

# Pilates-based exercise in the reduction of the low back pain: an overview of reviews

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**Abstract. – OBJECTIVE:** Pilates is a popular system of exercise that is recommended for healthy individuals and patients with low back pain (LBP). The restoration of muscle function in lumbopelvic stability and pelvic floor muscles has been fostered by practices based on this strategy. Restoring or sustaining the motor control of the lumbar spine and proper body posture during each exercise is very important. The aim of this umbrella review (UR) of systematic reviews and narrative reviews is to detect the effects of exercise on patients with chronic low back pain (CLBP).

**MATERIALS AND METHODS:** Records were published in December 2019 and identified from Web of Science, PubMed, and Scopus. Studies that addressed this topic were included. The protocol was registered on PROSPERO (246510).

**RESULTS:** The Pilates method, using functional exercises, improves muscular strength and endurance. Eleven studies were included in the UR. Nine reviews for chronic LBP concluded that there were pain relief and functional progression from the Pilates-based exercise intervention in the short-term. There was strong evidence that Pilates exercise improved flexibility and dynamic balance and enhanced muscular endurance among healthy people in the short-term.

**CONCLUSIONS:** Pilates exercise improved dynamic balance and flexibility also raised muscular endurance in people in the short time. There was some evidence that admits this exercise as effective in body fat reduction and increasing fat-free mass in the short-term.

*Key Words:*

Pilates-based exercises, Low back pain, Overview, Systematic review, Narrative reviews.

## Introduction

Low back pain (LBP) is a common symptom occurring in all ages together with leg pain or lower limb neurological symptoms<sup>1</sup>. LBP is de-

defined as “pain, increased muscular tension, and/or stiffness with or without referred lower limb discomfort located between the costal margin and the inferior gluteal folds<sup>2</sup>”. This pathological condition is one of the most complaints observed in the context of primary care<sup>2</sup>. The estimated 7.3% worldwide population suffering activities are caused by LBP. One of the common reasons of musculoskeletal disorders is LBP<sup>1</sup>. Pilates is a concept of body and mind exercise and a system of repetitive exercises including whole-body movements, breathing, centering, rhythm, and concentration. Pilates is a mindful approach exercise that promote strength, stability and is used for health enhancement and in several diseases<sup>3</sup>. This method was developed by Joseph Pilates during the 1920s. It has also been shown that this exercise is popular among women of all ages<sup>4</sup>. Pilates is a series of about 500 exercises and inspiration from diverse exercise which include martial arts, yoga, ballet, Zen meditation as well as ancient Greek and Roman exercise<sup>2</sup>. This exercise makes stretches and balanced all the major muscle in the body with a special attention to core strength to improve general fitness and wellbeing<sup>2</sup>.

There is evidence<sup>2</sup> that Pilates-based exercises are useful in reducing LBP. Pilates is used in some rehabilitation programs and promotes the restoration of muscles or sustain the motor control of the lumbar spine and proper body posture<sup>2</sup>. A recent systematic review<sup>2</sup> has investigated that Pilates is a system of exercises widely used in patients with a disorder in the back which raises endurance in the muscle, improves dynamic balance and flexibility, and decreases pain during the short time.

Since this theme was considered by many authors, and sometimes the results are in conflict, the aim of this review is to provide a summary of the available evidence using already published

systematic and narrative review to assess the effects of the Pilates Method-exercise on patients with chronic LBP.

**Survey Methodology**

This systematic review was carried out according to the PRISMA<sup>5</sup> guidelines (Figure 1).

**Identification of Relevant Studies**

Systematic reviews that examined the effect of Pilates on LBP were identified through the principled probe of three electronic databases PubMed, Web of Science and Scopus, and using the keywords (“Pilates-based exercises” OR “Pilates” AND “treatment” AND “low back pain”) with the Boolean operator. Limits were applied for the language of the articles (English, Spanish, Italian) but not for the year of publication. When duplica-

tes or repeated publications were encountered in the database search, eligible papers were considered only once. We looked for all databases in December 2019.

