CRITICALLY APPRAISED TOPIC

FOCUSED CLINICAL QUESTION

For an adult patient with chronic, nonspecific low back pain is Pilates exercise effective in reducing pain?

AUTHOR

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CLINICAL SCENARIO

In my orthopaedic outpatient clinical rotation one of my patients was a middle-aged female who complained of chronic low back pain that had no specific cause. I cannot remember the exact onset of her back pain, but I am pretty sure it had been a couple of months. She had 4 children, she was a widow, and her hobbies included taking care of her children, and cleaning and fixing up her house. The patient mentioned she used to be more active, and used to enjoy yoga classes. Some basic yoga and mat Pilates exercises were performed, and she responded very well to these exercises. As a clinician, I want to make my time with my patients the most effective and efficient and personally meaningful. For this scenario, knowing if I should use my Pilates training or choose another form of exercise to treat my patient would be beneficial in providing the best quality of care.

SUMMARY OF SEARCH

[Best evidence appraised and key findings]

Eleven studies were located that met my inclusion and exclusion criteria, including 9 randomized controlled trials, 1 systematic review of randomized controlled trials, and 1 delphi study of expert opinions. Three studies were reviewed in detail.

Clinically and statistically Pilates can improve chronic nonspecific low back pain in comparison to no exercise. Unfortunately, there is no high quality evidence that Pilates is better than other forms of exercise. The types of Pilates performed, mat-based or equipment-based, should be based off of patient's preferences as there is no conclusive evidence that states one type is superior.

CLINICAL BOTTOM LINE

Current best evidence suggests that Pilates can result in greater pain reduction than minimal intervention. Patients who completed Pilates biweekly for 3 months demonstrated significant reductions in low back pain and function. The type of pilates chosen, mat-based or equipment-based should be based off of patient's preferences because currently there is no strong evidence that one is better than the other. Pilates delivered through a Pilates certified Physical Therapist is an appropriate and safe alterative to general exercise. Further high quality studies with large sample sizes, long-term follow-ups, and economic evaluations are required to further study the effects of Pilates on chronic, nonspecific low back pain in this population.

This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor

SEARCH STRATEGY

Terms used to guide the search strategy			
Patient/Client Group	**I**ntervention (or Assessment)	**C**omparison	**O**utcome(s)
Chronic Constant Recurren* Non-specific Nonspecific General Low back pain Lower back pain Low backache Lumbago	Pilates "Pilates training" "Pilates-based exercise" "Pilates-based physical therapy"	N/A	Pain Ache

Final search strategy:

PubMed:

1. (Chronic OR constant OR recurren*) AND (Non-specific OR nonspecific) AND (Low back pain OR lower back pain OR low backache OR lumbago) (n=892)
2. (Chronic OR constant OR recurren*) AND (Non-specific OR nonspecific) AND (Low back pain OR lower back pain OR low backache OR lumbago) Filters: human, English, adult 19-64 years (n= 444)
3. (Chronic OR constant OR recurren*) AND (Low back pain OR lower back pain OR low backache OR lumbago) Filters: human, English, adult 19-64 years (n= 5143)
4. Pilates OR "pilates training" OR "pilates-based exercise" OR "pilates-based physical therapy" Filters: human, English, adult 19-64 years (n= 85)
5. #2 AND #4 (n =7)
6. #3 AND #4 (N=12)

Databases and Sites Searched	**Number of results**	**Limits applied, revised number of results (if applicable)**
PubMed	**33**	**12**- apply filters human, English, aged 19-64 years
CINAHL	**42**	**8**- apply filters English, aged 19-64 years
Embase	**45**	**19**- apply filter adult and middle age

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria
• English publications • Publications that are applicable to my focused clinical question • Published between 2000 to present • Systematic reviews, randomized control trails, and non-randomized trials.
Exclusion Criteria
• Non-English publications • Published before 2000 • Case reports • Studies that do not relate to Pilates exercise, the population, or the outcome of concern

