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NON-SPECIFIC CHRONIC LOW BACK PAIN: WHICH EXERCISE?

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Abstract: Low back pain, one of the skeletal and muscular system problems, is one of the most common chronic diseases in the world. Chronic low back pain is an important disorder that affects the daily, social, and work-life of individuals. The majority of people experience low back pain at least once in their life. In this sense, it affects both social and economic life. Low back pain can be acute or chronic, depending on the duration of the syndrome. Interventional, medication, rehabilitation, and exercise methods can be used in the treatment of chronic low back pain. In this study, it was investigated which exercise among the exercise models was more effective in the treatment of non-specific chronic low back pain. "Exercise" and "Chronic low back pain" were used as keywords in database searches. As treatment approaches, the effects of Abdominal Hypopressive exercise, Pilates, Yoga, Tai Chi, McKenzie, Gait, Dynamic and Static Stabilization Exercises, Motor Control and Gradual Activity Exercises in patients with low back pain were investigated. It has been determined that all the exercise models investigated reduce non-specific chronic low back pain and positively affect the mental state and quality of life of the patients. The fact remains that, it can be said that Pilates exercises come into prominence more than other exercises in terms of the stated effects.

Key words: Low back pain; Exercise methods; Health

SPESİFİK OLMAYAN KRONİK BEL AĞRISI-HANGİ EGZERSİZ?

Öz: İskelet ve kas sistemi sorunlarından olan bel ağrısı dünyada en yaygın görülen kronik hastalıklarından biridir. Kronik bel ağrısı bireylerin günlük, sosyal ve iş yaşantısını etkileyen önemli bir rahatsızlıktır. İnsanların büyük çoğunluğu hayatında en az bir kere bel ağrısı sorunu yaşamaktadır. Bu anlamda hem sosyal hem de ekonomik hayatı etkilemektedir. Bel ağrısı, sendromun süresine bağlı olarak akut veya kronik olabilir. Kronik bel ağrısı tedavisinde girişimsel, ilaç, rehabilitasyon ve egzersiz yöntemleri kullanılabilir. Bu çalışmada Egzersiz modelleri arasında hangi egzersizin spesifik olmayan kronik bel ağrısı tedavisinde daha etkili olduğu araştırıldı. Veri tabanı araştırmalarında "Egzersiz" ve "Kronik bel ağrısı" anahtar kelimeler olarak kullanıldı. Tedavi yaklaşımlarında, Karın Hipopresif egzersizi, Pilates, Yoga, Tai Chi, McKenzie, Yürüyüş, Dinamik ve Statik Stabilizasyon Egzersizleri, Motor Kontrol ve Kademeli Aktivite Egzersizlerinin bel ağrısı olan hastalarda etkileri incelenmiştir. İncelenen tüm egzersiz modellerinin spesifik olmayan kronik bel ağrısını azalttığı, hastaların ruhsal durum ve yaşam kalitesini olumlu yönde etkilediği tespit edilmiştir. Bununla birlikte Pilates egzersizlerinin belirtilen etkiler açısından diğer egzersizlere göre daha fazla ön plana çıktığı söylenebilir.

Anahtar Kelimeler: Bel ağrısı; Egzersiz metotları; Sağlık

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INTRODUCTION

Low back pain is one of the most common chronic diseases in the world. It is still a public health problem in almost all developed countries (Linek et al., 2020; Maher et al., 2017). It has been determined that 75-85% of people experience low back pain at least once in any period of their lives with the effect of their economic and social environments (Andersson, 1999; Bressler et al., 1999; Carey et al., 2000). Low back pain can be chronic or acute, depending on the duration of the syndrome. According to studies, low back pain is defined as acute if it lasts less than 6 weeks, subacute for 6-12 weeks, and chronic if low back pain lasts longer than 12 weeks (Foster, 2011). While a specific diagnosis can be made in approximately 15% of people with low back pain, a specific diagnosis cannot be made in approximately 85% (Van Tulder et al., 2006). According to the European Physical Therapy Guidelines, there are 3 types of low back pain. The first is specific spinal pathology, that is, nerve root pain, the second is radicular pain, and the third is nonspecific low back pain. Treatment of low back pain often requires a multidisciplinary treatment approach. Exercise therapy has an important place in these approaches. Thus, it is known that non-specific chronic low back pain can be reduced with physical exercises (Oesch et al., 2010; Wells et al., 2014). While exercise should be avoided in the intervention of acute low back pain, exercise is recommended for patients with subacute and chronic low back pain. Studies or reviews using exercise therapy in chronic low back pain have not proven any of these exercises to be superior to the other (Van Middelkoop et al., 2010).

This study, it is aimed to examine the research involving exercise intervention in the treatment of nonspecific chronic low back pain and to reveal which one is effective. In addition, for patients, fitness leaders, coaches, and interested persons, the loss of time due to trial and error is avoided to guide them and focus on exercise therapy.

