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Chronic Low Back Pain in Fast Bowlers a Comparative Study of Core Spinal Stabilization and Conventional Exercises

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Abstract. [Purpose] Fast bowlers are very prone to low back pain. Due to persistence of chronic low back pain (cLBP) fast bowlers suffer disturbances in their daily living and sports specific activities that lead to functional disability. The purpose of this study was to investigate the effect of spinal core stabilization exercises on the pain intensity and the functional activity of fast bowlers. [Subjects] Thirty male fast bowlers with cLBP with a mean age of 20.79 ± 2.08 years [Methods] Subjects were screened for this study by using inclusion and exclusion criteria. Experimental and control groups (n=15 in each group) received core stabilization exercises and conventional lumbar flexion-extension exercises respectively. The total study duration of the interventions was 8 weeks. The outcome variables used were the Visual Analogue Scale (VAS) to measure pain and the Oswestry low back pain disability questionnaire (OLBPDQ) to measure functional disability. [Results] The results showed significant functional improvement (post OLBPDQ score) and decreased pain intensity (VAS score) in both the groups but the experimental group which received spinal core stabilization exercises showed more significant improvements than the control group. [Conclusion] We conclude that the incorporation of spinal core stabilization exercises in the management of chronic low back pain would have better results than conventional exercises for cases of cLBP in fast bowlers.
Key words: Core stabilization, Chronic LBP, Cricket

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INTRODUCTION

Low back pain (LBP) is one of the most common symptoms in the developed world, yet its origins are among the most elusive. It can be extremely disabling, and the social and economic burden is enormous[1)]. The cause of the vast majority of LBP is unknown; and current tests cannot identify a pathological cause for the pain in at least 85% of cases. For this reason, such LBP is now usually termed non-specific low back pain[2)]. Non-specific LBP currently cannot be further classified, and it is often referred to according to its duration: acute LBP (duration of less than six weeks); sub-acute LBP (duration of more than six weeks and less than three months); and chronic LBP (duration of more than three months)[3)]. It is widely held that 90% of low back pain is short-lived and that most patients get better on their own. However, this myth has been dispelled in multiple studies. Elliott et al. followed more than 2000 individuals over 4 years and concluded that chronic pain is a common, persistent problem with a relatively high incidence and low recovery rate[4)]. Chronic low back pain has a prevalence ranging from 35% to 75% at 12 months after the initial attack of pain[5)].

Despite high fitness levels and often intensive strength training programs, fast bowlers still suffer LBP. High muscle endurance is also reported as being an important factor in LBP, given the repetitious nature of bowling over a long period. Non-specific chronic low back pain is a very common complaint in athletes, 70% to 85% of all suffer from cLBP at some time in their lives. It is defined as 'mechanical' pain of musculoskeletal origin in which symptoms vary with physical activities and time, and often spread to one or both buttocks or thighs. The upper body configuration of fast bowlers performs by counter rotation (12° to 40°) in the delivery stride, which may increase the incidence of lumbar spondylosis, disc abnormalities, and muscle injury[7)]. Fast bowlers have increased risk of LBP because of the repetition of their action, which repeatedly places stresses on the joints of their lower limbs and lower back[4)]. The incidence of LBP among cricketers is 8% and as high as 14% among fast bowlers. Multifidus muscle atrophy can exist in highly active, elite athletes with LBP[6)]. Low back injuries account for the greatest loss of playing time among professional fast bowlers in cricket. Bruce et al. emphasized an activity like fast bowling requires the full range of lumbar joint movement in flexion, extension, lateral flexion and rotation. Stiff joints at particular interval levels of the lumbar spine may place extra forces on existing hypermobile joints at other levels and cause injury[8)].

Exercise is safe for individuals with back pain, because it does not increase the risk of future back injuries or work absence. Substantial evidence exists supporting the use of

exercise as a therapeutic tool to improve impairments in back endurance and stiffness. Most studies have observed improvements in global pain ratings after exercise programs, and many have observed that exercise can lessen the behavioral and cognitive effects and disability aspects of back pain syndromes[9, 11]. Strengthening has become a major trend in rehabilitation. Core strengthening is, in essence, a description of the muscular control required around the lumbar spine to maintain functional stability. Although lumbar exercises have been the commonest method for general strength training in chronic low back pain, recent advances in the field of athletic training for prevention of recurrent episodes of chronic low back pain involve segmental stabilization training for the core stabilizers[9].

