



## Chronic Low Back Pain - The Exercise Prescription

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### Abstract

Chronic low back pain is a potentially disabling comorbidity of the obesity epidemic. Defined as pain in the lumbar region lasting more than three months, it can occur secondary to acute occupational, recreational or sports injury or as the result of cumulative trauma from occupational repetitive strain.

CLBP may be aggravated by occupational demands that promote poor posture and load the lumbar intervertebral discs - from heavy labor to extended sitting and standing.

The accumulation of adipose tissue in the central abdominal region further loads the lumbosacral spine contributing to malalignments and chronic pain.

Exercise has been proven to be a safe and effective first line intervention in the treatment, rehabilitation and prevention of CLBP. Exercise can promote fat burning.

Evidence based research using performance outcome measures, electromyography and ultrasound imaging is reviewed.

A deficit in strength of core musculature has been proposed as contributing to CLBP. Core strengthening and hypertrophy of key muscle groups can be achieved using an array of modalities including isometric exercise, stability balls and the Pilates method.

**Keywords:** Exercise prescription; Exercise testing; Exercise frequency; Exercise intensity; Stability balls; Core strengthening; Pilates method; American College of sports medicine; Obesity; Chronic low back pain

### Mini Review

In 1996 the Department of Health and Human Services, responding to the alarming increase in prevalence of obesity in America, urged the Centers for Disease Control, the National Institutes of Health and the American College of Sports Medicine to establish evidence based guidelines for the level of exercise and physical activity needed to produce measurable results in normalizing body composition and mitigating the health effects of obesity [1,2].

Chronic low back pain (CLBP) is a potentially disabling comorbidity of the obesity epidemic. Defined as pain lasting more than three months, it can be aggravated by occupational demands that promote poor posture and load the lumbar intervertebral discs - from heavy labor to extended sitting and standing.

The American Council on Exercise (ACE) published the Clinical Exercise Specialist Manual in 1999. It recognized exercise as a first line intervention for those with CLBP and cites early research showing the frequency and severity of CLBP episodes were decreased in those who exhibited "good cardiovascular fitness, strong abdominal musculature and good paravertebral strength" [2].

The American College of Sports Medicine pioneered exercise programming for CLBP calling for resistance training to increase abdominal and lumbar extensor strength [3].

Experts agree caloric restriction combined with physical activity exceeding caloric intake remains the fundamental formula for optimizing body composition. Weight loss can be the single most effective intervention in mitigating the severity of CLBP for those who are obese [4].

The Bureau of Labor Statistics predicts the Fitness Industry will experience 30% growth by 2018. It's growing demand warrants higher standards of certification and licensure for fitness professionals working in traditional medical settings [5,6].

A perceived lack of standardization in screening, dose assignment and assessment of safety, efficacy and outcome measurements for exercise programs designed to rehabilitate CLBP, hinders their acceptance and inclusion in traditional medical settings.

CLBP drives emergency room, urgent care and primary care office visits and accounts for fully one third of Workers Compensation costs. While the majority of low back pain episodes subside within three months of onset, recurrence rates as high as 60% have been reported [3].

An extensive body of research exists proving selected exercises to be a first line intervention in the prevention, treatment and rehabilitation of CLBP [7-11].

The Association of Chartered Physiotherapists published Therapeutic Exercise for Lumbopelvic Stabilization in 2004. It offers evidence based practical guidance on key muscle systems involved in the prevention and rehabilitation of CLBP.

Core muscles strengthen and stabilize the spine, pelvis and shoulders. They include Rectus Abdominis, Erector Spinae, Multifidus, External and Internal Obliques, Transversus Abdominis, Hip Flexors, Gluteus Maximus, Medius and Minimus, Hamstrings, Hip adductors and Piriformis [11].

Peer reviewed research studies document improvement in CLBP using performance outcome measurements for core strengthening exercises. Performance standardization is achieved through evidence based science using electromyography (EMG). EMG research detects patterns of core muscle activity in patients with CLBP [12,13].

Individuals with CLBP have been found to exhibit greater trunk muscle activity and observed "stiffness" during exercises in the frontal, sagittal and transverse planes. These findings have been interpreted as being due to muscular spasm [13].

Hodges et al. cite "ineffective muscular stabilization of the lumbar spine" in those with CLBP using EMG research focused on motor control of a principle muscle in core strength and stability - Transversus Abdominis [14].

Deficiencies in EMG activity in Multifidus and the Iliocostalis Lumborum muscles were detected when comparing healthy controls with patients with CLBP by Danneels et al. [15].

Researchers from the University of Australia's Department of Sport and Exercise Science recorded lumbar spine range of motion and corresponding EMG activity in those with CLBP performing commonly recommended core strengthening and stabilizing exercises. Muscle activity was measured using pairs of surface electrodes from Rectus Abdominis, External obliques and Lumbar Erector spinae [13].

The researchers detected no increase in trunk muscle activity or stiffness when comparing CLBP patients with healthy controls. Of significance, they documented no worsening of CLBP during performance of commonly recommended core strengthening exercises [13].

A highly referenced study on EMG activity of lumbar muscles during isometric exercise in those with CLBP was conducted by a multidisciplinary team of exercise physiologist, physical therapists and physicians. Cassisi et al. studied core and lumbar paraspinal muscle activity across five angles of flexion during isometric exercises and at rest in health controls and those with CLBP [12].

The group used surface integrated EMG to determine whether CLBP subjects exhibit a high muscle tension spasm model versus a low muscle tension deficiency model. Their conclusions support the model of CLBP as a muscular deficiency state.

