Effectiveness of Mat Pilates or Equipment-Based Pilates Exercises in Patients With Chronic Nonspecific Low Back Pain: A Randomized Controlled Trial

Maurício Antônio da Luz Jr, Leonardo Oliveira Pena Costa, Fernanda Ferreira Fuhro, Ana Carolina Taccolini Manzoni, Naiane Teixeira Bastos Oliveira, Cristina Maria Nunes Cabral

Background. The Pilates method has been widely used to treat patients with chronic low back pain. Pilates exercises can be performed in 2 ways: by using specific equipment or without it (also known as mat Pilates). There are no studies, however, that have compared the effectiveness of mat Pilates with that of equipment-based Pilates.

Objective. The aim of this study was to compare the effectiveness of mat Pilates and equipment-based Pilates in patients with chronic nonspecific low back pain.

Design. A 2-arm randomized controlled trial with a blinded assessor was conducted.

Setting. The study was conducted at a private physical therapy clinic in Brazil.

Patients. Eighty-six patients with chronic nonspecific low back pain participated.

Intervention. The patients were randomly allocated to 1 of 2 groups: a mat Pilates group (n=43) and an equipment-based Pilates group (n=43). The participants in both groups attended 12 Pilates sessions over a period of 6 weeks.

Measurements. The primary outcomes were pain intensity and disability. The secondary outcomes were global perceived effect, patient's specific disability, and kinesiophobia. A blinded assessor evaluated the outcomes at baseline and 6 weeks and 6 months after randomization.

Results. After 6 months, there was a statistically significant difference for disability (mean difference=3.0 points, 95% confidence interval [CI]=0.6 to 5.4), specific disability (mean difference=−1.1 points, 95% CI=−2.0 to −0.1), and kinesiophobia (mean difference=4.9 points, 95% CI=1.6 to 8.2) in favor of equipment-based Pilates. No differences were found for the remaining outcomes.

Conclusions. Equipment-based Pilates was superior to mat Pilates in the 6-month follow-up for the outcomes of disability and kinesiophobia. These benefits were not observed for pain intensity and global perceived effect in patients with chronic nonspecific low back pain.

M.A. da Luz Jr, PT, MS, Master's and Doctoral Programs in Physical Therapy, Universidade Cidade de São Paulo, São Paulo, Brazil.

L.O.P. Costa, PT, PhD, Master's and Doctoral Programs in Physical Therapy, Universidade Cidade de São Paulo, and Musculoskeletal Division, The George Institute for Global Health, Sydney, New South Wales, Australia.

F.F. Fuhro, PT, Physical Therapy Department, Universidade Cidade de São Paulo.

A.C.T. Manzoni, PT, Physical Therapy Department, Universidade Cidade de São Paulo.

N.T.B. Oliveira, PT, Master's and Doctoral Programs in Physical Therapy, Universidade Cidade de São Paulo.

C.M.N. Cabral, PT, PhD, Master's and Doctoral Programs in Physical Therapy, Universidade Cidade de São Paulo, Rua Cesário Galeno 475, São Paulo, Brazil CEP 03071-000. Address all correspondence to Dr Cabral at: cristina.cabral@unicid.edu.br.

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Chronic low back pain (ie, persistent low back pain for 3 months or longer[1]) is a significant public health problem[2–4] involving high costs with treatment.[5] A recent systematic review[6] showed that 39% of adults have had at least 1 episode of low back pain. According to the Global Burden of the Disease Study data,[7] low back pain is one of the 4 most common conditions among 291 health conditions, as well as the condition that affects more people in the world in terms of years lived with disability. One study conducted in Brazil indicated that 13.5% of the population reported chronic back problems, representing the second most common complaint among Brazilians.[8] Exercise programs are suggested by clinical practice guidelines[2,9] as an effective treatment to reduce pain intensity and short-, medium-, and long-term disability in these patients.[10]