Popular training programmes for the abdominal muscles tend to emphasize strength by using the muscles as prime movers. Sit up actions with or without rotation, and leg raise exercises often form the bases of many programmes. However, one of the most important functions of the abdominal muscles is the stabilization of the spine, a feature often neglected, especially in sport[10].

Despite its widespread use, core strengthening has been little researched. Core strengthening has been promoted as a preventive regimen, as a form of rehabilitation, and as a performance enhancing program for various lumbar spine and musculoskeletal injuries. Though stabilization exercises have become a major focus of spinal rehabilitation as well as of prophylactic care such as sports injury prevention[13], the prognosis of chronic LBP has rarely been studied and is therefore largely unknown. The few studies that have addressed this issue included participants with acute and subacute LBP[12].

SUBJECTS AND METHODS

Thirty professional fast bowlers with cLBP were screened at sports complexes around Riyadh, KSA. The subjects had a mean age of 20.79 ± 2.08 years. The inclusion criteria for the study were: non-specific LBP[14, 15] with or without referred pain (of a non-radicular nature) of at least 3 months with physiotherapy scheduled to start; average pain intensity over the last 2 weeks ≥3 and ≤8 on a 0–10 visual analogue scale; minimal to moderate disability score (0% to 40%) on the Oswestry Low Back Pain Disability Questionnaire(OLBPDO)**;** good understanding (written and oral) of the English language; and willingness to comply with the study protocol. Exclusion criteria included factors reflecting the presence of serious spinal disorders, as described in LBP treatment guidelines[14, 15]; abdominal surgery within the past 12 months, or a history of spinal or limb surgery; systemic illness; neurological or muscular degenerative disorders; peripheral vascular disease; subjects with body mass index of more than 27; subjects with central nervous system impairments; respiratory or cardiovascular impairment affecting the perturbation trial; and prior participation in a programme of spine segmental stabilization exercises. All participants gave their signed informed consent to participation after receiving verbal and written information about the study. Prior to the participation in the study, subjects were randomly divided in to two groups group A & B, and which performed core strengthening and conventional exercise regimes respectively. The total study duration of the interventions was eight weeks, and the exercises were performed on 4 days of each week.

The outcome measures used were Visual Analogue Scale (VAS) to measure pain which is rated by the subject on a scale ranging from 0 (pain free) to 10 (maximum pain)[17], and the Oswestry low back pain disability questionnaire (OLBPDQ)[16] to measure how low back pain affected the functional activities of daily living. Questionnaires were given to the participants who were asked to fill them before and after intervention. When the participants needed help in answering the items on questionnaires, they were assisted by junior physiotherapists who had no clinical responsibilities in carrying out the trial.

Core stabilization regime**:** A basic outline of the various exercises for local and global muscles and the differences in their function was given before the start of the program. In group-A, initially received fourteen guided training sessions each lasting 45 min, which emphasized core muscle co-contraction, 4 days a week. The 8 week treatment protocol was divided into 3 phases. Each exercise was performed in 3 sets of 5 repetitions with 5 seconds hold time and 10 seconds rest between each repetition and a minutes rest in between each set. In the first phase of the training, attention was focused on facilitating isolated local muscle activity with emphasis on continuation of normal breathing. Subsequently, the hold time and the number of repetitions were increased, and subjects were trained to maintain these contractions in various postures (four-point kneeling, supine, prone, sitting and standing).

Once an accurate and sustained contraction of the local muscles was achieved in different postures (10 to 15% MVC, 10 contractions with 10-s holds), the exercises progressed to the second phase which involved applying low load to the muscles through controlled movements of the upper and lower extremities. The main aim during the third phase was to integrate these low grade static contractions with normal static and dynamic functional tasks so that these contractions became habitual.

