level using Borg Scale) were obtained. At baseline, 4th week and 8th week post intervention, assessment of pain and disability was enabled using the visual analogue scale and Oswestry disability questionnaire.

Ethical approval was sought from health research and ethics committee of Lagos University Teaching Hospital, informed written consent was also obtained from the subjects before including them in the study.

The sample size was calculated using the Cohen's formula for sample size determination. [21] By assuming α value as 1.96 and β value as 0.84. ES = Efficient size (using a large effect size of 0.7) [22]

Of the 48 subjects recruited for this study, 6 were found ineligible and were not involved in the study. The eligible ones were randomly allocated to 3 different groups through computer generated numbers after consecutive sampling technique. Group A (14 subjects) received stabilization exercise, group B (14 subjects) received aerobic exercise while group C (14 subjects) was the control group who received transcutaneous electrical nerve stimulation therapy (TENS) with back care education for 16 sessions, however, 23 subjects completed the study (9 males and 14 females). Nineteen subjects did not complete with reasons ranging from transportation, illness and job. Subjects participated in the

protocols twice weekly for 8 consecutive weeks (Figure 1).

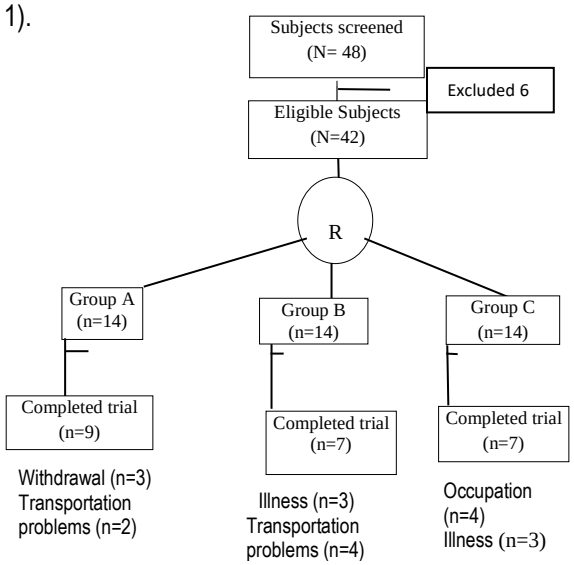


**Figure 1. Flow of participants for the study.**

R: Randomization, Group A: Stabilization exercise Group, Group B: Aerobic exercise Group

Group C: Control Group, N: Total number of subjects n: Number of subjects in each group

The data were analyzed with statistical package for social sciences (SPSS) Inc., Chicago, Illinois, USA) Version 22 for Windows package program. Mean and standard deviation was used to summarize demographics and quantitative data). Kruskal wallis test and analysis of variance (ANOVA) were used for longitudinal comparison depending on the type of data, either continuous or categorical data. Paired samples t-test and Wilcoxon sign rank test were used to determine the comparison between baseline and 8th week values of the outcome measures depending on the data i.e. parametric or non-parametric. A post-hoc evaluation of ANOVA using the least significant difference (LSD) was used to determine the comparison of mean changes between the three groups in order to detect where significance lies and which intervention was more efficacious. The level of significance was set at P≤ 0.05.

## Results

The mean age of subjects in groups A, B and C were 56.70 ± 7.75years, 58.44 ± 9.36 years and 53.60 ± 13.01 years respectively. The three groups did not differ significantly in all the physical characteristics (Table I).

The result showed that there was a significant difference in pain severity at 4 weeks and 8 weeks post-treatment (Table II). There was no significant difference in Functional disability at 4 weeks and 8 weeks post treatment when across group comparison was done. (Table II) The post hoc analysis (Least significant

**Table I: Physical Characteristics of the Subjects in all the Groups**

| | All subjects Mean ±SD N=23 | Group A* Mean ±SD n= 9 | Group B* Mean ±SD n= 7 | Group C* Mean ±SD n= 7 | P value |
|---|---|---|---|---|---|
| Age(years) | 58.52±6 59 | 57.44±7.83 | 61.29±7.76 | 57.15±2.04 | |
| Height (m) | 1.64±0.09 | 1.65±0.100 | 1.63±0.08 | 1.64±0.11 | 0.92 |
| Weight(Kg) | 79.50±10.52 | 77.83±13.73 | 74.71±6.24 | 76.58±10.45 | 0.85 |
| BMI (Kg/m2 ) | 28.34±3.25 | 28.44±3.97 | 28.16±2.82 | 28.42±3.13 | 0.98 |

*Group A: Stabilization exercise; Group B: Aerobic exercise; Group C: Control group
BMI: Body mass index.

**Table II: Comparison of Clinical Outcomes Across the Three Groups at Baseline, End of 4th Week And 8th Week.**

| | Outcome Measure | Group A Mean ±SD | Group B Mean ±SD | Group C Mean ±SD | Anova | Kruskal Wallis | p- value |
|---|---|---|---|---|---|---|---|
| Pre-Rx (Baseline) | PAIN | 6.23±1.98 | 6.33± 1.41 | 4.30±1.83 | 2.01 | - | 0.15 |
| | FD | 31.00±0.13 | 34.00± 0.34 | 26.00±0.14 | 2.72 | 0.26 | |
| Mid-Rx (End of 4th week) | PAIN | 4.44±1.24 | 5.38±1.19 | 3.50±1.51 | 4.06 | - | 0.03* |
| | FD | 22.00± 0.10 | 32.00±0.12 | 24.00±0.14 | | 3.59 | 0.17 |
| Post-Rx (End of 8th week) | PAIN | 3.00±0.87 | 5.00±1.16 | 3.00±1.00 | 9.74 | - | 0.001* |
| | FD | 17.00 ±0.08 | 31.00± 0.14 | 23.00±0.14 | | 4.14 | 0.13 |

**(* Significant at p ≤ 0.05)**
Group A: **Stabilization exercise;** Group B: **Aerobic exercise;** Group C: **Control group;**
Rx: **Treatment;** FD: **Functional Disability**

difference) showed that the significance lies between groups A & B and B & C post-treatment intervention for pain severity (Table III).