Pilates is an exercise technique that is currently being used to treat patients with low back pain.[11–13] This traditional method, consisting of more vigorous exercises with high intensity and high level of difficulty, has undergone adaptations over time and is named "modified Pilates."[14] Modified Pilates, which consists of exercises adapted to each patient, gradually increases the difficulty level of the exercises according to the individual's abilities and characteristics.[11] Thus, the technique is now being prescribed to patients of all ages and for rehabilitation.[14]

The Pilates method is based on 6 basic principles: centering, concentration, control, precision, fluidity, and diaphragmatic breathing.[12,15] The method's main characteristic is the performance of the exercises with isometric contraction of the transversus abdominis, perineal, gluteal, and multifidus muscles during diaphragmatic breathing, known as "Powerhouse."[12,16–18] The method can be divided into mat Pilates (performed on the ground and without any special apparatus) and equipment-based Pilates (performed on machines known as Cadillac, Ladder Barrel, Step Chair, and Reformer, consisting of springs and pulleys).[18] A systematic review[19] suggests that the equipment-based exercises are safer and easier to learn and can provide a better stability to the body.

Four systematic reviews[20–23] published recently on the effectiveness of the Pilates method in the treatment of patients with chronic low back pain show conflicting results. There is evidence from these reviews that Pilates is more effective than usual care, other types of treatment for reducing pain intensity and disability, or no treatment.[20,21,23] However, 1 review observed some evidence of no reduction in pain or disability compared with usual care and other types of treatment.[22] Additionally, most clinical trials published to date have used only mat Pilates as a form of treatment.[16,17,24–28] Only 2 clinical trials proposed the combination of mat Pilates and equipment-based Pilates,[29,30] without comparing the 2 isolated forms of exercise.

The recent literature shows disagreement with regard to the evidence for Pilates in the treatment of patients with chronic low back pain, and there are no studies to date comparing mat Pilates with equipment-based Pilates. Therefore, the objective of this study was to compare the effectiveness of mat Pilates and equipment-based Pilates in order to assist physical therapists in relation to the evidence of the method and clinical decision making.

Method

Study Design

This 2-arm randomized controlled trial with a blinded assessor was conducted in Brazil. The study protocol and a detailed description of the exercises have been published elsewhere.[31]

Setting and Participants

The study was conducted at a private physical therapy clinic in Campo Limpo Paulista, São Paulo, Brazil, between October 2011 and July 2012. We selected patients from both sexes, aged 18 to 60 years, who were referred for physical therapy treatment following a medical appointment and who had experienced low back pain for more than 3 months. The exclusion criteria were: contraindication for physical exercise according to the Physical Activity Readiness Questionnaire[32]; practices Pilates regularly; pregnancy; previous spinal and lower limb surgeries; history of spinal fracture or inflammatory, rheumatic, or neurological disorders; systemic metabolic disease; nerve root compromise; tumor; infection; osteoporosis; structural deformity; inability to understand written or spoken Portuguese; and received physical therapy treatment in the previous 6 months. All participants gave written informed consent prior to the study.

Randomization and Concealed Allocation

A simple randomization schedule was performed on Microsoft Excel for Windows (Microsoft Corp, Redmond, Washington) by an independent researcher who was not involved in the recruitment of the participants or in the assessments. After the initial assessment, the participants were referred to the physical therapist in charge of the intervention and were allocated to 1 of 2 groups by means of simple randomization using sealed, opaque, and sequentially numbered envelopes. The intervention groups were: (1) a mat Pilates group, which received treatment with exercises performed on the ground using a mat, Swiss ball, and elastic bands, and (2) an

equipment-based Pilates group, which received treatment with Pilates exercises on the Cadillac, Reformer, Ladder Barrel, and Step Chair. These machines were created for providing resistance exercises with springs and pulleys, which can make the exercises easier or more difficult to execute.