METHODS

In the literature review, while it was designed electronically on December 25, 2020 to cover the years 2000-2021, it was searched from Google Academy, PubMed, Europe, CrossRef and ACSM, Journals databases using only Turkish and English languages. While deciding whether the article is suitable for the study, the title and summary of the articles on chronic low back pain and exercise involving both male and female participants were examined. Studies were included if they fulfilled the following criteria: (1) Systematic reviews, meta-analysis, and randomized controlled trials, (2) >14 years population with chronic (At least 3 months) nonspecific low back pain, and (3) Using only exercise therapy without the use of medication. This study did not include articles whose language is not English or Turkish. The full text of all articles included in the study was reviewed and focused on the following questions:

1. The effect of exercise on nonspecific low back pain
2. Comparison of exercise models
3. Analyzing which exercise is better

RESULTS

The database search found 41 articles for compilation. Among these studies, 8 articles that did not include exercise treatments were excluded from the study. The full texts of 33 articles included in the study were reviewed and accepted (Figure 1). In the studies reviewed, there are many types of exercises for chronic low back pain such as general strengthening, aerobic

exercise, stretching, stabilization exercises, Pilates, yoga, tai-chi, walking, dynamic and static stabilization exercises, and hypopressive gymnastic exercises (Table 1).

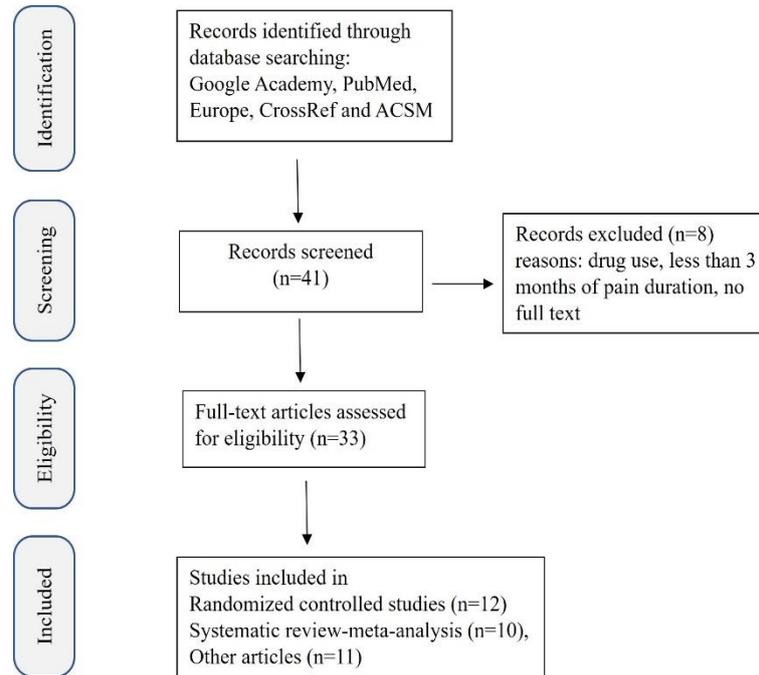


Figure 1. The study selection flow of this systematic review.

Table 1. Characteristics of Included Studies

Article	Age, Gender	Exercise	Pain Duration	Conclusion, Findings
Bhadauria & Gurudut (2017) Comparative effectiveness of lumbar stabilization, dynamic strengthening, and Pilates on chronic low back pain: randomized clinical trial	Total 44 male and female participants aged 20–60	Three different exercises, including lumbar stabilization exercises, dynamic strengthening exercises and pilates exercises, consisting of 10 sessions for 3 weeks	Participants with chronic non-specific low back pain for more than 3 months	When Pilates exercises and dynamic strengthening exercises were compared, it was determined that pilates exercises were more effective after a 3-week period.
Patti et. al. (2016) Pain Perception and Stabilometric Parameters in People with Chronic Low Back Pain After a Pilates Exercise Program A Randomized Controlled Trial	Exercise group 19 participants (41.31±11.24) Control group 19 participants (41.63±13.01) (did not specify gender)	Pilates exercises for 14 weeks, 3 sessions a week, each session 50 minutes	Participants with chronic nonspecific low back pain for more than 12 months	It was found that pilates exercises lasting 14 weeks improved balance and reduced low back pain.
Aladro-Gonzalvove et. al. (2013) Pilates-based exercise for persistent, non-specific low back pain and associated functional disability: A meta-analysis with meta-regression	Male and female participants aged 18-65	Pilates exercises 30-60 minutes, total 12 sessions 1-2 times a week	Participants with low back pain for at least 3 months	The focus of pilates is to activate the stabilizing muscles in the trunk and lower back, thus it can often be recommended for people with low back pain.
Coşkun & Can (2012) Kronik bel ağrısında dinamik ve statik stabilizasyon egzersizlerinin ağrı ve fonksiyonel düzeye etkileri	Total 30 participants 1- Static exercise group (mean age 33) 2- Dynamic exercise group (mean age 31)	Static and dynamic exercises for 6 weeks, 3 days a week	Participants with low back pain for at least 3 months	Both exercise models have been found to have a healing effect as treatment.
Costa et. al. (2009) Motor Control Exercise for Chronic Low Back Pain: A Randomized Placebo-Controlled Trial	Total 154 participants aged 18-80	Motor control exercise or placebo for 8 weeks, total 12 sessions	Participants with low back pain for at least 3 months	Gradual activity helps with problems such as back pain and kinesiophobia, reduces disability. Motor control exercises are also