RESULTS OF SEARCH

Summary of articles retrieved that met inclusion and exclusion criteria

Author (Year)	Study quality score	Level of Evidence	Study design
Yamato (2015)[1]	**11/11 Amstar**	**1a**	**Systematic Review**
Antonio da Luz (2014)[2]	**9/11 Pedro**	**1b**	**Randomized control trial**
Natour (2015)[3]	**9/11 Pedro**	**1b**	**Randomized control trial**
Wajswelner (2012)[4]	**9/11 Pedro**	**1b**	**Randomized control trial**
Wells (2014)[5]	**17/32 COREQ**	**4**	**Delphi survey/Expert opinion**
Miyamoto (2011)[6]	**9/11 Pedro**	**1b**	**Randomized control trial**
Gladwell (2006)[7]	**6/11 Pedro**	**1b**	**Randomized control trial**
Notarnicola (2014)[8]	**15/27 Downs & Black**	**2a**	**Non-randomized control trial**
Donzelli (2006)[9]	**7/11 Pedro**	**1b**	**Randomized control trial**
Rydeard (2006)[10]	**9/11 Pedro**	**1b**	**Randomized control trial**

BEST EVIDENCE

The following 3 studies were identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting these studies were:

- **Yamato (2015)[1]** – this is a systematic review of randomized controlled trails (level 1a evidence) on the effects of Pilates for low back pain. This is the highest ranked article I found, and on the Amstar scale this review was given an 11/11 based on my appraisal. The provided review information adequately answered my PICO question, and is relevant to my patient.
- **Antonio da Luz (2014)[2] –** this study is a randomized controlled trial (level 1b evidence) that compares the effectiveness of mat-based Pilates and equipment-based Pilates on reducing chronic, nonspecific low back pain. On the PEDro scale this study was given a 9/11 based on my appraisal, making it one of the highest quality RCTs on my list. It is important to know the research behind the different styles of Pilates in order to make the most appropriate decision for my patient.
- **Natour (2015)[3]** – this study is a randomized controlled trial (level 1b evidence) that assessed the effectiveness of the Pilates method on pain, function, and quality of life among adult patients with chronic non-specific low back pain. On the PEDro scale this study was given a 9/11 based on my appraisal, also making it one of the highest quality RCTs on my list. This study also provides information that is appropriate for my patient.

SUMMARY OF BEST EVIDENCE

(1) Description and appraisal of "Pilates for low back pain (Review)" by Yamato, TP, et al (2015). [1]

Aim/Objective of the Study/Systematic Review:
The purpose of this systematic review was to evaluate the effectiveness of the Pilates method in reducing low back pain (non-specific acute, subacute, and chronic non-specific). Also, this review compared the Pilates method to other interventions, placebo, and no intervention.[1 (3)]
Study Design [e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant] Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.
• This systematic review pooled data from eligible randomized control trials that "examined the effectiveness of Pilates intervention in adults with acute, subacute, or chronic non-specific low back

pain."[1(3)]

- **Search Strategy: [1(11)]** The randomized controlled trials were searched from the following databases from the date of their inception to March 2014: CENTRAL, MEDLINE, MEDLINE In-process and Other Non-Indexed Citations, EMBASE, CINHAHL, PEDro, and SPORTDiscus. Reference lists of eligible papers and trial registry websites (ANZCTR, mRCT, ReBEC, and WHO ICTRP) were also searched. The review provided 7 appendices that listed the detailed keywords used.
- **Selection Criteria: [1(11)]** The selection committee consisted of 2 pairs of authors (CMNC and LCMS, BTS and TPY) that "independently screened titles and abstracts for potentially eligible studies."[1(7)] Cristina MN Cabral (CMNC) and Luciola C Menezes Costa (LCMS) are in the Masters and Doctoral Programs in Physical Therapy at the Universidade Cidade de São Paulo in Brazil. Bruno T Saragiotto (BTS) and Tie P Yamato (TPY) work in the musculoskeletal division at The George Institute for Global Health at University of Sydney in Sydney, Australia. Disagreements between the authors were dissolved by a 3rd review author (LOPC or CM). Leonardo OP Costa (LOPC) is on the faculty of medicine at The George Institute for Global Health at University of Sydney in Sydney, Australia. Christopher G Maher (CM) works in the musculoskeletal division at The George Institute for Global Health at University of Sydney in Sydney, Australia.
- **Data Collection:** BTS and TPY extracted the following data from each of the eligible papers: bibliometric data, study characteristics, characteristics of the participants, description of the interventions including dose and co-interventions, duration of follow-up assessments, outcomes assessed, study results and time periods for outcomes assessment.[1 (11)] To quantify the treatment effects of the continuous outcome measures (pain intensity, disability, quality of life) mean difference (MD) was used.[1(12)] They turned all of these outcome scales into a common 0 to 100 scale."[1(12)]." The following subgroups were created: types of control groups, duration of follow-up, and risk of bias.[1(13)] The types of control groups were divided into 2 groups: minimal intervention or other intervention.[1(13)] Duration of follow-up was divided into short-term, intermediate-term and long-term.[1(13)] Risk of bias was divided into low and high risk of bias.[1(13)]
- **Meta-analysis:** The "pooling of the data was dependent on the level of statistical heterogeneity."[1(12)] They "combined results in a meta-analysis using random-effects model if the I^2 value was less than 50%.[1(12)] If substantial statistical heterogeneity was present," they did not "quantitatively pool the results but presented them as a narrative synthesis."[1(12)]
- **Publication Bias:** The 'Risk of bias' assessment tool, recommended by The Cochrane Collaboration and the Cochrane Back Review Group was used to assess the risk of bias in the included studies. The review did not assess "publication bias with funnel plots because too few studies were included in the meta-analysis."[1(18)]
- **Test for Heterogeneity:** Heterogeneity was assessed by "visual inspections of the forest plots" and by a chi-square test.[1 (12)]