Interventions

The sessions lasted 1 hour and were administered twice a week for a period of 6 weeks. The participants of both groups received an individual and supervised treatment by a Pilates-certified physical therapist with 4 years of experience. In the first session, the participants of both groups were trained to activate the Powerhouse, which represents the isometric contraction of the transversus abdominis, perineal, gluteal, and multifidus muscles during diaphragmatic breathing.[12,16–18] In the following session, all of the participants began the specific treatment for their group, recalling the activation. On average, 15 to 20 exercises were performed per session, with each exercise being repeated no more than 10 times, according to the limitations of each participant. All of the exercises were adapted and modified, being performed in 3 levels of difficulty: basic, intermediate, and advanced. For example, the "hip opener" is a basic exercise in which the patient sits with lower limbs in abduction and places 1 hand on the contralateral foot. The difficulty level of this exercise was raised by increasing the amplitude of lower limb abduction and trunk flexion until touching the contralateral foot with both hands. Similarly, the "roll up" is an advanced exercise in which the patient is placed in a supine position, flexes the spine, and contracts the abdominal muscles until the back does not touch the ground, with hands extended toward the feet. To make this exercise easier, participants were instructed to perform only the isometric contraction of the abdomen, lift the scapulae off the floor until the entire back was lifted, and touch their feet with their hands.

When adaptations were not possible, the exercise was substituted for another with a similar objective. The level of difficulty for each exercise was set according to individual needs and increased as participants learned how to perform each exercise correctly without postural compensation[25,29] and pain, by increasing, for example, the number of repetitions (to no more than 10 repetitions) as well as the range of motion for the exercise. The exercises were performed independently by each participant. The full description of the exercises used in both treatments (including the starting and final positions, number of repetitions, and a photo of each exercise) is presented in the trial protocol, which was published elsewhere.[31]

Assessment of Clinical Outcomes

The assessments were conducted at baseline and 6 weeks and 6 months after the randomization by a blinded assessor who did not know to which group each participant had been allocated. The participant had to be present for the baseline assessment; however, the following assessments were conducted by telephone. It was not possible to blind the participant and the physical therapist due to the interventions.

The primary outcomes, as described in the protocol,[31] were pain intensity and disability measured at 6 weeks and 6 months after randomization. Pain intensity was assessed with the 11-point Pain Numerical Rating Scale,[33] where 0 is "no pain" and 10 is "pain as bad as could be." The participants rated their average pain intensity in the previous 7 days. Disability was assessed using the Roland-Morris Disability Questionnaire,[34] which contains 24 "yes/no" questions related to normal activities of daily living, and each affirmative answer equals 1 point. The final score was calculated by adding up the points. The higher the score is, the greater the disability.

The secondary outcomes also described in the protocol[31] were global perceived effect, the patient's specific disability, and kinesiophobia measured at 6 weeks and 6 months after randomization. The global perceived effect was assessed using the Global Perceived Effect Scale,[35] an 11-point numerical scale in which −5 represents "vastly worse," zero is "no change," and 5 is "completely recovered." On this scale, the higher the score is, the greater the recovery from the condition. The specific disability was assessed with the Patient-Specific Functional Scale,[36] in which the participants identified 3 significant activities that are difficult to perform or that they are unable to perform due to chronic low back pain and then rated on an 11-point scale how capable they felt to perform the identified activities, with 0 being "unable to perform the activity" and 10 being "able to perform the activity at preinjury level." The final score is the mean of the 3 ratings, and the higher the score is, the greater the specific disability. Kinesiophobia was assessed with the Tampa Scale for Kinesiophobia, which consists of a 17-item questionnaire. The items vary from 1 to 4 points, with 1 point for "strongly disagree," 2 points for "partially disagree," 3 points for "partially agree," and 4 points for "strongly disagree." For the total score, it was necessary to invert the scores of questions 4, 8, 12, and 16. The final score can vary from 17 to 68 points, and the higher the score is, the greater the degree of kinesiophobia.

