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Effect of isometric back endurance exercises on patients with non-specific chronic low back pain: Randomized control trail

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ABSTRACT

Objective: The study's goal was to determine the impact of isometric back endurance exercises on pain, function and trunk extensor muscles endurance. *Methods*: Total 60 male patients of ranging in age between 20 to 40 years ago were afflicted with chronic nonspecificlow back pain were divided into two groups, each with an equal number of participants, group A (experimental group) and group B (control group). Prior to the intervention, each subject's VAS, modified Oswestry disability index, and Biering Sorensen test scores were recorded. After that, both sets of participants got a 15-minute hot pack treatment. And then Isometric back endurance exercises were given to group A, as well as conventional exercises (stretching and strengthening exercises), and group B received conventional exercises (stretching and strengthening exercises only) 3 times each week for consecutively 6 weeks. The values of VAS, modified Oswestry disability index, and BieringSorensen test were again measured at the end of 6 weeks. *Results:* When the baseline values of both groups were compared, it was discovered that a highly significant improvement in pain, function and endurance in group A more than group B. *Conclusion*: In individuals with chronic low back pain, isometric back endurance exercises were found to be beneficial in decreasing pain and disability while also increasing back extensor endurance.

Keywords: Back endurance, back isometric exercise, chroniclow back pain, Oswestry, Sorensen

1. INTRODUCTION

Non-specific chronic low back pain is a condition that affects many people and a prevalent health condition that affects people of all ages all over the world (Park et al., 2018). More than 80% of working-age individuals have LBP at some time in their life (Vujcic et al., 2018). LBP is becoming more common among young and middle-aged adults, according to research (Hoy et al., 2014). Any type of discomfort, muscular tension, or stiffness between the

costal borders and the inferior gluteal folds, with or without lower-limb radiation, is considered 1ow back pain. However, in the vast majority of instances, no medical explanation for their back pain can be identified, and hence no definitive diagnostic classified as "nonspecific" low back pain can be given. Mechanical strain might produce nonspecific low back pain symptoms (e.g., manual material handling, sports activities) and/or psychosocial stresses (e.g., complicated cognitive demands, job unhappiness), but they can also occur on their own (Morlion, 2013).

Low back, lumbosacral, and sacroiliac discomfort that lasts longer than three months is referred to as chronic1ow back pain (CLBP). Chronic low back pain frequently results in discomfort and functional impairment, lowering the personal quality of life (Morlion, 2013). Low back muscle endurance has been identified as both a cause and a consequence of LBP. Low back muscular endurance has also been identified as a significant cause of chronicity and recurrence of LBP (Adedoyin et al., 2011). The lumbar spine's passive components may be strained as a result of the trunk extensor muscles' inadequate endurance, resulting in low back discomfort. Evidence shows that persons with low back pain have lower muscular endurance than people who do not have low back pain (Abdelraouf and Abdel-Aziem, 2016).

Due to exhaustion, people with low back pain may be unable to respond to the demands of an unexpected load. Fatigue from repeated loading also causes a lack of control and accuracy, which may predispose a person to injury (Bala, 2012). The goal of this study was to see if isometric back endurance exercises improved endurance, disability, and pain in those with nonspecific chronic low back pain.

2. MATERIALS AND METHODS

All patients signed a consent form approved by the ethical committee of Taif University (No.42-0097), prior to the start of the study.

Study setting, design, and duration

At King Abdul-Aziz Hospital in Taif, Saudi Arabia, a randomized triple-blinded controlled study was undertaken through verbal and written advertising. Subjects were recruited from the physical therapy department's 0utpatient c1inic. The study begin in March 2020 till January 2021.

Criteria for eligibility

Criteria for inclusion

Subjects that satisfy the following criteria are included in this study: Referred by an orthopedic surgeon for non-specific persistent low back pain that has been bothering her for three months. The patient's age should be between 20 and 45 years old.