				effective in reducing non-specific low back pain by improving physical impairments such as endurance, muscle strength and balance.
Ferreira, M. L et. al. (2007) Comparison of general exercise, motor control exercise and spinal manipulative therapy for chronic low back pain: A randomized trial	Total 240 participants	General exercise, motor control exercise or spinal manipulative treatment for 8 weeks	Participants with low back pain for at least 3 months	Motor control exercise and spinal manipulative treatment have been reported to be slightly better than general exercise in patients with chronic nonspecific back pain.
Ferreira, M.L et. al. (2016) The McKenzie Method for Low Back Pain: A Systematic Review of the Literature With a Meta-Analysis Approach	Male and female participants aged 14-76	Prone push-ups, lumbar rolls, posture training, McKenzie exercises	Participants with low back pain for at least 3 months	McKenzie exercises have been suggested to be more effective than passive therapies, including massage.
Gatantino, M.L et. al. (2004) The Impact Of Modified Hatha Yoga On Chronic Low Back Pain: A Pilot Study.	Total 22 participants aged 30-65	Yoga exercises for one hour 2 times a week for 6 weeks	Participants with low back pain for at least 3 months	It has been stated that yoga is beneficial for low back pain, but a larger study is needed for conclusive evidence.
Hall, A.M et. al. (2016) Does pain-catastrophizing mediate the effect of taichi on treatment outcomes for people with low back pain	Total 102 participants with a mean age of 64-69 years	Taichi exercise for 10 weeks, 2 sessions a week, 40 minutes each session	Chronic low back pain	It has been stated that taichi exercise is beneficial for low back pain.
Hall, A.M et. al. (2011) Taichi exercise for treatment of pain and disability in people with persistent low back pain: a randomized controlled trial	Total 160 participants aged 18-70	Taichi exercise for 10 weeks, 40 minutes each session	Chronic low back pain	It has been stated that taichi exercise reduces low back pain and is a safe and effective exercise for those who have long-term low back pain.
Halliday et. al. (2016) A randomized controlled trial comparing the McKenzie method to motor control exercises in people with chronic low back pain and a directional preference	Total 70 participants aged 18-70	McKenzie exercises and motor control exercises for 8 weeks, total 12 sessions	Participants with low back pain for at least 3 months	The McKenzie method was found to provide greater improvement than motor control exercises.
Hasanpour-Dehkordive et. al. (2017) A comparison of the effects of Pilates and McKenzie training on pain and general health in men with chronic low back pain: a randomized trial	Total 36 male participants aged 40-55 1. McKenzie group 2. Pilates group 3. Control group	McKenzie exercises for 6 weeks, 3 sessions a week, 1-hour each session	Participants with low back pain for at least 3 months	Pilates and McKenzie exercises reduced pain in patients with chronic low back pain, however, pilates exercises were noted to be more effective in improving overall health.
Hosseiniifar, M et. al. (2013) The effects of stabilization and McKenzie exercises on transverse abdominis and multifidus muscle thickness, pain, and disability: a randomized controlled trial in nonspecific chronic low back pain	Total 30 participants aged 18-50 1. McKenzie group 2. Stabilization exercise group	McKenzie exercise and stabilization exercise for 1 hour each session, three times a week for 6 weeks	Participants with low back pain for at least 3 months	It has been stated that both exercises reduce chronic low back pain, but stabilization exercises reduce pain and disability more than McKenzie.
Lin, H.T et. al. (2016) Effects of Pilates on patients with chronic non-specific low back pain: a systematic review		Pilates exercise for 1 hour per session, 2-3 times a week for 6-8 weeks.	Participants with low back pain for at least 3 months	Pilates showed significant improvement in pain relief and functional recovery in patients with chronic low back pain.
Miyamoto, G.C et. al. (2013) Efficacy of the Pilates method for pain and disability in patients with chronic nonspecific low back pain: a systematic review with meta-			Participants with low back pain for at least 3 months	It has been stated that Pilates exercises are more effective than minimal practice in improving pain and disability in the short