All scales were cross-culturally adapted and clinimetrically tested in

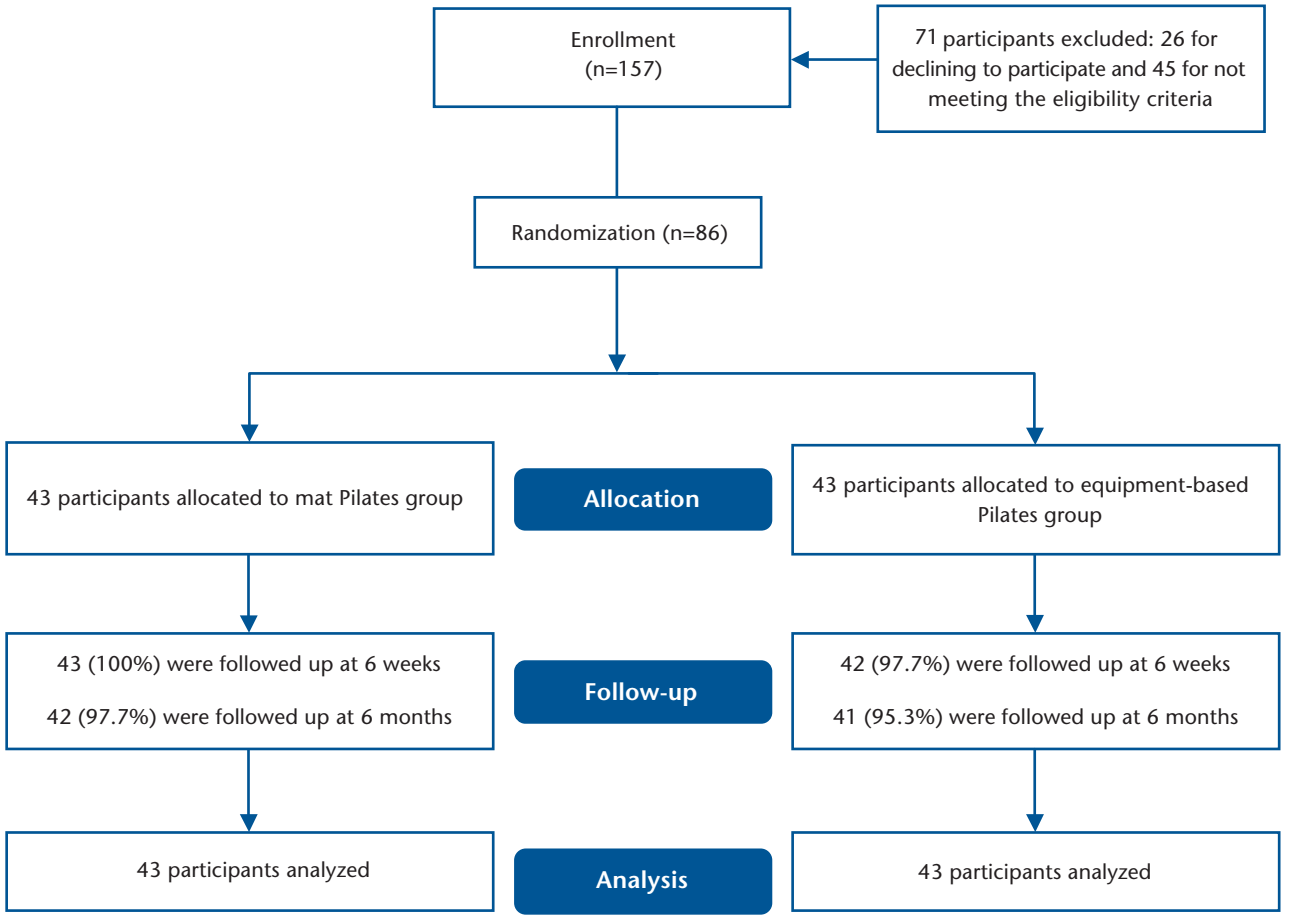

Figure.
Flow diagram of participants through the study.

a Brazilian population.[37–41] Before the first treatment sessions, the Expectancy for Improvement scale was used to measure the participant's expectation regarding treatment in the mat Pilates group or the equipment-based Pilates group. This scale is an 11-point numerical scale, where 0 represents "no expectancy for improvement" and 10 represents "expectancy for the greatest possible improvement." Immediately after the first session, the Treatment Credibility scale[42] was used. This scale consists of 4 questions that assess the individual's degree of confidence that symptoms will improve and his or her confidence in the proposed treatment. The scores vary from 0 to 6, with 0 being "not at all confident" and 6 being "very confident."