Setting

- Community advertisements and primary or tertiary care in Australia, South America, Europe, or Asia. Two studies did not list the setting.

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

In this systematic review, 9 studies yielded 478 participants. Most of the participants were "middle aged (mean age = 38 years old) ranging from 22 to 50 years of age."[1(15)] "Two trials included only women participants, and the rest of the trails included both men and women."[1 (15)] "All trials included exclusively chronic participants (low back pain persisting for 12 weeks or more), except for one trial that included participants with LBP for at least six weeks."[1(15)]

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control

The Pilates "untrained'" group who received no intervention, minimal intervention, or another type of exercise.

Experimental

The Pilates "trained" group performing the Pilates method. The Pilates method was described as a "comprehensive body conditioning, which aims to develop better body awareness and improve posture."[1(9)] The following were listed as the six basic principles of the Pilates method: centering, concentration, control, precision, flow, and breathing in coordination with the exercises.[1 (9)] Duration of the Pilates treatment programs

varied between studies, ranging from 10 days to 90 days.[1 (15)] The mean number of sessions in the Pilates program was 15.3, "ranging from 6 to 30 sessions."[1(15)] For all studies the sessions lasted about 1 hour.[1 (15)]

Outcome Measures (Primary and Secondary)

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

Primary Outcomes

- **Pain intensity:** This was measured in all 9/9 studies. All studies measured pain intensity with a visual analogue scale (VAS) or numerical rating scale (NRS), with the exception of one study that used the 0-5 point Roland Morris pain rating visual analogue scale (RMVAS). [1(15)] The systematic review converted all of the scales to a 0-100 point scale.[1 (15)]
- **Disability:** This was measured in 7/9 studies. The Roland Morris Disability Questionnaire was used for 3 studies, the Ostwestry Disability Index was used for 3 studies, and the Quebec Disability scale was used for the 7th study.[1 (16)] The systematic review converted all of these scales to a 0-100 point scale.[1 (16)]
- **Global Impression of Recovery:** This was measured in 1/9 studies.[1 (15)] This was measured using the Global Perceived Effect Scale.[1 (15)]
- **Quality of Life:** This was measured in 2/9 studies.[1(15)] This was measured using the SF-36.[1(15)]

Secondary Outcomes

- **Function:** This was measured in 2/10 studies.[1(15)] This was measured using the Patient Specific Functional Scale.[1(15)]
- **Follow-up:** Short-term follow-up was measured in 9/9 studies.[1(15)] Short-term follow-ups "varied from 4 to 8 weeks."[1(15)] Intermediate follow-up was measured in 3/9 studies.[1(15)] Intermediate follow-up varied from 3 to 6 months.[1(15)] None of the studies included any follow-up past 6 months.[1(15)]

Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under 'critical appraisal' on next page]