Conventional regime: Group B performed basic conventional physiotherapy strengthening exercises. The rate of perceived exertion was used to monitor the level of exertion during strengthening exercises, and it ranged from 6 to 9, 10 to 15 and 16 to 20 in the respective phases. Based on physical examination and the clinical judgment of treating therapist, 83% of the participants received a hyperextension exercise program as the main mode of treatment, and 17% of participants received a flexion exercise program as the main mode of treatment. Progression of patients in both groups was decided by the treating physiotherapist.

Both groups of patients were given back ergonomics care lessons, and a model demonstration of safe lifting techniques in back cares classes during the first week of the intervention. As commonly prescribed in Indian settings, 10 minutes of moist heat was also given to both groups at the end of each session. A exercise sessions lasted approximately 45 minutes. This study was approved by the Medical Ethics

Committee of King Saud University.

RESULTS

Statistical analysis was performed using SPSS version 11.0. There were two study groups, group A (Core strengthening) and group B (Conventional), with 15 subjects in each group. The subjects had a mean age of 20.46 ± 2.08 years, a mean height of 171.93 ± 5.01 cm, and a mean weight of 64.73 ± 2.3 kg. There was no significant difference in the anthropometric profiles of group A and B.

The independent sample t-test was used to test the differences between the two groups (Table 1, 2), and the paired t-test was used to test differences within the groups (Table 3, 4). The between group analysis was done using the independent sample t-test for pain intensity and functional disability at pre-intervention and post-intervention. Pre and post intervention values of VAS and OLBPDQ in group A and B were respectively; pre-VAS 4.6 ± 1.06 and 4.66 ± 0.72, and post-VAS 2.40 ± 0.63 and 3.33 ± 0.062; and pre-OLBPDQ 23.25 ± 5.86 and 23.36 ± 5.55, and post-OLBPDQ19.82 ± 4.93 and 22.18 ± 5.40. The results of the experimental group were superior to those of the control group with respect to the decreases pain intensity and functional disability. The pain intensity scores demonstrated significant improvements in the post-VAS score (p=0.002). The functional improvement also showed significant improvement in post OLBPDQ score (p = 0.000).

The paired t-test was used to test improvements in pain intensity and functional scores. The within group analysis of VAS (Post VAS) scores showed significant differences in both groups (group A and B)(p = 0.00 for both). The post intervention functional improvement of (OLBPDQ) scores also showed significant improvements in both the groups (p =0.00 for groups A and B).

Table 1. Comparison of VAS between groups

VAS	Group A	Group B
Pre	4.60 ± 1.06	4.66 ± 0.72
Post	2.40 ± 0.63	3.33 ± 0.62
Diff.	2.20 ± 0.67	1.33 ± 0.72

Table 2. Comparison of OLBPDQ between groups

OLBPDQ	Group A	Group B
Pre	23.25 ± 5.86	23.36 ± 5.55
Post	19.82 ± 4.93	22.18 ± 5.40
Diff.	3.38 ± 1.19	1.18 ± 0.65

Table 3. Comparison of VAS and OLBPDQ within group A

Variables	Mean ± SD
Pre-VAS	4.60 ± 1.05
Post-VAS	2.40 ± 0.63
Pre-OLBPDQ	23.20 ± 5.86
Post-OLBPDQ	19.82 ± 4.93

Table 4. Comparison of VAS and OLBPDQ within group B

Variables	Mean ± SD
Pre-VAS	4.66 ± 0.72
Post-VAS	3.33 ± 0.61
Pre-OLBPDQ	23.36 ± 5.55
Post-OLBPDQ	22.18 ± 5.40

DISCUSSION

According to current evidence-based clinical guidelines, exercise therapy (of any type) is one of the few recommended treatments for nonspecific cLBP[22]. The purpose of the present study was twofold. The primary aim was to examine the changes in self-rated pain and disability after a programme of therapeutic ‘‘spinal segmental stabilization’’ exercises[23] for patients with cLBP. The specific exercises, which aim to restore deep trunk muscle motor control[23], have become a popular concept in contemporary physiotherapy, following numerous scientific reports of trunk muscle dysfunction in connection with LBP (reviewed in[24]). A secondary aim was to evaluate the influence of various cognitive factors and beliefs on the conventional exercise programme. Our results showed that there were significant differences in the pain intensity score and functional outcome score after spinal core stabilization exercises and conventional lumbar exercises in both the experimental and control groups.