Thus, EMG research supports the safe and effective role core strengthening exercise plays in the Exercise Prescription for CLBP. A systematic review on the effectiveness of physical and rehabilitation interventions for CLBP found that compared to usual care, "exercise therapy improved post treatment pain intensity and disability [16].

One of the most well researched interventions for CLBP is the Pilates method. Joseph Hubertus Pilates emigrated to the US in 1923 to establish a vanguard New York studio in which he applied his "Contrology" method to the rehabilitation of professional dancers.

Torso stability achieved through abdominal strength is a governing concepts of the Pilates Method [17].

EMG analysis of both Pilates mat, reformer and Cadillac trapeze demonstrate increases in joint flexibility, muscle strength, balance, stabilization and whole body conditioning in those with CLBP [18].

Both Pilates and core strengthening exercise produced clinical improvement in a randomized study of 87 volunteers with CLBP. Significant improvement on self reported measures of pain, disability and function were documented with both interventions [19].

Researchers from the University of Portugal analyzed EMG activity of the Transversus Abdominis, obliques and Multifidus during Pilates exercise. They conclude, "The Pilates Method develops strength of the body center, focusing on the contraction of muscles and contributing to lumbosacral stability" [20].

Measurements with ultrasound screening of Transversus Abdominis and Obliques activity during Pilates exercise showed measurable increased thickness of the muscle groups [21].

The Mayo Clinic has developed an online slide show of exercises proven effective in core strength and stabilization [22].

The National Strength and Conditioning Association (NSCA) offers an on-line Webinar produced by Nick Tumminelo NSCA-CPT, titled Top Ten Abdominal Exercises grounded in evidence based science. Top exercises involve the use of a stability ball including the Pike and Rollout [23].

Sawyer Enterprises produces Progressive Exercise Prescription Pads (PEP Pads) for back strengthening and lumbosacral stretch, designed to improve strength, endurance, mobility and flexibility of the spine. PEP Pads can be used to complement traditional therapies for CLBP. Each PEP pad offers individualized recommendations for exercise frequency, repetitions, precautions as well as progress and outcome notes [24].

The American College of Sports Medicine was founded in 1954 as the world's largest sports medicine and exercise science organization. Called the "Gold Standard" in exercise science, ACSM's Guidelines for Exercise Testing and Prescriptions offers evidence based standards for exercise testing and prescription (Figure 1).



**Figure 1:** The Pike is ranked the number one exercise for ab strengthening by Nick Tumminelo [23].

The 9th edition offers the latest in research and clinical science and summarizes key components of the exercise prescription for CLBP including exercise methods, frequency, intensity and duration [25].

Exercise programming includes progression in core and extremity strength, postural stabilization [26] and muscular endurance to meet both occupational and functional demands (Figures 2 to 10).



**Figure 2:** The Mayo Clinic recommends the Superman for core strengthening [22].



**Figure 3:** The Pilates Cadillac Trapeze reformer can be used to create modified "bridge" exercises to lift and strengthen the pelvis and lumbosacral spine. From the practice of Ahimsa Porter Sumchai MD, NSCA-CPT.



**Figure 4:** The Pilates ring serves as a rigid suspension prop to strengthen and lengthen the spine. From the practice of Ahimsa Porter Sumchai MD, NSCA-CPT.



**Figure 5b:** Barbell tight rotations.



**Figure 5a:** The Rainbow is ranked one of the top 10 ab strengthening exercises by Nick Tumminello [23].



**Figure 5c:** Barbell tight rotations - completion.



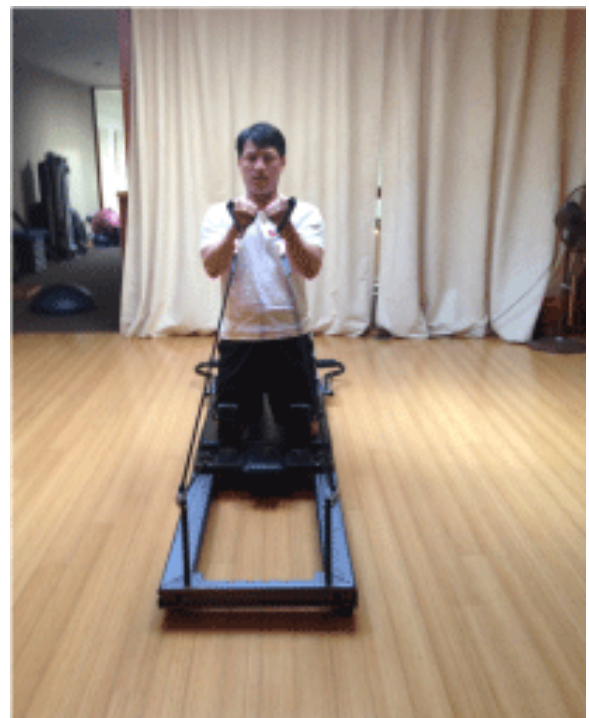
**Figure 6:** The deadlift has been shown to strengthen the "kinetic chain" muscles of the posterior compartment including Lumbar Erector Spinae, Gluteus Maximus and Minimus, Hamstrings and Calf muscles [23].



**Figure 7:** The rollout on a stability ball is ranked a top exercise for ab strengthening by Nick Tumminello [23].



**Figure 8:** A modified plank on a stability ball anchored by a barbell and power rack. From the practice of Ahimsa Porter Sumchai, MD NSCA-CPT.



**Figure 9a:** Exercises performed in the kneeling position on the Pilates Allegro Reformer rigorously engage the core in strength, balance and stabilization [17].



Figure 9b: Kneeling on the Pilates reformer.



Figure 10: Research suggests exercises that involve motion of the pectoral girdle and shoulder girdle maximally engage the core [23].

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