analysis				term.
Moon, H.J et. al. (2013) Effect of lumbar stabilization and dynamic lumbar strengthening exercises in patients with chronic low back pain	Total 24 participants	Lumbar stabilization exercise and conventional lumbar dynamic exercise for 60 minutes each session, 2 days a week for 8 weeks	Participants with low back pain for at least 3 months	Both lumbar stabilization and traditional lumbar dynamic strengthening exercises have been reported to reduce low back pain.
Neyaz, O et. al. (2019) Effectiveness of hatha yoga versus conventional therapeutic exercises for chronic nonspecific low-back pain.	Total 70 participants aged 18-55	General exercise and yoga for 6 weeks, 35 minutes each session	Participants with low back pain for at least 3 months	Both Conventional Therapeutic Component exercise and Yoga exercise improved chronic low back pain.
Alhakami et. al. (2019) Effects of McKenzie and stabilization exercises İnreducing painin tensiy and functional disability in individuals with nonspecific chronic low back pain: a systematic review	Male and female participants aged 18-80	McKenzie and stabilization exercises with 10 to 15 reps	Participants with chronic nonspecific low back pain for more than 3 months	Both McKenzie and stabilization exercises were better than traditional exercise programs in reducing functional disability in patients with chronic nonspecific low back pain.
ATILGAN, E. & Erbahçeci, F. (2018) Kronik bel ağrılı bireylerde yoga ve fizyoterapi programının yaşam kalitesi, denge, ağrı düzeyi ve uyku kalitesi üzerine etkilerinin karşılaştırılması	Total 40 participants aged 18-65	Yoga exercises and physiotherapy exercises, 5 days a week for 4 weeks	Participants with chronic nonspecific low back pain for more than 3 months	Yoga and physiotherapy exercises have been found to positively affect balance, quality of life and low back pain in patients with chronic low back pain.
Chang, D. G et. al. (2016) Yoga as a treatment for chronic low back pain: A systematic review of the literature	Male and female participants aged 30-45	Yoga, stretching, trunk stability exercises twice a week, 20-60 minutes each session	Participants with chronic nonspecific low back pain for more than 3 months	Yoga has been found to both reduce back pain and reduce the risk of injury.
Cramer, H et. al. (2013) A Systematic Review and Meta-analysis of Yoga for Low Back Pain	Men and female participants aged 30-65	Yoga exercises for 12-24 weeks, 30-90 minutes each session	Participants with chronic nonspecific low back pain for more than 3 months	Yoga has been determined to be effective in the short term.
Weifen et. al. (2013) Effectiveness of Tai Chi Practice for Non-Specific Chronic Low Back Pain on RetiredAthletes: A Randomized Controlled Study	Total 320 participants (mean age 37.6±5.4) 1- Experimental group 2- Control group	Taichi exercises for 6 months, 5 days a week, 45 minutes each session	Participants with chronic nonspecific low back pain for at least 12 months	Taichi has a better effect than some other exercises in the treatment of non-specific chronic low back pain
Wang et. al. (2019) Effects of whole-body vibration exercise for non-specific chronic low back pain: an assessor-blind, randomized control ledtrial	Total 84 participants aged 18-60 1- Experimental group 2- Control group	Full body vibration exercises and general exercises for 12 weeks, three times a week	Participants with chronic nonspecific low back pain for more than 3 months	It has been found that whole body vibration exercise may provide greater benefit than general exercise for relieving pain and improving functional disability in patients with nonspecific chronic low back pain..
Zamani et. al. (2011) Pilates exercise effect on painand general health of female patients with chronic low back pain	Exercise group (1540.20±8.07) Control group (38.30±7.84)	Pilates exercises for 6 weeks	Participants with chronic nonspecific low back pain for more than 3 months	Pilates exercises have been found to be more effective than traditional treatment methods in reducing pain levels and improving general health in patients with chronic low back pain, and therefore pilates exercises have been recommended for patients with chronic low back pain.
Yılmaz et. al. (2015) Kronik Mekanik Bel Ağrısı Olan Hastalarda Egzersizle Beraber Fizik Tedavi Uygulamalarının Sadece Egzersiz Tedavisi ile Karşılaştırılması	Total 46 participants aged 25-70	In both groups, 2 sessions per day of lumbar flexion+extension, strengthening of the lumbar and abdominal muscles and stretching	Participants with chronic nonspecific low back pain for more than 3 months	Effective results can be obtained by performing regular exercises in patients with chronic low back pain. More successful results have been obtained with

		the iliopsoas, hamstrings and quadriceps exercises for 14 days. In addition, in physical therapy group, 10 sessions of hot pack+therapeutic ultrasound+interferential current therapy		physical therapy applications along with exercise.
Wells et. al. (2014) The effectiveness of Pilates exercise in people with chronic low back pain: a systematic review.	Participants aged 23-48	Pilates exercises for 4-8 weeks	Participants with chronic nonspecific low back pain for more than 3 months	It has been determined that pilates exercises provide more improvement in pain and functional abilities in the short term compared to normal care and physical activity. It has been noted that Pilates exercise offers equivalent improvements to massage therapy and other forms of exercise.
Wells et. al. (2012) Defining Pilates exercise: A systematic review				The focus of pilates is to activate the stabilizing muscles in the torso and lower back, so it is often recommended for people with low back pain.
Petersen, T et. al. (2002) The effect of McKenzie therapy as compared with that of intensive strengthening training for the treatment of patients with subacute or chronic low back pain	Total 260 participants 1. McKenzie group 2. Intense dynamic strengthening exercise group	Outpatient training for 2 groups for 8 weeks, followed by home exercise for 2 months	Participants with low back pain for at least 8 weeks	The McKenzie method and intensive dynamic strengthening training appear to be equally effective in treating patients with subacute or chronic low back pain.
Rydeard, R et. al. (2006) Pilates-based therapeutic exercise: effect on subjects with nonspecific chronic low back pain and functional disability	Total 39 participants aged 20-55 1- Experimental group 2- Control group	Pilates exercises for 4 weeks	Chronic low back pain	It has been stated that Pilates exercises reduce back pain and provide improvement.
Shamsi, M et. al. (2017) Comparison of spinal stability following motor control and general exercises in nonspecific chronic low back pain patients	Total 51 participants 1. Motor control 2. General exercise	A total of 16 sessions of exercise 3 times a week, Motor control exercise time is 20 minutes, while overall exercise time is 14 minutes,	Participants with chronic nonspecific low back pain for more than 3 months	It was stated that pain and disability were significantly reduced in both groups in patients with chronic low back pain. However, it has been stated that the two exercise types are not superior to each other.
Shnayderman, I. & Katz-Leurer, M. (2013) An aerobic walking programme versus muscle strengthening programme for chronic low back pain: a randomized controlled trial	Total 52 male and female participants aged 18-65	Walking exercises and general exercises for two different groups for 6 weeks, twice a week, 20-40 minutes each session	Participants with chronic nonspecific low back pain for more than 3 months	It has been stated that walking exercises for six weeks are as effective as special strengthening exercises for the waist and that the walking program reduces chronic low back pain.
Suh, J.H et. al. (2019) The effect of lumbar stabilization and walking exercises on chronic low back pain: A randomized controlled trial	Total 60 participants 4 groups (participants over 20 years old)	Exercises for 30-60 minutes 5 times a week for 6 weeks, 1. Group: Flexibility exercise 2. Group: Individualized graded lumbar stabilization exercise 3. Group: Stabilization exercise 4. Group: Walking exercise	Participants with chronic nonspecific low back pain for more than 3 months	It has been stated that stabilization and walking exercise should be recommended to patients with chronic low back pain, because it not only helps to relieve back pain, but also helps prevent chronic back pain by improving muscular endurance.
Vanti, C et. al. (2019) The effectiveness of walking versus exercise on pain and function in chronic low back	Total 510 participants aged 22-53	General exercise and walking exercise for 4-6 weeks, 5 days a week, 30-40 minutes each	Participants with chronic nonspecific low back pain for more than 3 months	Walking can be considered as an alternative to other physical activities.