**PubMed**

(“exercise movement techniques”[MeSH Terms] OR (“exercise”[All Fields] AND “movement”[All Fields] AND “techniques”[All Fields]) OR “exercise movement techniques”[All Fields] OR (“Pilates”[All Fields] AND “based”[All Fields] AND “exercises”[All Fields]) OR “Pilates based exercises”[All Fields]) AND (“therapy”[Subheading] OR “therapy”[All Fields] OR “treatment”[All Fields] OR “therapeutics”[MeSH Terms] OR “therapeutics”[All Fields]) AND (“low back pain”[MeSH Terms] OR (“low”[All Fields] AND “back”[All Fields] AND “pain”[All Fields]) OR

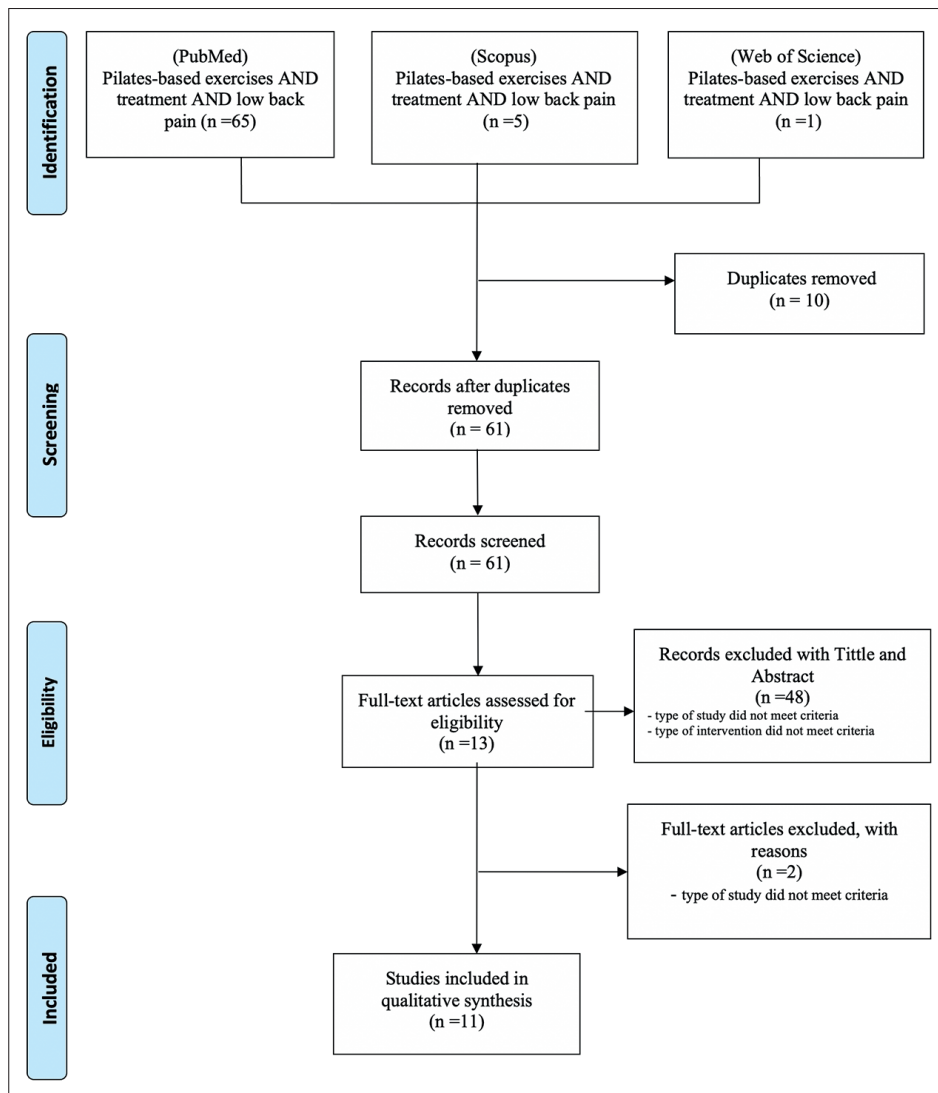


Figure 1. PRISMA<sup>5</sup> guidelines.

“low back pain”[All Fields]) AND (“review”[Publication Type] OR “review literature as topic”[-MeSH Terms] OR “review”[All Fields]).

### **Scopus**

(“Pilates-based” AND “exercises” AND “treatment” AND “low” AND “back” AND “pain” AND “”).

### **Web of Science**

Ts=(Pilates-based) AND Ts=(exercises) AND Ts=(treatment) AND Ts=(low) AND Ts=(back) AND Ts=(pain).