Criteria for exclusion

The following were the criteria for exclusion: any previous spinal or lower limb surgery, a pre-diagnosed instance of spinal or pelvic fracture, pregnancy, pre-diagnosed case of general problems such as uncontrolled hypertension, prior myocardial infarction, respiratory diseases, etc., a particular kind of low backache, i.e. backache caused by any nerve root compression (radicular syndrome), trauma, infection, or tumor, intervertebral disc prolapse Patients with signs and symptoms of instability, such as spondylolysis and spondylolisthesis corresponding to asymptomatic spinal level: catching, locking, releasing, or a sense of insecurity instability, individuals having a history of congenital abnormalities, such as ankylosing spondylitis, and patients who have already had back surgery.

Blinding, concealment, & allocation

A research assistant (not involved in data collection or interventions) will perform Random number creation in Microsoft Excel for Windows was used for the randomization. The allocation will be kept hidden in opaque sealed envelopes with sequential numbers. After the initial assessment, the eligible subjects will be randomly allocated to one of the two groups. The therapist will be allowed to uncover the concealment at the time of the first session. The assessor, the subject, and the data analyst (statistician) will not be aware of the allocation arm throughout the entire study. The statistician will be kept blind by coding the data of each group before sending them for statistical analysis.

Interventions

In the current study, there will be two arms of intervention. All arms will receive hot backs and mobility exercises. Additionally, the experimental group will receive isometric back endurance exercises.

Hot packs

At the start of the exercises, all patients were given a heat pack for 15 minutes in a prone laying posture.

Conventional exercises

The conventional exercise will as follows (Inani and Selkar, 2013)

Stretching exercises

Static stretching exercises were provided to the muscles that were determined to be tight during the evaluation. Isometric spine workouts - Abdominal hollowing: patient positioned supine resting with knee bend. Patients were instructed to progressively pull in their abdomens towards their spines (pressing down on a towel placed beneath the lumbar curve) while keeping their trunks still. - Back extensors isometric: person supine with the arm at side. The subject was told to arch his back by pressing the back of his neck and sacrum on the mat.

Bridging exercises

In a crook laying posture, the individual was instructed to elevate the pelvis off the plinth to form an arch, which was supported by the shoulders and feet. Active flexion exercises for the spine that are graded Hands at sides, subject in crook lying posture. Different components of the exercise are present, such as asking the subject to stand up straight with their hands at their sides, then progressing to crossing their arms over their chest and asking them to stand up straight, and finally placing their hands behind their neck and repeating the procedure.

Graded active extension exercises of spine

Different components of exercise are present in the prone posture of the subject. Initially, the patient was requested to extend the lumbar spine (raising the sternum off the floor) while keeping his hands at his sides. The patients were next instructed to extend their lumbar spine (raising their head, chest, and ribs off the floor), and then to extend their lumbar spine with their hands clasped behind their heads (lifting the head, chest, and ribs from the floor).

Isometric back endurance exercises

The endurance training regimen was modified from Chok et al., (1999). The patient is positioned in a prone position. There are four stages to the activity. Bilateral shoulder raises in a prone posture make up the first level. In a prone posture, the second level comprises a contralateral arm and leg lifts. The patient was asked to place both hands behind his head and execute bilateral shoulder raises at the third level. Bilateral shoulder raises with arms completely raised make up the fourth level. If there is no adverse reaction, the patient keeps the posture for 10 seconds. Each exercise was repeated 10 times. The patient was then told to take a 30-second to one-minute break. Patients who performed well were given one minute of respite after every 50 repetitions until they had completed 300 repetitions. 5 series of 10 repetitions for 6 cycles is the dose. To offer a higher training stimulus, the duration spent in the unsupported posture was gradually increased to 20 seconds. Patients who were having trouble with a certain level of exercise (e.g., level 2) were instructed to quit and try a greater level of exercise (e.g, level 3). If he was able to complete the higher-level exercise (level 3), he would remain at that level and stop doing the lower-level activity. If a patient was unable to deal with the level 3 activities, he was instructed to return to level 1 and gradually proceed to level 2. The goal is to get the participants to exert modestly within their pain threshold (Chok et al., 1999; Mbada et al., 2014).