**Table III: Post Hoc Analysis of Change in The Clinical Outcome Measure Parameters Across the Three Groups.**

| Outcome Measures | Group | Group | Mean Difference | P Value |
|---|---|---|---|---|
| Pain | Group A | Group B | 2.00 | 0.01* |
| | | Group C | 0.00 | 1.00 |
| | Group B | Group A | 0.00 | 0.01* |
| | | Group C | 2.00 | 0.01* |
| | Group C | Group A | 0.00 | 1.00 |
| | | Group B | 2.00 | 0.01* |

(* Significant at $p \leq 0.05$)
Group A: Stabilization exercise; Group B: Aerobic exercise; Group C: Control group;

Table IV shows the comparison of the mean score of outcome measure parameters at pre-treatment and 8 weeks post-treatment in all the three groups.

The result showed significant difference between pre and post-treatment assessment for functional disability (FD) within each of the groups using Wilcoxon – test. There was also significant difference between pre- and post-treatment assessment for pain severity in each of the groups using Paired t-test (Table IV).

## Discussion

This study revealed tremendous improvements in all the outcomes measure parameters assessed for the three groups in patients with (NSCLBP). All outcome variables (functional disability and pain severity) improved significantly post intervention.

The mean scores of body mass index (BMI) of subjects in this study showed that subjects in all the groups were either overweight or obese. This further buttressed the report that overweight and being obese is an established risk factor for the development and progression of low back pain.[23]

There was improvement in the entire outcome measures (pain, disability) assessed in this study pre and post intervention but the mean score of the outcome measures revealed that Stabilization exercise group showed more improvement than the aerobic exercise group. This possibly might be as a result of the reestablishment of the normal control of the deep spinal muscles (DSM), which reduced the activity of more superficial muscles (rectus abdominis, external oblique, internal oblique) which when recruited stiffens the spine and increase activity in the lumbar muscles. This results into decrease in pain and improvement of disability level. More so, that co-contraction of the local muscles (DSM) such as transversus abdominis (TrA) and lumbar multifidus (LM) have been reported to be efficient in the stabilization of the motion segments of the lumbar spine particularly within the neural zone. Thus providing a stable base on which the global muscles (superficial muscles) can safely act.[24] This agrees with the findings of the study of Akodu et al[8] who revealed that stabilization exercise was beneficial in the management of functional disability and pain in NSCLBP patients.

It is also in accordance with the findings of the study by Venkata and Sreekar[25] who compared Stabilization exercises and conventional exercises on patients with CLBP and concluded that core stabilization is effective in the treatment of mechanical low back pain.

**Table IV: Comparison of Clinical at Pre-Treatment And Post-Treatment (End Of 8th Week) in The Three Groups**

| | Outcome Measure | Pre-Rx Mean ± SD | Post-Rx Mean ± SD | z-Value | t-value | p- value |
|---|---|---|---|---|---|---|
| Group A | FD | 31.00 ±0.13 | 17.00±0.75 | 2.56 | - | 0.01* |
| | PAIN | 6.11±2.19 | 3.00±0.87 | - | 4.79 | 0.00* |
| Group B | FD | 34.00±0.13 | 31.00±0.14 | 2.41 | - | 0.02* |
| | PAIN | 6.86±1.07 | 5.00±1.16 | - | 4.59 | 0.00* |
| Group C | FD | 26.00±0.14 | 23.00±0.14 | 2.12 | - | 0.03* |
| | PAIN | 4.86±1.57 | 3.00±1.00 | - | 7.12 | 0.001* |

(* Significant at $p \leq 0.05$)
Group A: Stabilization exercise; Group B: Aerobic exercise; Group C: Back care (Control group)
RX: Treatment Z: Wilcoxon sign rank test FD: Functional disability

The reduction in pain and functional disability in the aerobic exercise group could be due to the increased flow of blood and nutrients to structure in the back which supports healing and reduces the stiffness in the joints of the back that lead to back pain simply because it is easier to control or lose weight, decreasing the stress placed on the spine structures and joints. It could also be due to increased production of endorphins after 30 or 40 minutes of exercise which helps in combating pain.[26]

This finding is supported by the report of the research carried out by Chan et. al[27] who revealed that aerobic exercise intervention and conventional physiotherapy improves functional disability and pain severity in individuals with chronic low back pain. The result also agrees with the study of Murtezani et. al[28] who revealed that aerobic exercise reduces pain and disability in patients with chronic low back pain. The result of this study is also in support of the finding of the study of Sinkc and Suad[18] who reported that aerobic exercises could reduce pain severity in acute, subacute and chronic LBP. The limitation of this study is that there was high rate of drop out from this study. Therefore, caution should be exercised in the interpretation of the outcome of this study. It is recommended that physiotherapist should select appropriate types of exercise based on patient's preferences and convenience. Future studies can be carried out with a greater study population and also to determine long term efficacy.

## Conclusion

The findings of this study confirmed that patients with non-specific chronic low back pain can achieve noteworthy benefit from the utilization of stabilization exercise, aerobic exercises and back care. However, stabilization exercise has shown a better effect than aerobic exercise in improving pain and functional disability in patients with non-specific chronic low back pain.

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