pain: a systematic review and meta-analysis of randomized trials		session. (walking+exercise)		However, it was stated that adding exercise to walking did not provide statistically more improvement in the short term.
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Abdominal Hypopressive And Exercise

These exercises are the technique that shrinks your diaphragm while holding your breath; it creates internal pressure on your abdominal muscles; thus, it strengthens the pelvic floor and abdominal wall and reduces back pain. This provides benefits such as strengthening the abdominal muscles, stretching the lumbar spine and hamstring muscles, and rearranging the body posture (Oesch et al., 2010).

Abdominal hypopressive exercise programs have recently started to be preferred because they are easy and can be done in a short time. It is stated that when applied together with abdominal hypopressive exercises and massage therapy, it is more effective in reducing non-specific low back pain. A study using the Abdominal Hypopressive Gymnastic exercise method showed that this type of exercise has a positive effect on spinal flexibility in both healthy individuals and patients with chronic low back pain (Bellido-Fernández et al., 2018).

Pilates Exercises

Pilates was developed by Joseph Pilates from a series of exercises that involved physical and mental strategies such as Western yoga, Greek and Roman gymnastics, karate and zen in the 1920s. These series of exercises include core endurance, flexibility, movement, endurance, posture and breathing control exercises. It is seen that individuals with low back pain cannot move the stabilizing muscles in the trunk and the lower part of low back. For this reason, Pilates exercise is designed to help reactivate these muscles. Pilate's exercises increase the support of the lower part of the trunk and reduce pain and disability. The focus of Pilates is to activate the stabilizing muscles in the trunk and the lower part of low back, therefore, it is often recommended for people with low back pain (Aladro-Gonzalvo et al., 2013; Wells et al., 2012).

One study compared the effects of McKenzie and Pilates exercises in patients with chronic low back pain. According to the results of this study, although Pilates and McKenzie training has been shown to reduce pain in patients with chronic low back pain, Pilates training has been reported to be more effective in improving general health (Hasanpour-Dehkordi et al., 2017). In a 2017 study, Bhadauria and Gurudut (2017) analyzed the effects of lumbar stabilization, dynamic strengthening, and Pilates exercises on chronic low back pain, and in this study, Pilates exercises were found to be more effective than dynamic exercises in chronic low back pain.

In another study examining the effect of Pilates in people with chronic low back pain, it was determined that Pilates exercises provide more improvement in pain and functional abilities in the short term compared to normal care and physical activity, and also reported that Pilates exercise offers equivalent improvements to massage therapy and other types of exercise Wells et al., 2014). In a similar study, full recovery was observed in the patient group with chronic low back pain who did Pilates exercises, while no improvement was observed in the control group (Rydeard et al., 2006).

In a review about Pilates; it has been reported that Pilate's exercises have a positive effect on pain relief and functional strengthening in chronic low back pain patients who do Pilates

exercises. However, it has also been reported that a total of 20 hours of work to be done by adding waist and trunk exercises in other types of exercise showed similar results with Pilates (Lin et al., 2016). In a study conducted by Patti et al. in 2016, it was reported that chronic low back pain patients who did regular Pilates exercise for 14 weeks had reduced pain and improved balance.

In a study of 28 women, selected Pilates exercises were found to be more effective than conventional treatment methods in reducing pain levels and improving overall health in patients with chronic low back pain, thus, Pilates exercises have been recommended for patients with chronic low back pain (Zamani et al., 2011). In another review, low-cost interventions such as general care and physical activity were reported to have the same effects as other types of exercise (Lim et al., 2011; Wells et al., 2014). Many articles reviewed have revealed that Pilates relieves low back pain, in two studies among them, they stated clinically that Pilates almost completely eliminated non-specific chronic low back pain (Miyamoto et al., 2013; Rydeard et al., 2006).

Yoga Exercises

Yoga is a physical, mental and spiritual practice originated in India. Yoga aims to achieve serenity in mind and spirit through postures and meditation (Agarwal, 2013). Scientific studies have stated that yoga increases the activity of the parasympathetic nervous system, thalamic gamma amino butyric acid (GABA) level and peripheral nerve activity in specific positions (Cramer et al., 2013; Gündüz and Erçalık, 2014). There is also evidence that it has a short-term beneficial effect on disability and a long-term beneficial effect on pain.