A categorical scale was used to rate how easy it was to cope with the activity. The scale had five grades: 1="no sweat, could have done one more round," 2=" just nice," 3=" slightly strenuous, but coping okay," 4="can't continue anymore and 5="just can't do it." Patients who responded with scale grades 1, 2, or 3 were progressed to the next exercise in addition to the existing exercise. If their reaction was a scaled grade 4 or 5, they were requested to come to a halt. The physical therapist kept track of everything. During and after each exercise session, the easy exercise was evaluated (Chok et al., 1999; Mbada et al., 2014).

Outcome measures

Visua1 analog scale (VAS)

The Visua1 Analog Scale (VAS) is a single-item pain assessment scale. Because VAS is simple to apply, it may be used in a range of clinical and research contexts. It is made up of a horizontal (100 mm) line with labels at both ends indicating the two most extreme pain categories (no pain and intense pain) (Hussien et al., 2017). The participants will be required to make a mark on the horizontal

line that indicates their current pain level. The distance between the left end of the line and the mark made by the patient will be measured using a ruler to produce a quantitative value for pain level. This reading will be used in the data analysis that follows. VAS is a trustworthy, legitimate, and responsive system, according to Sindhu and colleagues (Sindhu et al., 2011).

The Modified Oswestry Disability Questionnaire

The Modified Oswestry Disability Questionnaire (MODQ) has ten items that measure LBP and pain's effects on function. Personal care, lifting, walking, sitting, standing, sleeping, social life, travel, and employment/homemaking are some of the functions addressed (instead of the sex life item) in Oswestry Disability Questionnaire. There are six statements in each question, ranging from 0 (no disability) to 5 (disability) (maximal disability). The patient chooses the statement that most accurately represents his or her current state. The total possible score is divided to acquire a disability score, multiply the total of the scores (i.e., 50). To find out what percentage of a patient's disability is, The total is then multiplied by 100, with 0% (no disability) and 100% (the most severe handicap) being the results.). The Arabic MODQ is a translation of the English M0DQ has adequate psychometric properties and is a feasible, reliable, and to some extent sensitive instrument for measuring the degree of disability in LBP patients in Arabic speaking communities (Al Amer et al., 2020).