### **Study Selection and Eligibility Criteria**

All studies had been selected independently by two researchers (GLT and SG) who evaluated the association between the Pilates-based exercises and the reduction of the LBP. The eligibility criteria were considered according to the PICOS methodology (Population, Intervention/exposure, Comparator group, Outcome, and Study design) as follows: Population – people with LBP; Intervention/Exposure – Pilates-based exercises; Compared with no exercise and patients who only performed normal or routine health care; Outcomes – reduction pain; Study design – systematic and narrative reviews.

Articles were excluded if studies were not about the topic “Pilates-based exercises and low back pain”. All duplicate records were excluded from medical databases. References were managed using ZOTERO. Quality assessment was conducted by using a measurement tool to assess systematic reviews (AMSTAR1)<sup>6</sup>.

### **Data Extraction and Quality Assessment**

All data have been independently extracted by two different researchers (GLT and SG) who identified relevant information and rated the quality of systematic reviews using the AMSTAR tool<sup>6</sup> (Table I). Disagreements about quality were solved with a third researcher (DM). The protocol was registered on PROSPERO (CRD42021246510).

## **Results**

### **The Identification of Relevant Studies**

The electronic search initially resulted in 71 citations of which 61 remained after duplication removal. Following the screening of titles and abstracts, 48 studies have been excluded as they did not fulfill the inclusion criteria. After the full-text screening, 2 articles were removed because

the type of intervention did not meet the inclusion criteria. Finally, 11 articles were included in the umbrella review. Among these, 3 were narrative reviews<sup>2,7,8</sup> and 8 were systematic review<sup>9,10-17</sup> studies. Systematic reviews were mainly conducted using primary studies from a range of countries (Australia, Italy, Cuba, Brazil, UK, Spain), while the 3 narrative reviews included primary studies from Poland, Taiwan, and Singapore. Table I shows the summary of the characteristics of the included studies.

### **Quality Included Reviews**

Findings of the quality assessment are presented in Table I. Most systematic reviews were judged to be of high quality<sup>9,13,16,17</sup>, five were mediocre<sup>8,10,12,14,15</sup> but two of them had low quality<sup>2,7</sup>.

In a study by Eliks et al<sup>2</sup> the authors did not consider the PICO approach and any PRISMA flowchart and they just compared the previous reviews about the effectiveness of Pilates in chronic LBP.

### **Summary of Findings**

The findings from systematic reviews that we identified include studies conducted between 2008 and 2019. 50 records were excluded because they did not include special outcome trials on Pilates and patients with LBP. The studies by Kamioka et al<sup>3</sup> and Wells et al<sup>11</sup> were excluded because they were a summary of a systematic review and randomized controlled trials on Pilates exercise in people with chronic low back pain. Out of 71 studies only 11 were included in this review.

Among the 11 studies included in this umbrella review, three were narrative reviews<sup>2,7,8</sup> and were carried out in Poland<sup>2</sup> Taiwan<sup>7</sup> and Singapore<sup>8</sup>. Eliks et al<sup>2</sup> described Pilates as a type of exercises widely used in patients with Low Back Pain, with the aim of improving functional outcomes and decreasing pain in the short-term (up to 3 months). Lin et al<sup>7</sup> found that Pilates can be effective in pain reduction and functional improvement.

In 2011, Lim et al<sup>8</sup> compared disability and pain in people with persistent non-specific LBP whose problems were resolved with Pilates exercises. Results indicated that Pilates-based exercise were superior to other interventions for the reduction of their pain.

A systematic review conducted by Yamato et al<sup>9</sup> considered the effects of Pilates on patients with non-specific acute, subacute, or chronic LBP and demonstrated that its effectiveness is greater than other interventions for pain intensity and disability reduction.