A randomized 2016 study, with a few exceptions, previous studies and recent randomized control trials show that yoga can reduce pain and disability, can be practiced safely, and is well received by participants. Although its effects cannot be fully determined at the moment, some studies also show that yoga can treat psychological symptoms (Chang et al., 2016).

In a study with 1080 participants, they had yoga exercises done at different times. According to the results of the study, when the exercisers were compared with the control group, evidence was found that exercisers had small to moderate improvements in back function at three and six months. It is unclear whether there is any difference between yoga and other exercises or whether exercise combined with yoga is more effective than exercise alone for back pain (Gatantino et al., 2004). In a study conducted in 2019, 70 people with chronic low back pain participated. Some of the participants did yoga exercises, while rehabilitation and physiotherapy support were provided to the other part. Significant improvements were seen in back pain intensity and back-related dysfunction in both groups (Neyaz et al., 2019).

In a similar study, when two groups applying a yoga program and a physiotherapy program were compared; It was found that chronic low back pain decreased, balance functions improved, and quality of life improved in both groups. However, in the comparison between the two groups, it was found that the difference in pain intensity was in favor of the physiotherapy group (Atılğan and Erbahçeci, 2018).

Up to the present, few studies have been conducted to determine the effect of an individual-designed yoga program for the treatment of chronic pain, based on physical abilities and pain history. Highland et al. (2018) 68 people participated in their study for chronic low back pain. According to the encouraging results of the feasibility trial of an individually designed yoga

program for patients with low back pain, pain levels were reduced in the group that took individually prepared yoga classes.

It has been observed that yoga classes are more effective than physiotherapy sessions. However, its usefulness in reducing symptoms related to chronic low back pain and improving functions was limited to a few months. In an American study, although there are numerous privatized yoga exercises for chronic low back pain for people with chronic low back and neck pain, none of them have been proven to be fully effective for chronic low back pain (Haldeman and Dagenais, 2008). Yoga and stretching exercises can be considered as a suitable activity to reduce moderate low back pain and to enable patients to participate in physical activity.

Tai Chi Exercises

Tai chi exercises were first developed in China as a self-defense sport, and then became popular all over the world. Its basic principles are core stabilization, consisting of slow and smooth movements. It is an exercise method that improves muscle strength and balance ability, can be applied easily, and can be preferred in some specific diseases such as fibromyalgia and knee osteoarthritis (Cho, 2014). It has recently gained popularity in Australia, Canada, the UK and the US for use in a variety of health conditions, including fall prevention and arthritis management (Logghe et al., 2010). In a randomized study of 160 people with persistent low back pain, it was stated that 10 weeks of tai chi exercises improved pain and disability and to be a safe and effective intervention for those experiencing long-term low back pain symptoms (Hall et al., 2011). In an Australian study, it was stated that tai chi reduced the symptoms of low back pain and could be an alternative treatment for people with chronic musculoskeletal disorders (Hall et al., 2016).

In the study conducted with 320 retired athletes with non-specific chronic low back pain, tai chi, swimming, jogging and backward walking exercises were performed. While there was no significant difference between tai chi and swimming, a significant difference was found between tai chi and other exercises. Therefore, it can be said that tai chi exercises are more effective than some branches (Weifen et al., 2013).

As a matter of fact, studies preoccupy that tai chi exercises can reduce small and moderate pain in a short time without tiring patients with low back pain. However, it has been stated that these pains should be reduced by 30% for clinically significant improvement (Ostelo et al., 2008). Although more studies are needed to prove it clinically, tai chi exercises are performed slowly and gently and allowing chronic patients to act according to their physical fitness, which causes them to be preferred.

McKenzie Exercises

The McKenzie method was developed by Robin McKenzie, a New Zealand physiotherapist, in 1981 for patients with low back pain who did not require surgery. It is an extremely effective and reliable management for low back pain, loss of lumbar lordosis and hernias (The McKenzie Institute, 24 September 2020). This method has three components: evaluation, planning and prevention of exercise according to patients' directional preferences. "Although McKenzie exercises are known as extension exercises, they also involve trunk flexion, trunk extension and lateral displacements" (McKenzie and May, 2003). It is known that McKenzie exercises reduce pain in the short term and improve functions in the long term in patients with nonspecific chronic low back pain. In summary, McKenzie therapy is more effective than passive methods for treating low back pain.

Udermann et al. (2004) stated that the McKenzie method had a positive effect between disability and psychosocial variables in patients with chronic low back pain.

As a result of a study by Petersen et al., it was stated that the McKenzie method reduced pain and disability after two months in patients with chronic low back pain. In the study, they stated that McKenzie training is effective in reducing pain, increasing the movements of the spine, rehabilitation, increasing the endurance of soft tissues and restoring flexibility in patients with chronic low back pain. As a result of an 8-month study comparing Pilates and McKenzi exercises, Petersen et al. (2002) stated that there was no difference between the treatments. In another study comparing the effects of McKenzie and Pilates exercise in patients with chronic low back pain, it was stated that Pilates and McKenzie education reduced pain in patients with chronic low back pain, but Pilates education was more effective in improving general health (Hasanpour-Dehkordi et al., 2017).