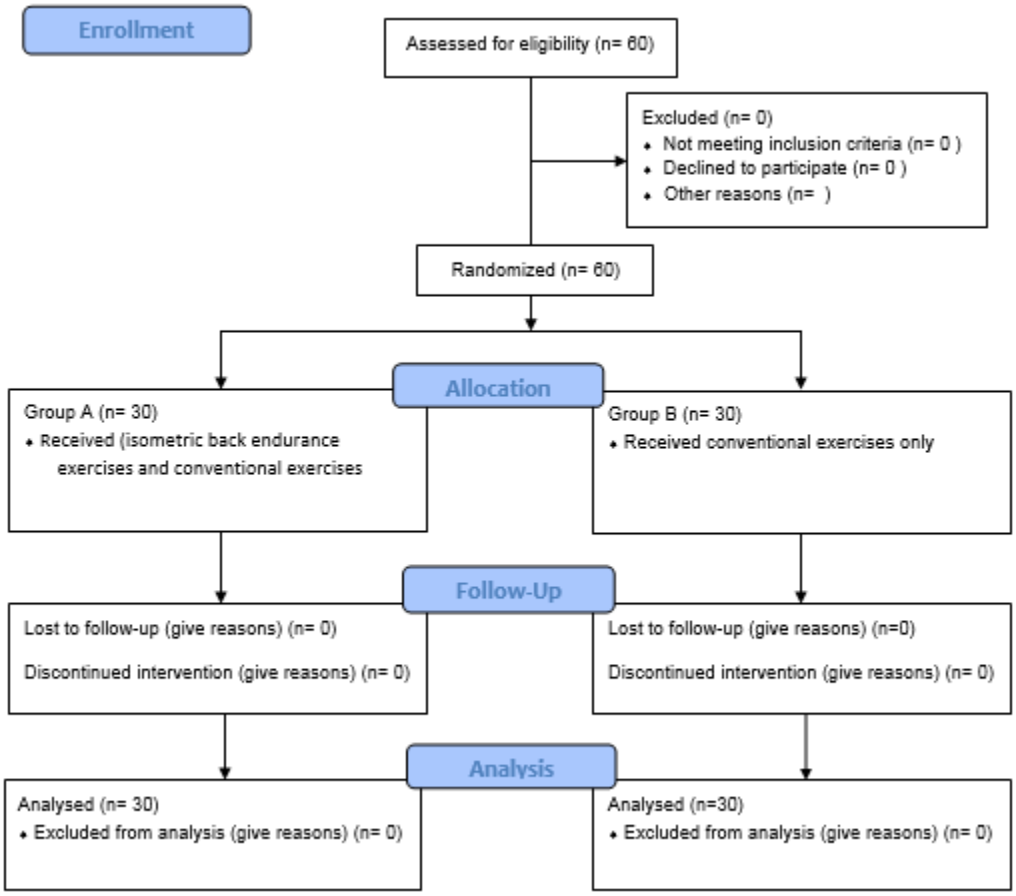

Figure 1 Study flow chart

Assessment of Trunk extensor endurance

The subject's trunk extensor endurance was measured using the Sorensen test, which involved placing the patient in a prone posture at the table's edge and measuring how long the subject could hold the unsupported trunk (from the upper border of the iliac crest) horizontal while prone. Three broad straps were used to secure the thigh and ankles to the table. Arms were crossed in front of the chest. The patient was told to stay in the horizontal position until he lost control of his posture, which he did reached the limit of his tolerance for the procedure, or experienced tiredness symptoms. Timing began when the patient became horizontal and unsupported. The patient was verbally encouraged to maintain this position; if the patient fell below horizontal, he was given another chance to regain it; however, if he fell a second time, the duration was recorded; if the patient complained of low back pain

or leg cramps, the test was stopped and the time was recorded; if the patient complained of low back pain or leg cramps, the test was stopped and the time was recorded; if the patient complained of low back pain or leg cramps, the test was stopped and time recorded (Moreau et al., 2001). The Sorensen test is a valid and reliable method of determining the endurance of the back extensor muscles (Martínez-Romero et al., 2020; Demoulin et al., 2016).

Procedures

Patients recruited randomly into 2 groups (A and B). All patients were treated with hot packs and conventional exercise. Group A was treated with the isometric back endurance exercisesin addition to the conventional exercises and hot packs. While group B were treated with the conventional exercises and hot packs. All patients were being assessed by the visual analog scale, The Modified Oswestry Disability Questionnaireand Sorensen test for assessment of pain, function, and Back extensor muscle endurance before treatment and after 6 weeks of treatment (18 sessions) the treatment program was given for three sessions per week on alternative days for six weeks (figure 1).

Statistical methods

SPSS (Version 22) for Windows was used to analyze the data. Descriptive statistics including the mean and standard deviation were used to describe general characteristics of the subjects and outcome variables. For assessment of the effect of intervention in pre and post-intervention, mean scores were analyzed using a paired-sample t-test to determine whether there were any significant differences. An independent t-test was used to determine significant differences between groups. The p-value < 0.05 was taken as significant.

3. RESULT

Table 1 shows the patient characteristics of both groups. A paired t-test revealed no significant differences between the two groups in terms of age, weight, height, or BMI as (P>0.05). All measurements outcomes (pain intensity, function disability, and back extensor endurance) improved post-treatment for both groups, but a paired t-test revealed that all measured outcomes significantly improved post-treatment for group A than group B (Table 2).