**Table I.** Summary of findings and quality of evidence for all outcomes included in this umbrella review.

Authors	Country	Study design	Number of papers included	Year	Result	Quality assessment (AMESTAR)
Eliks et al <sup>2</sup>	Poland	R	3	2019	In numerous studies including reviews, a positive effect of Pilates such as reduction pain and improving functional outcomes was observed at short term (up to 3 months).	2
Yamato et al <sup>9</sup>	Australia	SR	9	2016	There is slow- to moderate-quality evidence that Pilates is more effective than minimal intervention with most of the effect sizes being considered medium for pain intensity and disability.	10
Lin et al <sup>7</sup>	Taiwan	R	8	2016	In patients with chronic low back pain, Pilates showed significant improvement in pain relief and functional enhancement. Other exercise showed effects similar to those of Pilates.	4
Patti et al <sup>12</sup>	Italy	SR	29	2015	This systematic search showed evidence that Pilates method-based exercise are more effective than no treatment or minimal physical exercise interventions in the management of chronic nonspecific low back pain.	6
Wells et al <sup>13</sup>	Australia	SR	14	2014	According to this systematic review, Pilates exercise results in statistically significant improvement in pain and functional ability in the short term compared to usual care and physical activity in people with chronic low back pain.	11
Aladro-Gonzalvo et al <sup>17</sup>	Cuba	SR	9	2013	The results of this systematic review demonstrated Pilates is moderately better than another physiotherapeutic treatment in reducing disability and provides comparable benefits to minimal intervention.	11
Miyamoto et al <sup>14</sup>	Brazil	SR	7	2013	In this systematic review displayed Pilates was better than a minimal intervention to reducing pain and disability in patients with chronic low back. Pilates was not better than other type of exercise for short-term pain reduction.	9
Pereira et al <sup>15</sup>	Brazil	SR	5	2012	This systematic review did not conclude that Pilates improves functionality and pain on patients who have low back pain.	8
Posadzki et al <sup>16</sup>	UK	SR	4	2011	The reviewed studies conclude the Pilates better therapeutic results than usual or standard care.	10
Lim et al <sup>8</sup>	Singapore	R	7	2011	The results indicated Pilates-based exercise is superior to minimal intervention for reduction of pain in individual with nonspecific low back pain.	8
La Touche et al <sup>10</sup>	Spain	SR	3	2008	The results of the studies analyzed positive effects, such as improving general functions and in reducing pain when applying the Pilates method in treating non-specific chronic low back pain in adults.	9

Patti et al<sup>12</sup> considered 29 systematic reviews and meta-analyses and randomized control trials from 2000 to 2014. 20 studies showed a positive effect on LBP. In 9 studies, pain was evaluated before and after interventions. The control group included both with and without interventions. In this systematic review, authors found Pilates method-based exercises as being more effective than other physical exercise interventions in the management of chronic non-specific LBP.

The systematic review by Wells<sup>13</sup> also showed significant improvement in pain and functional ability management. Another systematic review<sup>18</sup> demonstrated that Pilates is moderately better than other physiotherapeutic treatments in reducing disability.

Miyamoto et al<sup>14</sup> found that Pilates, compared to minimal interventions in patients with chronic low back pain, was most efficacious.

On the other hand, other reviews<sup>15,16</sup> reported that Pilates was not exactly better than other types of exercise<sup>15</sup>.

Pereira et al<sup>15</sup> compared the Pilates' method with no exercise or lumbar stabilization for pain and functionality in patients with chronic LBP. They did not find this method as able to improve functionality and reduce pain in patients who had faced LBP.

Posadzki et al<sup>16</sup> in 2011 declared that there was inconclusive evidence that Pilates method was effective in reducing pain and disability in people with chronic LBP. However, some authors<sup>2,7-10,12-17</sup> demonstrated that Pilates gives better therapeutic results than usual or standard care.

The study by La Touche et al<sup>10</sup> in 2008 showed positive effects of this method of exercises in improving muscle function and modifying pain and disability.

## Discussion

The purpose of this umbrella review was to summarize and compare systematic and narrative reviews and determining the effects of the Pilates' method exercises on patients with chronic LBP. The Pilates' method, including functional exercises, improves muscular strength and endurance<sup>18</sup>. Table I presents a summary of eleven studies. Nine of them<sup>2,7-10,12-17</sup> concluded that there were pain relief and functional progression in the short-term for chronic LBP thanks to the Pilates-based exercises. There was strong evidence that Pilates

exercises improved flexibility and dynamic balance and enhanced muscular endurance among healthy people in the short-term. Furthermore, with regard to body composition, some evidence showed that Pilates exercises in the short term can be effective in the reduction of body fat mass and increasing fat-free mass<sup>2,7-10,12,13,16,17</sup>. However, Miyamoto et al<sup>14</sup> and Pereira et al<sup>15</sup> reported that the effectiveness of Pilates-based exercise could not be authenticated.

Miyamoto et al<sup>14</sup> asserted that the Pilates' method can be recommended for the reduction of pain and disability; however, no definitive conclusion can be obtained regarding the analyzed outcomes in the medium-term. According to the evidence by Eliks et al<sup>2</sup>, most trials were carried out in small groups (up to 50 participants) with females at an average age of 40-50 years. Moreover, it has been recommended that supervised sessions should last about 60 minutes, with a frequency of two to three times a week<sup>2</sup>.