Data Analysis

The study was designed to detect a difference of 1 point in pain intensity in the Pain Numerical Rating Scale[33] (estimate for standard deviation=1.4 points), 1 point in the Patient-Specific Functional Scale[36] (estimate for standard deviation=1.4 points), 1 point in the Global Perceived Effect Scale[35] (estimate for standard deviation=1.3 points), and 4 points in the Roland-Morris Disability Questionnaire[34] (estimate for standard deviation=4.9 points). The following specifications were considered: α=.05, statistical power of 80%, and follow-up loss of 15%. The sample calculation determined a sample of 86 participants.

The data were double entered, and the analysis followed the intention-to-treat principles. The significance level was set at 5% for the entire statistical analysis. In the between-group analysis, the effects of the intervention were calculated using linear mixed models that consider the treatment groups, time, and interaction terms between treatment groups versus time. For this analysis, all mean differences were adjusted for dependency multiple time points (including baseline estimates). Unadjusted effect sizes and their 95% confidence intervals (95% CIs) also were calculated. In the within-group anal-

ysis, the outcomes of pain intensity, general and specific disability, global perceived effect, and kinesiophobia were compared using the Student *t* test for dependent samples. The analyses related to the Treatment Credibility and Expectancy for Improvement scales was performed using the Student *t* test for independent samples. The data were analyzed using the SPSS Statistics for Windows version 19 software package (SPSS Inc, Chicago, Illinois) by a blinded statistician who received the coded data.

Role of the Funding Source

This study was supported by National Council of Technological and Scientific Development (CNPq), Brazil (479645/2011-6).

Results

One hundred fifty-seven patients with chronic low back pain were referred to the physical therapy clinic between October 2011 and May 2012 (Figure). Of these patients, 71 were excluded: 26 did not agree to participate, and 45 did not meet the eligibility criteria (13 exercised regularly, 17 were over 60 years of age, 11 had serious spinal pathologies, and 4 had undergone back surgery).

The sample's demographic characteristics are described in Table 1. The groups were composed mainly of women with a mean age of 40 years. In the mat Pilates group, 41.9% of the participants had undergone physical therapy treatment previously, and the main treatment was electrotherapy (77.8%). In the equipment-based Pilates group, 23.3% had undergone prior physical therapy treatment, and 50% of them received electrotherapy.

Regarding the use of medication, 48.8% of the participants in the mat Pilates group used medication at baseline, of whom 33.3% used analgesics, 23.8% used anti-inflammatories, and 42.9% used muscle relaxants. In the equipment-based Pilates group, 51.2% used medication at baseline, of whom 9.1% used analgesics, 50% used anti-inflammatories, and 40.9% used muscle relaxants.

A total of 516 treatment sessions were provided. In the mat Pilates group, 48 absences were recorded (mean of attended sessions per participant=10.8, SD=2.1), representing an attendance rate of 91.4% of the given sessions. In the equipment-based Pilates group, 30 absences were recorded (mean of attended sessions per participant=11.3, SD=1.6), representing an attendance rate of 94.2% of the sessions. Additionally, 1 participant in the mat Pilates group had dropped out in the 6-week follow-up, and 1 participant in the mat Pilates group and 2 par-

Table 1.
Baseline Characteristics of the Participants[a]