- **Subgroup analysis:**
  - **Pilates vs. minimal intervention short-term follow-up:** [1(6-8)]
    - There is low quality of evidence that Pilates improves pain compared with minimal intervention, with a medium effect size (mean difference (MD) -14.05, 95% confidence interval (CI) -18.91 to -9.91; P value < 0.001).
    - There is low quality of evidence that Pilates improves disability compared with minimal intervention, with a small effect size (MD -7.95, 95% CI -13.23 to -2.67; P value = 0.003)
    - There is low quality of evidence that Pilates improves function compared with minimal intervention with a small effect size (MD 1.10, 95% CI 0.23 to 1.97)
    - There is low quality of evidence that Pilates improves global impression of recovery compared with minimal intervention with a small effect size (MD 1.50, 95% CI 0.70 to 2.30)
  - **Pilates vs. minimal intervention intermediate follow-up:**[15(6-8)]
    - There is moderate quality of evidence that Pilates improves pain compared with minimal intervention, with a medium effect size (MD -10.54, 95% CI -18.46 to -2.62).
    - There is moderate quality of evidence that Pilates improves disability compared with minimal intervention, with a medium effect size (MD -11.17, 95% CI -18.41 to -3.92)
    - There is low quality of evidence that Pilates does not improve function compared with minimal intervention with no statistically or clinically significant MD (MD 0.80, 95% CI -0.00 to 1.60)
    - There is low quality of evidence that Pilates does not improve global impression of recovery compared with minimal intervention with no statistically or clinically significant MD (MD 0.70, 95% CI -0.11 to 1.51)
  - **Pilates vs. other exercise short-term follow-up:** [1(21-23)]
    - Due to low quality of evidence and heterogeneity of trials the effect of Pilates on pain was not estimated (I^2 = 74%)
    - There is moderate quality of evidence that Pilates does not improve disability compared other exercises with no statistically or clinically significant MD (MD -3.29, 95% CI -6.82 to 0.24)
    - There is low quality of evidence that Pilates does not improve function compared with other exercises with no statistically or clinically significant MD (MD 0.10, 95% CI -2.44 to 2.64)
  - **Pilates vs. other exercise intermediate follow-up:** [1(21-23)]
    - Due to low quality of evidence and heterogeneity of trials the effect of Pilates on pain was not estimated (I^2 = 86%)

        - There is moderate quality of evidence that Pilates does not improve disability compared other exercises with no statistically or clinically significant MD (MD -0.91, 95% CI -5.02 to 3.20)
        - There is low quality of evidence that Pilates improves function compared with other exercises with a small effect size (MD -3.60, 95% CI -7.00 to -0.20)
- **Test of Heterogeneity**
    - For the studies included in the subgroup of Pilates vs. minimal intervention, short-term follow-up, pain outcome, the test for heterogeneity showed P= 0.38 (df= 5) and I^2= 6% which suggests low heterogeneity.
    - For the studies included in the subgroup of Pilates vs. minimal intervention, intermediate follow-up, pain outcome, the test for heterogeneity showed P= 0.34 (df= 1) and I^2=0% which suggests low heterogeneity.
    - For the studies included in the subgroup of Pilates vs. minimal intervention, short-term follow-up, disability outcome, the test for heterogeneity showed P= 0.06 (df= 4) and I^2= 56% which suggests substantial heterogeneity.
    - For the studies included in the subgroup of Pilates vs. minimal intervention, intermediate follow-up, disability outcome, the test for heterogeneity showed P= 0.44 (df= 1) and I^2= 0% which suggests low heterogeneity.

Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

- The author found no high quality evidence that supported pilates compared to minimal intervention or to other exercises. The author did find "low to moderate quality evidence that Pilates is more effective than minimal intervention for pain and disability."[1(4)] This is "primarily because there are only a few small studies (range 17 to 87 participants)."[1(24)]
- The author found a small effect when Pilates was compared to other exercises at intermediate follow-up.[1 (4)]
- Overall, the author found some evidence for the effectiveness Pilates for low back pain, but there is "no conclusive evidence that it is superior to other forms of exercise."[1(4)]
- The author recommended that the decision to use Pilates for low back pain should be based on the "patient's or care provider's preferences, and costs."[1(4)]

Critical Appraisal

Validity

[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]

Comment on missing information in original paper.