In a systematic review by Wells et al<sup>13</sup>, 14 randomized controlled trials were selected among 152 studies for the years 2005-2014. They have considered the Pilates method with minimal interventions (usual care), massage, cycling<sup>19</sup>, McKenzie<sup>20</sup> and traditional lumbar stabilization exercises<sup>21</sup>, etc. Pilates programs were performed one to three times per week, for 4-15 weeks, and the duration of each session was 30-60 min. In other study, mats and special Pilates exercises were used. The evaluation of the therapeutic program was carried out after 4-15 weeks<sup>19</sup>. Another study<sup>22</sup> was accomplished after 24 weeks. The results suggested that Pilates exercise offers a greater improvement in pain intensity and functional ability compared with usual care and physical activity minimal interventions in the short-term. However, in comparison to a massage or other forms of exercise, the Pilates method provided equivalent outcomes<sup>13</sup>.

The Cochrane systematic review by Yamato et al<sup>9</sup> included 10 randomized controlled trials from 2006 to 2014, which compared Pilates to minimal intervention comprising education, non-steroidal anti-inflammatory drugs, following daily activities, no intervention, or other types of exercises<sup>9</sup>. The Pilates program lasted from 10 to 90 days with a different number of sessions, from 6 to 30; approximately 1-hour sessions were performed 1-4 times per week. Outcome measures were recorded in the short-term (up to 3 months) and intermediate term (up to 6 months). Eventually, concerning pain



decrement, they found that the Pilates' method had resulted to be more effective than minimal intervention. Nevertheless, this review showed no conclusive evidence that Pilates was superior to other forms of exercise<sup>9</sup>.

The latest systematic review by Lin et al<sup>7</sup>, based on eight randomized controlled trials selected from 40 studies up to 2015, compared Pilates' method with minimal interventions or other forms of exercise. Patients were divided in groups: Pilates group, little or no intervention group, and usual healthcare group. Pilates exercises have been demonstrated to be useful in pain reduction and functional improvement. This improvement occurred within 12 to 24 weeks, but no clinically significant differences were found between 6 and 8 weeks<sup>7</sup>.

La Touche et al<sup>10</sup> in 2008 suggested that the Pilates method reduces pain and disability, whereas Lim et al<sup>8</sup> in 2011 reported that the Pilates' method declines pain when it is compared with minimal treatments, but not the same conclusions with disability. In contrast, Pereira et al<sup>15</sup> in 2012 concluded that the Pilates' method did not have effects on the reduction of pain and disability.

In 2011, Posadzki et al<sup>16</sup> concluded that there was inconclusive evidence that Pilates' method is effective in reducing pain and disability in people with chronic LBP. Despite this, Lim et al<sup>8</sup>, Aladro-Gonzalvo et al<sup>17</sup>, and Pereira et al<sup>15</sup> keep investigating people with non-specific LBP. In the systematic review by Patti et al<sup>12</sup>, the authors referred to all included articles that were focused on functional disability and pain. All studies were started as sessions with basic exercises, but the duration and frequency of sessions were significantly different. Therefore, results had shown that Pilates method-based exercises, were more effective than no treatment or minimal physical exercise interventions on LBP, and similar results were shown in Yamato et al<sup>9</sup>, Miyamoto et al<sup>14</sup>, and Lim et al<sup>8</sup>.

## Conclusions

According to the published literature, Pilates' method exercises represent a valid tool to improve muscular strength and endurance in people with LBP in the short-term. Moreover, it has been effective on reducing body fat mass and enhancing fat-free mass in the short-term. In addition, it may decrease pain and movement restrictions. Although the present data highlighted

the full potential and possible benefits derived by these techniques, to warrant a widespread diffusion, it would be necessary to further scientific evidence by designing and implementing research studies precisely, that can confirm the Pilates method exercise beneficial effects for patients with chronic LBP.

## Conflict of Interest

The Authors declare that they have no conflict of interests.

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## Authors' Contribution

G.L and C.C conceived of the presented idea. S.G developed the theory and performed the computations. G.L and I.B and D.M verified the analytical methods. G.L encouraged and supervised the finding of this work. All authors discussed the results and contributed to the final manuscript.

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