In their study, Alhakami et al. (2019) stated that both McKenzie and stabilization exercises were better than traditional exercise programs in reducing functional disability in patients with nonspecific chronic low back pain. Hosseinifar et al. (2013) compared the effectiveness of stabilization and McKenzie exercises on pain, disability and thickness of the abdominis and multifidus muscles in patients with nonspecific chronic low back pain. As a result of the study, it was found that stabilization exercises were more effective than McKenzie exercises in improving pain severity and function score and increasing the thickness of the abdominis muscle.

In the study of Halliday et al., (2016) the McKenzie method was compared with motor control exercises. It was stated that there was no significant increase in deep trunk muscle development in people who applied the McKenzie method or motor control exercises. However, it was reported that the perceived improvement was higher in people who applied the McKenzie method compared to motor control exercises. For this reason, it has been stated that the McKenzie method can also be preferred. In a similar study, the effect of the McKenzie method on low back pain was investigated; it has been stated that it is more effective than passive treatment for acute low back pain, but no information has been given about its effect on chronic low back pain (Ferreira, 2006).

Motor Control Exercises and Gradual Activity

It is a commonly used form of exercise for chronic non-specific low back pain. Motor control exercises have been developed for patients with low back pain to control the superficial trunk muscles such as the transversus abdominis and multifidus, which are responsible for keeping up the stability of the spine (Ferreira et al., 2007).

“Gradual exercises were developed based on studies showing that cognitive-behavioral aspects such as patient mood and cognition are important factors associated with delayed improvement in back pain and increased levels of disability in patients with chronic pain” (Hurwitz et al., 2005). Briefly stated, gradual activity helps with issues such as fear of back pain and kinesiophobia, reducing disability, and motor control exercises are also effective in reducing non-specific low back pain by improving physical disorders such as endurance, muscle strength and balance (Costa et al., 2009).

In a study comparing the McKenzie method with motor control exercises, it was found that chronic low back pain reduced pain in both groups, but motor control exercises did not have

much effect on obliquus externus and obliquus internus muscle thickness, McKenzie exercise is effective in muscle thickness, even if just a tad (Halliday et al., 2016).

In a study conducted in 2017; Motor control exercise was applied to some of the patients with non-specific chronic low back pain and general exercise was applied to the other part, and low back pain decreased in both groups. It was explained that the increase in stability was achieved in all positions in the motor control group, but, in the general exercise group, it was not in all positions (Shamsi et al., 2017).

Another study compared general exercise, motor control exercise, and spinal manipulative therapy for chronic low back pain. Measurements were made at 8 weeks, 6 months and 12 months. It was stated that the motor control group gave more positive results than the other groups in the measurements made at the 8th week, however, in the measurements made at the 6th and 12th months, the three groups gave similar results (Ferreira et al., 2007).

Critchley et al. have shown that gradual activity is less costly than motor control exercise due to slightly greater effects and lower healthcare costs (Hurwitz et al., 2005). One study comparing gradual activity and motor control exercise, stated that these exercises have effects such as improving the quality of life in reducing low back pain and disability, however, no exercise type is superior to the other (Ferreira et al., 2007).

Finally, Yılmaz et al. (2015) in their study, it was determined that pain decreased in both the exercise and physiotherapy group. However, they stated that physical therapy applications are more effective in minimizing pain, therefore, the pain of patients who cannot provide sufficient efficiency with exercise will decrease by applying a combination of exercise and physiotherapy.

Walking

The importance of walking in terms of human health, even if, has begun to be understood in our country as well as all over the world. As is known, doctors commonly recommend walking to cure or decrease chronic low back pain. It is known that walking, which is easier than other exercises and suitable for the structure of our organism, is the most natural exercise of our body. In addition, it was stated that 30 minutes of brisk walking a day is required for fat burning, so walking is important for a healthy life (İri et al., 2010).

In a meta-analysis study on adults with chronic low back pain; the effects of walking compared to exercise were investigated. In the research conducted; it was found that the efficacy of walking and exercise appeared statistically similar in short, medium and long-term follow-ups, however, walking and exercise together did not provide any statistical improvement in the short term. In the study, it was stated that the effects of walking and exercise were similar, walking can be considered as an alternative to other physical activities (Vanti et al., 2019).

One study found that a six-week walking program for the low back was as effective as a six-week special strength training program (Shnayderman and Katz-Leurer, 2013). In another study, it was stated that walking exercises can be recommended for patients with chronic low back pain and walking exercises relieve back pain, and also prevent chronic back pain by increasing muscle endurance (Suh et al., 2019).

Dynamic and Static Stabilization Exercises

The purpose of dynamic stabilization exercises is to find and maintain a neutral spine that adapts to the curvature of the spine, minimizes stress and is a natural stance. Maintaining the neutral spine in a healthy posture provides information about muscle condition and joint positions. To explain briefly, the main purpose of static stabilization is keeping the vertebral column in a proper position during daily movements.