For this systematic review I used the tool "Assessment of Multiple Systematic Reviews" (AMSTAR). The score for this paper was 11/11. One strength of this review was that all included studies were limited to randomized control trials that were evaluated by a selection committee. The authors performed a comprehensive electronic search using the search strategies by the Cochrane Back Review Group.[1 (11)] Each study was assessed for quality using the GRADE approach, which is recommended in the "*Cochrane Handbook for Systematic Reviews of Interventions* and adapted in the updated Cochrane Back Review Group method guidelines."[1(12)] These quality results were listed in the study. The review's method for searching, selecting, and appraising was clearly addressed and could be reproducible. Statistical information was provided regarding effect size for all outcome measures. The review also looked at heterogeneity of all subgroups, and only included studies that were homogeneous into the meta-analysis.

Interpretation of Results

[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean.

- In the pooled data for Pilates vs. minimal intervention for pain outcome, short-term follow-up, the random effects model forest plot shows a favourable effect for the Pilates intervention in decreasing low back pain. However, confidence intervals of 2/6 studies crossed 1 indicating no difference between Pilates and minimal intervention. Also, all studies had very small squares indicating the studies had small sample sizes that carried low weight.[1 (19)]
- In the pooled data for Pilates vs. minimal intervention for pain outcome, intermediate follow-up, the random effects model forest plot shows a favourable effect for the Pilates intervention in decreasing low back pain. Only two studies were included in this meta-analysis but these studies had greater sample sizes, and carried more weight in comparison to the short-term follow-up subgroup. Also, none of the

confidence intervals crossed 1 indicating a difference between the two interventions.[1 (19)]

- For Pilates vs. minimal intervention, disability outcome measure, there was not substantial heterogeneity between the studies. However, meta-analysis was still not performed due to inconsistency between the studies and low quality of evidence. [1(19)]
- Meta-analysis was not performed for Pilates vs. minimal intervention, function or global impression of recovery outcome measures, because there was only 1 study per measure that provided low quality evidence.[1 (19)]
- In the pooled data for Pilates vs. other exercises for disability outcome, short-term follow-up, the random effects model forest plot shows a small favourable effect for the Pilates intervention in decreasing disability. However, the confidence interval of 1 out of 2 studies crossed 1 indicating no difference between Pilates and other exercises.
- In the pooled data for Pilates vs. other exercises for disability outcome, intermediate follow-up, the random effects model shows a very small overall favourable effect for the Pilates intervention in decreasing disability. However, the confidence intervals of both studies included in the meta-analysis cross 1 indicating no difference between Pilates and other exercises. In addition, one of the studies outcomes favours other exercise over Pilates.
- Due to high level of heterogeneity "the results of pain intensity at short-term and intermediate follow-up" for Pilates vs. other exercises were not combined in a meta-analysis.[1 (19)] I^2 for short-term follow-up = 74%, and I^2 for intermediate follow-up was 86%. [1(19)]
- Meta-analysis was not performed for Pilates vs. other exercises, function outcome measure, because there was only 1 study for this measure that provided low quality evidence.
- Global impression of recovery outcome measure was not evaluated in any of the studies included in Pilates vs. other exercise.
- The review used a random effects model, which I think is appropriate for this study because of the heterogeneous samples from the studies.
- Unfortunately, no information is provided about long-term follow-up that could be useful information when answering my clinical question.

(2) Description and appraisal of "Effectiveness of Mat Pilates or Equipment- Based Pilates Exercises in Patients With Chronic Nonspecific Low Back Pain: A Randomized Controlled Trial" by Antônio da Luz Jr, M, et al (2014).[2]

Aim/Objective of the Study/Systematic Review:

The purpose of this randomized controlled trial was to compare the effectiveness of mat Pilates and equipment-based Pilates in patients with chronic nonspecific low back pain.[2(623)]

Study Design

[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.

- 2-arm randomized controlled trail with a blinded assessor.[2(624)]
- The subjects constituted a convenience sample recruited to the study between October 2011 and July 2012.[2(624)]
- The subjects were randomly assigned on Microsoft Excel for Windows by an independent researcher not involved in the recruitment or assessments of the subjects.[2(624)]
- The subjects were randomly assigned to a control or treatment group by using a concealed allocation method.[2(624)]
- Outcome measures were collected at baseline, 6 weeks after randomization, and 6 months after randomization.[2(625)]
- The assessor was blinded, and did not know which group each participant had been allocated.[2(624)] The certification of the blinding of the assessor was not discussed.
- Intention-to-treat analysis was employed.[2(626)]
- The biostatistician who performed the data analysis was blinded.[2(627)]
- A priori power calculation was conducted to determine sample size, and with 80% power and alpha level of 0.05 the study was designed to detect a difference of 1 point in the Pain Numerical Rating Scale, 1 point in the Patient-Specific Functional Scale, 1 point in the Global Perceived Effect Scale, and 4 points in the Roland-Morris Disability Questionnaire.[2(626)]