Variable	Mat Pilates Group (n=43)	Equipment-Based Pilates Group (n=43)
Age (y)	43.5 (8.6)	38.8 (9.9)
Sex		
Male	9 (20.9)	11 (25.6)
Female	34 (79.1)	32 (74.4)
Low back pain duration (mo)	48.0 (96.0)	36.0 (48.0)
Weight (kg)	71.5 (13.1)	74.1 (12.5)
Height (m)	1.6 (0.1)	1.7 (0.1)
Body mass index (kg/m^2)	27.0 (4.6)	26.9 (4.2)
Marital status		
Single	10 (23.3)	8 (18.6)
Married	28 (65.1)	33 (76.7)
Divorced	3 (7.0)	2 (4.7)
Widowed	2 (4.7)	0 (0)
Educational level		
Primary education	15 (34.9)	12 (27.9)
Secondary education	18 (41.9)	22 (51.2)
Tertiary education	10 (23.3)	9 (20.9)
Income (in Brazilian minimum wages)	4.7 (3.9)	4.9 (2.8)
Physical therapy treatment		
Yes	18 (41.9)	10 (23.3)
Other type of treatment		
Yes	1 (2.3)	0 (0)
Use of medication		
Yes	21 (48.8)	22 (51.2)
Pain intensity (0–10 points)	6.4 (2.1)	5.5 (2.3)
Disability (0–24 points)	10.8 (5.4)	10.2 (5.6)
Patient-specific disability (0–10 points)	4.9 (2.3)	4.8 (1.9)
Global impression of recovery (−5 to 5 points)	−1.6 (2.2)	−1.0 (2.6)
Kinesiophobia (17–68 points)	39.7 (8.1)	39.6 (8.0)

[a] The categorical variables are expressed as n (%), and the continuous variables are expressed as mean (SD). The duration of low back pain is expressed as median (interquartile range).

Table 2.
Expectancy for Improvement and Treatment Credibility[a]

Expectancy for Improvement (0–10)	Mat Pilates Group (n=86)	Equipment-Based Group (n=86)	*P*
	8.9 (1.5)	9.0 (1.5)	.09
Treatment Credibility	**Mat Pilates Group (n=42)**	**Equipment-Based Group (n=41)**	
How confident do you feel that this treatment can help to relieve your pain? (0–6 points)	5.3 (1.1)	5.4 (0.9)	.54
How confident do you feel that this treatment will help you manage your pain? (0–6 points)	5.4 (0.8)	5.5 (0.8)	.63
How confident would you be in recommending this treatment to a friend who has similar complaints? (0–6 points)	5.6 (0.9)	5.7 (0.6)	.34
How logical does this therapy seem to you? (0–6 points)	5.7 (0.6)	5.8 (0.5)	.58

[a] Data are expressed as mean (SD).

ticipants in the equipment-based Pilates group had dropped out in the 6-month follow-up. These values represent a high adherence to treatment as well a low dropout rate. No adverse events were observed during the intervention period.

The means and standard deviations of the Expectancy for Improvement scale and the Treatment Credibility scale are shown in Table 2. There were no between-group differences. Table 3 presents the results of within-group analyses, and Table 4 presents the between-group differences, including the effect sizes with their 95% CI values. In the within-group comparison, the results showed a significant difference for all outcomes ($P<.01$) except for kinesiophobia in the mat Pilates group in the 6-month follow-up. In the between-group comparison, the results showed no significant difference for any of the outcomes in the 6-week follow-up. In the 6-month follow-up, there was a significant difference, with greater improvement in the equipment-based Pilates group for the outcomes of disability (mean difference=3.0 points, 95% CI=0.6 to 5.4), specific disability (mean difference=−1.1 points, 95% CI=−2.0 to −0.1), and kinesiophobia (mean difference=4.9 points, 95% CI=1.6 to 8.2).

Discussion

This is the first randomized controlled trial comparing mat Pilates with equipment-based Pilates in patients with nonspecific low back pain. Six weeks after treatment, there was no significant difference between the groups for any of the assessed outcomes. However, the results can be considered clinically significant for both groups, given that the difference between the means before and 6 weeks after treatment for the primary outcomes of pain and disability were greater than the values considered clinically significant for patients with nonspecific low back pain.[43] Six months after randomization, there was a significant improvement for the outcomes of disability, specific disability, and kinesiophobia in the group treated with equipment-based Pilates.

These results can be generalized for patients with characteristics similar to those of the participants of this study (ie, patients with long-term, nonspecific chronic low back pain who sought treatment and were referred for physical therapy, a typical situation in health services in Brazil). Regarding treatment, we consider that the Pilates method was well conducted, as the number of sessions and the duration of each session were the same for both groups. The exercises were designed and published previously,[31] which allows other physical therapists with Pilates training to reproduce this treatment. Additionally, the exercises were chosen with the same objective in both the mat Pilates group and the equipment-based Pilates group.