Dynamic exercises are performed to make the body feel muscle and joint awareness by stimulating both the central and peripheral nervous system (Parkhurst and Burnett, 1994; Vezina and Hubley-Kozey, 2000). Dynamic stabilization includes a variety of exercises. For more severe pain, it is generally recommended to start with leg lift exercises that strengthen the lower back and core muscles slowly and gradually. In a study conducted in 2012, dynamic and static stabilization exercises were performed on 30 people with chronic low back pain. As a result of the program applied for 6 weeks, it was explained that they found a significant difference in both dynamic and static stabilization exercise applications compared to the initial situation, and when the two groups were compared in terms of pain, they did not find a significant difference in terms of pain intensity (Coşkun and Can, 2012).

In a similar study, three different training methods were applied to 59 patients with chronic low back pain. The 10-week stabilization training was combined with dynamic resistance training of 19 people in the 1st group, the 10-week stabilization training was combined with 20 people in the 2nd group, the 10-week stabilization training was combined with 20 people in the 3rd group. It has been reported that general stabilization exercises and dynamic intense lumbar resistance training have no significant effect on the CSA of the lumbar multifidus muscle in patients with chronic low back pain. The static holding component between the concentric and eccentric phase has been found to be critical in inducing muscle hypertrophy during the first 10 weeks. Treatment consisting of stabilization training combined with an intense lumbar dynamic-static strengthening program was stated to be the most appropriate method to restore the extent of the multifidus muscle (Wang et al., 2019).

In a detailed study, the effectiveness of stabilization and McKenzie exercises on pain, disability and thickness of the abdominis and multifidus muscles were compared in patients with nonspecific chronic low back pain. As a result of the study, it was found that stabilization exercises were more effective than McKenzie exercises in improving pain severity and function score and increasing the thickness of the abdominis muscle (Hosseinifar et al., 2013).

In a study that analyzed the effect of lumbar stabilization and dynamic waist strengthening exercises in patients with chronic low back pain, it was found that both lumbar stabilization and dynamic strengthening exercises strengthen lumbar extensors and reduce low back pain. However, lumbar stabilization exercise was found to be more effective in lumbar extensor strengthening and functional recovery in patients with nonspecific chronic low back pain (Bhadauria and Gurudut, 2017; Moon et al., 2013).

In another study, it was stated that lumbar stabilization exercises can be recommended for patients with chronic low back pain, and walking exercises relieve back pain and prevent chronic back pain by increasing muscle endurance (Suh et al., 2019). According to the studies reviewed, the reason why static stabilization is more advantageous than dynamic exercises is that no exercise equipment is needed while performing these exercises.

DISCUSSION

In this study, current evidence on the effects of exercises such as abdominal hypopressing, Pilates, yoga, tai chi, McKenzie, motor control, walking and gradual activity in patients with non-specific chronic low back pain was tried to be presented. Efforts have been made to ensure the optimal application of the exercise models included in this study. Exercise comparisons, research articles and reviews are included in the study.

It has been stated that these exercises reduce pain in patients with non-specific chronic low back pain. There are differences between some exercise models compared to others in terms of time, cost or ease of doing. It has been expressed that abdominal hypopressive exercises have an effect on spinal flexibility both in healthy individuals and in patients with chronic low back pain, but this situation is short-lived (Bellido-Fernández et al., 2018; McKenzie and May, 2003; Moon et al., 2013; Ostelo et al., 2008; Wells et al., 2014). Examining the difference between motor control and gradual activity, Critchley and colleagues found no difference after certain months. They stated that gradual activity is preferred because of its lower cost. It is known that yoga reduces pain in patients with moderate low back pain and is a safe exercise.

In a review examining tai chi exercises, they stated that tai chi reduced back pain like other exercises, but it did not provide a full recovery in the back. Among the exercise models examined, it is seen that Pilates is the most ideal method in terms of cost, time, confidence, and improvement. As a matter of fact, it has been stated in the literature that Pilates is more effective when compared to other exercises (Aladro-Gonzalvo et al., 2013).

It has been clearly stated in our study that exercise has positive results in people suffering from low back pain. However, we should not forget that doing exercise models with some exercise assistant models can have a greater effect. For example, abdominal hypopressive exercise and massage therapy (Balthazard et al., 2012).

In a review called the effect of Pilates exercise on chronic low back pain, nearly 40 articles were reviewed, and it was stated that Pilates is an effective exercise. When choosing Pilates exercises for low back pain, factors such as the severity of the pain, the patient's recovery desire and the level of motivation should be considered. Exercise should be chosen according to the person's abilities and skills. In addition, we can say that patients who cannot achieve adequate recovery with exercise therapy can achieve successful results with a physical therapy program to be performed together with exercise. It is recommended that all exercises included in the study be performed for a long time in patients with non-specific chronic low back pain and their effects should be followed.

CONCLUSION

In this study, it was determined that abdominal hypopressive exercise, Pilates, yoga, tai chi, McKenzie, walking, dynamic and static stabilization, motor control and gradual activity exercises reduced non-specific chronic low back pain and affect the mental state and quality of life of patients positively. After all, as a result of this study, it was concluded that Pilates exercises came to the forefront more than other exercises in terms of the stated effects. In addition, according to the results of this study;

- Patients can do Pilates exercises in addition to their treatment.
- In addition to strength training, coaches can have their athletes do Pilates exercises.

- Athletes may prefer Pilates exercises as a pre-injury activity.

LIMITATIONS

The inclusion of only English and Turkish articles in this study inadvertently limited the study. In this respect, articles on low back pain and exercise published in other languages should also be reviewed.

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