Setting

[e.g., locations such as hospital, community; rural; metropolitan; country]

Subjects received treatment at a private physical therapy clinic in Campo Limpo Paulista, Sao Paulo, Brazil.[2(624)]

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

- There were 86 total subjects recruited to the study, 43 subjects to the mat Pilates group and 43 subjects to the equipment-based Pilates group.[2(626)]
- Subjects were selected if they were male or female, "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."[2(624)]
- The following were the exclusion criteria: "contraindication for physical exercise according to the Physical Activity Readiness Questionnaire; 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 previous 6 months."[2(624)]
- Gender:[2(627)]
    - Mat Pilates Group: 9 male, 34 female
    - Equipment-based Pilates Group: 11 male, 32 female
- Mean age: [2(627)]
    - Mat Pilates Group: 43.5 years
    - Equipment-based Pilates Group: 38.8 years
- Duration of low back pain: [2(627)]
    - Mat Pilates Group: 48 months
    - Equipment-based Pilates Group: 36 months
- At baseline, there were mainly women in both groups, but the groups were similar in age, BMI, marital status, educational level, income, pain intensity, disability, patient-specific disability, global impression of recovery, and kinesiophobia.[2(627)]
- There were some differences between the groups in the following categories:[2(627)]
    - Previous physical therapy treatment
        - Mat Pilates Group: 41.9% had previous treatment
        - Equipment-based Pilates Group: 23.3% had previous treatment
        - In both groups the main treatment was electrotherapy
    - Use of medication
        - Mat Pilates Group: 48.8% used medications (33.3% used analgesics, 23.8% anti-inflammatories, and 42.9% used muscle relaxants)
        - Equipment-based Pilates Group: 51.2% used medications (9.1% used analgesics, 50% anti-inflammatories, and 40.9% used muscle relaxants)
- Attendance rate for interventions[2(627)]
    - Mat Pilates Group: 91.4%
    - Equipment-based Pilates Group: 94.2%
- Available for follow-up[2(626)]
    - Mat Pilates Group: 43 subjects at 6 weeks, 42 subjects at 6 months
    - Equipment-based Pilates Group: 42 subjects at 6 weeks, 41 subjects at 6 months

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Both Mat Pilates and Equipment-Based Pilates

- The sessions lasted 1 hour for 2x/week for a period of 6 weeks.[2(625)]
- All subjects "received individual and supervised treatment by a Pilates-certified physical therapist with 4 years of experience."[2(625)]
- "In the first session, the subjects of both groups were trained to activate the Powerhouse, which represents the isometric contraction of the transverse abdominis, perineal, gluteal, and multifidus muscles during diaphragmatic breathing."[2(625)]
- In the following sessions on average 15-20 exercises were performed per session, "with each exercise being repeated no more than 10 times, according to the limitations of each patient."[2(625)]
- "All of the exercises were adapted and modified, being performed in 3 levels of difficulty: basic, intermediate, and advanced." "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 and pain, by increasing, for example, the number of repetitions as well as the range of motion for the exercise." [2(625)]

- "When adaptations were not possible, the exercise was substituted for another with a similar objective." [2(625)]
- The detailed descriptions of the exercises performed in both groups was published in another article: "Effectiveness of mat Pilates or equipment- based Pilates in patients with chronic non- specific low back pain: a protocol of a randomized controlled trial" by Antônio da Luz Jr, M, et al (2013).[2(625)]

Outcome Measures (Primary and Secondary)