The ‘crunch factor’ is defined as the instantaneous product of lateral flexion and axial rotational velocity of the lumbar spine. It was originally implicated in the development of lumbar spine pathology and lower back pain, not only in golf, but also in other sports involving hitting and throwing motions, and might be instrumental in the etiology of contralateral lumbar spine injuries sustained by cricket fast bowlers. Based on recent empirical research, we contend that the crunch factor could be important in cricket fast bowling, since the peak crunch factor appears to occur just after front foot impact when ground reaction forces are known to be at their highest[25].

Bowlers with a history of LBP position the thorax in more left-lateral flexion relative to the pelvis between 73–79% of the delivery stride, and move the thorax through a significantly greater range of lateral flexion relative to the pelvis during the delivery stride compared with bowlers with no history of LBP[26].

Our results show there was more improvement in pain intensity score and functional outcome score in the experimental group than in the control group. Independent sample t-test analysis has revealed that there were statistically significant differences in pain intensity (i.e. VAS score) and functional outcome (i.e. OLBPDQ score) between the

experimental group and the control group. These results may be due to the spinal core stabilization program having increased the stiffness and stability of the "major local trunk stabilizer muscle groups" which are responsible for the lumbar stabilization before the initiation of movements and while the movements are occurring in the upper and lower extremities of fast bowlers[18]. However, in the control group the conventional lumbar exercises only improved the strength of the stabilizer muscles and had no influence on the core stability. Accordingly the conventional lumbar exercises of the control group showed less improvement in the pain intensity score (VAS score) and the functional outcome score (OLBPDQ score)[9, 19].

The paired t-test analysis revealed that there were statistically significant decreases in mean values of pain intensity (VAS score) and functional outcome (OLBPDQ score) in both the experimental and control groups. However, at the end of the study the experimental group had showed greater improvement than the control group with respect to pain intensity (VAS score) and functional outcome (OLBPDQ score). The reason for this improvement is because of the experimental group subjects were performing spinal core stabilization exercises to improve the stiffness and stability of the transverse abdominal, multifidus and other secondary trunk stabilizer muscles[20, 21].

Earlier studies showed significant reductions in pain intensity and functional disability were achieved by the spinal segmental stabilization exercises at 10 weeks follow up[9, 18]. Another study demonstrated that the segmental stabilization exercises alter the abdominal muscle activation pattern in patients with chronic mechanical low back pain[22].

Rehabilitation using a motor control approach has been shown to be effective for subjects with LBP, and this may also benefit elite cricketers[27].

A mixed action is characterised by misalignment of the shoulders relative to the pelvis, and counter-rotation of the shoulders from a relatively front-on to a side-on alignment during the delivery stride[28]. This technique is thought to place greater torsional stresses on the lumbar spine than a pure side-on or front-on type of action. Mixed action bowlers also have greater amounts of extension and side flexion of the spine during delivery of the ball[29].

However, the precise mechanism linking the kinematics of the trunk during fast bowling and the pathomechanics of low back injury has yet to be established.

The co-contraction of the transverse abdominal muscle in particular, and the sub-umbilical portion and lumbar multifidus muscles on each side of the spine to increases the stiffness of the lumbar segments without interfering with trunk movements. The result of their contraction does not interfere with the rotation, mobility of the trunk in general, or with the freedom of motion of the limbs. In fact, it hardly moves the spine at all; it actually holds it in its place. Co-contraction at the level of deep, local, muscles can create support without restricting bigger movements in a segmental stabilization exercise regimen. Studies have highlighted the role of specific deep trunk muscles, such as the transverse abdomini (TrA) and the multifidus (MF), in stabilizing the lumbar spine. Abdominal drawing or abdominal hollowing is a widely adopted exercise to teach isolated co-contraction of TrA and MF without the contraction of global trunk muscles[30]. Clinicians and researchers theorize that improved activation of the segmental trunk muscles, with the goal of achieving higher segmental to multi-segmental synergistic ratios of activation, is the most efficient means of attaining needed trunk stability[32], reducing pain and improving functions[31].

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