One of the strong points of this study was participant recruitment, considering that the studies that recruit patients seeking treatment for low back pain demonstrate results that are more representative of the population than studies that recruit patients from the community.[44] The limitation of our study was that the therapist and the patients were not blinded to group allocation. This was a relative limitation, as it is not possible to blind therapists and patients in a randomized controlled trial with exercises. Thus, there are no studies in the literature that include blinded therapists or patients using exercise as a form of treatment. One way to minimize the effect of not blinding the patient was to include in the study only participants who had not used the Pilates method. That also may explain the fact that no significant differences were found in treatment credibility and expectancy for improvement between the groups.

No significant difference was found for pain intensity in the short to medium term (6 weeks and 6 months after randomization, respectively). A possible interpretation for this result is that the exercises chosen for both the mat Pilates and equipment-based Pilates groups activated the deep lower back muscles in a similar way, taking into account stretching and muscle strengthening. Studies that compared back stabilization exercises with conventional exercises in the treatment of patients with nonspecific chronic low back pain also have not shown significant differences for pain.[45,46] One study that compared the Pilates method with conventional exercises did not show any significant difference for pain and disability in the short to medium term.[30] Therefore, it is probably more difficult to observe significant differences for pain when the study is designed with both treatment groups performing active exercise.

With regard to disability, the results were favorable in the medium term for the equipment-based Pilates group, possibly because the exercises on machines facilitate learning and performance due to better stabilization.[19] The recommendations of the American College of Sports Medicine[19] point out these advantages in weight training equipment, which also may be the case of Pilates equipment, as both have pulleys, appropriate places to perform the exercise (eg, seats, rests, handles), and resistance controlled by springs or weights. Another factor that may be related to this result is the placebo effect inherent in the use of equipment. One study that analyzed this effect in clinical trials showed that the use of equipment or devices, confidence in the treatment technique, and the use of high technology can maximize the placebo effect.[47] This effect also may have occurred in the equipment-based

Table 3.
Within-Group Differences at Baseline and 6-Week and 6-Month Follow-ups[a]

Outcome	Interventions						Within-Group Differences			
	Baseline		6-Week Follow-up		6-Month Follow-up		Baseline to 6-Week Follow-up (95% CI)		Baseline to 6-Month Follow-up (95% CI)	
	Mat Pilates Group $\bar{X}$ (SD)	Equipment-Based Pilates Group $\bar{X}$ (SD)	Mat Pilates Group $\bar{X}$ (SD)	Equipment-Based Pilates Group $\bar{X}$ (SD)	Mat Pilates Group $\bar{X}$ (SD)	Equipment-Based Pilates Group $\bar{X}$ (SD)	Mat Pilates Group	Equipment-Based Pilates Group	Mat Pilates Group	Equipment-Based Pilates Group
Pain (0–10 points)	6.4 (2.1)	5.5 (2.3)	3.5 (2.6)	2.4 (2.5)	4.8 (2.7)	4.0 (3.0)	2.9[b] (1.8 to 4.0)	3.1[b] (2.3 to 3.9)	1.6[b] (0.7 to 2.6)	1.5[b] (0.4 to 2.6)
Disability (0–24 points)	10.8 (5.4)	10.2 (5.6)	3.4 (3.1)	3.8 (5.1)	7.8 (6.1)	4.1 (4.9)	7.4[b] (5.6 to 9.3)	6.4[b] (4.6 to 8.1)	3.2[b] (1.2 to 5.2)	5.9[b] (4.4 to 7.4)
Patient-specific disability (0–10 points)	4.9 (2.3)	4.8 (1.9)	7.5 (2.1)	7.6 (1.8)	6.2 (2.9)	7.3 (2.1)	−2.6[b] (−3.3 to −1.9)	−2.7[b] (−3.4 to −2.0)	−1.4[b] (−2.1 to −0.8)	−2.4[b] (−3.2 to −1.6)
Global impression of recovery (−5 to +5 points)	−1.6 (2.2)	−1.0 (2.6)	3.1 (1.8)	3.6 (1.9)	0.7 (3.2)	2.5 (2.4)	−4.7[b] (−5.5 to −3.8)	−4.5[b] (−5.3 to −3.7)	−2.4[b] (−3.5 to −1.3)	−3.6[b] (−4.5 to −2.7)
Kinesiophobia (17–68 points)	39.7 (8.1)	39.6 (8.0)	35.3 (6.6)	34.1 (7.8)	40.0 (9.9)	34.9 (7.9)	4.4[b] (2.4 to 6.5)	5.1[b] (2.3 to 8.0)	−0.3 (−2.5 to 2.0)	4.4[b] (1.5 to 7.3)