Table 1 Demographic data of patients

Variable	group A	group B	t-value	p-value
	Mean ± SD	Mean ± SD		
Age (year)	28.466(± 6.621)	30.866(± 5.152)	2.043	0.06
Weight (kg)	73.6 (± 12.1)	76.6 (±13.3)	1.125	0.82
Height (cm)	165.6 (±7.28)	170.3(±5.85)	1.876	0.82
BMI	25.773(4±.665)	26.667(±5.662)	0.412	0.687

SD: Standard deviation, P> 0.05 Non-significant

Table 2 Changes in pain intensity, function disability, and back extensors endurance

Parameter	Pre-treatment			Post-treatment		
	Intervention group	Control group	P-value	Intervention group	Control group	P-value
Pain intensity (VAS)	5.87 (±1.18)	4.87 (±1.65)	0.534	1.3 (± 1.16)	2.33 (±1.37)	0.003
Function disability	34.53 (± 13.0)	32.8(± 12.38)	0.880	11.73 (± 5.7)	20.73(± 9.76)	0.022
Back extensors endurance	29.66 (± 25.4)	21.13(±12.3)	0.827	66.1 (± 24.3)	27.7 (± 12.5)	0.010

Mean ±SD, P> 0.05 Non-significant

4. DISCUSSION

The goal of this study was to see if isometric back endurance exercises improved endurance, disability, and pain in those who have persistent low back pain that isn't specific in group A, individuals with non-specific chronic low back pain, isometric back endurance exercises in addition to conventional exercises reduced pain intensity, decreased disability, and increased back extensor endurance more than patients in group B who were only treated with conventional exercises.

Pain intensity

This study found that combining isometric back endurance exercises with conventional exercises decreases pain severity. This finding contradicts prior research by Chokk et al., (1999) and Bala et al., (2012). Their patients, on the other hand, experience subacute nonspecific low back pain, according to research by Clarke (2009). This research's findings differ from those of previous studies that reported no benefits after exercise intervention (Farrell and Twomey, 1982; Evans et al., 1987; Erhard et al., 1994) in these trials; flexion and extension mobility exercises were employed as part of the training regimen. This exercise program was not the same as the one used in this study, which consisted of extensor endurance exercises. The decrease in pain might be attributed to increased back extensor muscle endurance and strength as a result of training, since it's been suggested that inadequate trunk muscular endurance can cause tension on the passive components of the lumbar spine, resulting in low back discomfort.

Functional disability

Isometric back endurance exercises, in addition to conventional exercises, reduced disability in individuals with persistent low back pain, according to the study's conclusions. This is consistent with Chok et al., (1999) findings. After 3 weeks of back endurance exercises, they concluded that disability was linked to pain.

Trunk endurance

The findings of this study resemble those of Kahanovitz et a1., (1987) and Moffroid et a1., (1993). They discovered that endurance training increased the trunk extensors' isometric endurance in persons who did not experience low back pain. This study's findings are also linked to Clarke's (2009) research. Trunk extensors endurance training increases trunk extensors endurance in hockey players with acute low back discomfort (Clarke, 2009).

This result varies from those found in earlier Chok et al., (1999) investigations. Following trunk extensors endurance training, muscle endurance does not improve. In the Beverly Chok et al., (1999) study, for six weeks, participants were required to exercise three times each week. Differences in exercise dose and patient profile might explain the outcomes.

5. CONCLUSION

The study's major findings showed that isometric back endurance exercises, in addition to conventional exercises, were helpful in lowering pain and impairment, as well as increasing back extensor endurance, in individuals with non-specific chronic low back pain.

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Conflicts of interest

The authors declare that there are no conflicts of interests

Ethics approval

The study was approved by the Research Ethics Committee of Taif University (Ref 42-0097).

Data and materials availability

All data associated with this study are present in the paper.

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