[a] 95% CI=95% confidence interval.
[b] Significant difference within groups ($P<.01$).

Table 4.
Between-Group Differences at Baseline and 6-Week and 6-Month Follow-ups[a]

Outcome	Between-Group Differences			
	Adjusted Mean Difference (95% CI)		Unadjusted Effect Size (95% CI)	
	Baseline to 6-Week Follow-up	Baseline to 6-Month Follow-up	6-Week Follow-up	6-Month Follow-up
Pain (0–10 points)	0.3 (−1.1 to 1.7)	−0.1 (−1.5 to 1.3)	0.4[b] (0.0 to 0.9)	0.3 (−0.2 to 0.7)
Disability (0–24 points)	−1.0 (−3.4 to 1.4)	3.0[b] (0.6 to 5.4)	−0.1 (−0.5 to 0.3)	0.7[b] (0.2 to 1.1)
Patient-specific disability (0–10 points)	−0.1 (−1.1 to 0.9)	−1.1[b] (−2.1 to −0.1)	−0.1 (−0.5 to 0.4)	−0.4 (−0.9 to 0.0)
Global impression of recovery (−5 to +5 points)	0.1 (−1.1 to 1.4)	−1.2 (−2.4 to 0.1)	−0.3 (−0.7 to 0.2)	−0.6[b] (−1.1 to −0.2)
Kinesiophobia (17–68 points)	0.8 (−2.5 to 4.1)	4.9[b] (1.6 to 8.2)	0.2 (−0.3 to 0.6)	0.6[b] (0.1 to 1.1)

[a] 95% CI=95% confidence interval. Primary outcomes are highlighted in gray.
[b] Significant difference within groups ($P<.05$).

Pilates group, considering that the exercises were performed on machines, including the Reformer with springs. It is possible that these benefits also affected kinesiophobia, as exposure to the exercises can reduce the patients' fears concerning their problem.[48] If this exposure is facilitated by the stabilization and ease provided by the machines, there may be a greater reduction in the fear of movement.

Other studies using the Pilates method for chronic nonspecific low back pain are available in the literature. Miyamoto et al[26] found significant short-term reduction in pain and disability in the group that received a minimal intervention using mat Pilates; however, no difference was found in the medium term. Rydeard et al[29] found a significant difference in the short and medium term for pain and disability in the group that received an intervention using mat Pilates combined with the Reformer compared with a group that received normal treatment (eg, medical appointment and other specialists when necessary). The results of these studies[26,29] are similar to those of the present study with regard to disability. The difference in the results for pain may have occurred because the abovementioned studies compared the Pilates method with minimal intervention or a control intervention and not with another form of exercise.

Current studies favor the hypothesis that Pilates exercises are more effective than a minimal intervention or a control intervention in the treatment of people with chronic low back pain. Our results suggest that equipment-based Pilates can be more effective than mat Pilates because it maintains the medium-term effect for disability and kinesiophobia. However, as the results after treatment showed no statistically significant difference for outcomes, we suggest that physical therapists should consider the patient's preferences in the prescription of Pilates exercises performed on the ground or equipment. We recommend that future studies should conduct a parallel economic evaluation analysis, the results of which will help the choice of one of the techniques of Pilates exercises in clinical practice.

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