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

- The outcome assessment was completed in person at baseline, but the 6-week and 6-month assessments were conducted by telephone. The outcome assessments were completed by a blinded assessor.[2(625)]
- Prior to Pilates treatment[2(626)]
    - All of the subjects had their expectation regarding treatment measured using the Expectancy for Improvement scale. This scale ranges from 0 to 10, with 0 being "no expectancy for improvement" and 10 being "expectancy for the greatest possible improvement."
- Immediately after first Pilates treatment[2(626)]
    - All subjects completed the Treatment Credibility scale. 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 score vary from 0 to 6, with 0 being "not at all confident" and 6 being "very confident.""
- Primary outcome measures[2(625)]
    - Pain Numerical Rating Scale was used to assess pain. The scale ranges from 0 to 10, with 0 being "no pain" and 10 being "pain as bad as it could be."
    - Roland-Morris Disability Questionnaire was used to assess disability. The score can range from 0-24, with the higher score indicating greater disability.
- Secondary outcome measures[2(625)]
    - Global Perceived Effect Scale was used to asses global perceived effect. This is 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."
    - Patient Specific Functional Scale was used to assess subject specific disability. With this scale the subjects "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."
    - Tampa Scale for Kinesiophobia was used to assess kinesiophobia. The scale can range from 17 to 68 points, and the higher the score the greater degree of kinesiophobia.

Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under 'critical appraisal' on next page]

- There were no between-group differences of the Expectancy for Improvement scale and the Treatment Credibility scale.[2(628)]
- Within-Group Differences, including effect size with their 95% CI[2(629)]
    - Pain (0-10 points)
        - Baseline to 6-week follow-up
            - Mat Pilates: 2.9 (1.8 to 4.0)
            - Equipment-based Pilates: 3.1 (2.3 to 3.9)
        - Baseline to 6-month follow-up
            - Mat Pilates: 1.6 (0.7 to 2.6)
            - Equipment-based Pilates: 1.5 (0.4 to 2.6)
    - Disability (0-24 points)
        - Baseline to 6-week follow-up
            - Mat Pilates: 7.4 (5.6 to 9.3)
            - Equipment-based Pilates: 6.4 (4.6 to 8.1)
        - Baseline to 6-month follow-up
            - Mat Pilates: 3.2 (1.2 to 5.2)
            - Equipment-based Pilates: 5.9 (4.4 to 7.4)
    - Patient-specific disability (0-10 points)
        - Baseline to 6-week follow-up
            - Mat Pilates: -2.6 (-3.3 to -1.9)
            - Equipment-based Pilates: -2.7 (-3.4 to -2.0)
        - Baseline to 6-month follow-up
            - Mat Pilates: -1.4 (-2.1 to -0.8)

        - Equipment-based Pilates: -2.4 (-3.2 to -1.6)
    - Global Impression of recovery (-5 to +5 points)
        - Baseline to 6-week follow-up
            - Mat Pilates: -4.7 (-5.5 to -3.8)
            - Equipment-based Pilates: -4.5 (-5.3 to -3.7)
        - Baseline to 6-month follow-up
            - Mat Pilates: -2.4 (-3.5 to -1.3)
            - Equipment-based Pilates: -3.6 (-4.5 to -2.7)
    - Kinesiophobia (17-68 points)
        - Baseline to 6-week follow-up
            - Mat Pilates: 4.4 (2.4 to 6.5)
            - Equipment-based Pilates: 5.1 (2.3 to 8.0)
        - Baseline to 6-month follow-up
            - Mat Pilates: -0.3 (-2.5 to 2.0)
            - Equipment-based Pilates: 4.4 (1.5 to 7.3)
- In the within-group comparison there is a significant difference in all outcome measures (P<0.01), except for kinesiophobia in the mat Pilates group at 6-month follow-up.
- Between-Group Differences, including effect size with their 95% CI[2(63)]
    - Pain (0-10 points)
        - 6-week follow-up: 0.4 p (0.0 to 0.9)
        - 6-month follow-up: 0.3 (-0.2 to 0.7)
    - Disability (0-24 points)
        - 6-week follow-up: -0.1 (-0.5 to 0.3)
        - 6-month follow-up: 0.7 (0.2 to 1.1)
    - Patient-specific disability (0-10 points)
        - 6-week follow-up: -0.1 (0.5 to 0.4)
        - 6-month follow-up: -0.4 (-0.9 to 0.0)
    - Global impression of recovery (-5 to +5 points)
        - 6-week follow-up: -0.3 (-0.7 to 0.2)
        - 6-month follow-up: -0.6 (-1.1 to -0.2)
    - Kinesiophobia (17-68 points)
        - 6-week follow-up: 0.2 (-0.3 to 0.6)
        - 6-month follow-up: 0.6 (0.1 to 1.1)
- In the between-group comparison there were no significant differences in the 6-week follow-up for all outcome measures. 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, specific disability, and kinesiophobia

Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

Authors concluded that although there was no significant difference between the groups for any of the assessed outcomes at 6 weeks it is still 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."[2(628)] The authors proposed that there was no significant difference for pain intensity between the groups because both the mat and equipment-based Pilates activated the deep lower back muscles in a similar way."[2(629)] At 6-month follow-up the Equipment-based Pilates group had a greater improvement in the outcomes of disability, specific disability, and kinesiophobia. The authors hypothesized that these improvements were from the possibility that "the exercises on the machines facilitates learning and performance due to better stabilization."[2(629)] "A placebo effect might also be inherent in the use of equipment."[2(629)] Additionally, the authors suggested that the results could be "generalized for patients with characteristics similar to those of the participants in tis study."

Critical Appraisal

Validity

[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]

Comment on missing information in original paper.

- PEDro scale score: 9/11 based on eligibility criteria: Yes; Random Allocation: Yes; Concealed Allocation: Yes; Baseline Comparison: Yes; Blind Subjects: No; Blind Therapist: No; Blind Assessors: Yes; >85% participant outcomes: Yes; Intention-to-treat Analysis: Yes; Between-Group Comparison: Yes; Point estimates and variability: Yes
- The subjects and the physical therapists were not blinded, so that could have biased the outcomes.
- The random allocation and similarity between groups was reserved because the intention-to-treat

analysis was used.
- Since the subjects within the Equipment-based Pilates group used machines to perform their exercises the difference between groups could have existed because there is a "placebo effect that is inherent in the use of equipment."[2(629)] A study has "analysed this effect in clinical trials and showed that the use of equipment or devices, confidence in the treatment technique, and the use of high technology can maximize the placebo effect."[2629)]
- The use of linear mixed models for the between-group analysis and the use of t test for the within-group analysis appears appropriate for capturing the desired group comparisons.
- The authors only listed one limitation of their study: possible bias because the therapist and subjects were not blinded

Interpretation of Results

[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean.

The results favour equipment-based Pilates versus mat Pilates due to the significant differences of outcome measures in the between-group comparison at the 6-month follow-up. However, both groups showed significant improvement in pain, disability, patient-specific disability, and global impression of recovery from baseline to 6-week and 6-month follow-up. The equipment-based Pilates group showed significant improvement in kinesiophobia from baseline to 6-week and 6-month follow-up, but the mat Pilates group only showed significant improvement in kinesiophobia from baseline to 6-weeks.

The initial overall sample size met their calculated need for 86 subjects and the loss to follow-up was fairly small.[2(626)] One subject lost in the mat Pilates group at the 6-month follow-up, and one subject lost in the equipment-based Pilates group at both the 6-week and 6-month follow-up.[2(626))]

- Between-group Differences, Effect Size (95% CI)[2(630)]
  - Pain (0-10 points)
    - 6-week follow-up: 0.4 p (0.0 to 0.9) a moderate effect
    - 6-month follow-up: 0.3 (-0.2 to 0.7) a moderate effect
  - Disability (0-24 points)
    - 6-week follow-up: -0.1 (-0.5 to 0.3) a small effect
    - 6-month follow-up: 0.7 (0.2 to 1.1) a large effect
  - Patient-specific disability (0-10 points)
    - 6-week follow-up: -0.1 (0.5 to 0.4) a small effect size
    - 6-month follow-up: -0.4 (-0.9 to 0.0) a moderate effect size
  - Global impression of recovery (-5 to +5 points)
    - 6-week follow-up: -0.3 (-0.7 to 0.2) a moderate effect size
    - 6-month follow-up: -0.6 (-1.1 to -0.2) a large effect size
  - Kinesiophobia (17-68 points)
    - 6-week follow-up: 0.2 (-0.3 to 0.6) a small effect size
    - 6-month follow-up: 0.6 (0.1 to 1.1) a large effect size

(3) Description and appraisal of "Pilates improves pain, function and quality of life in patients with chronic low back pain: a randomized controlled trial" by Natour, J, et al (2015)

Aim/Objective of the Study/Systematic Review:

The objective of this randomized controlled trail was to assess the effectiveness of Pilates on pain, function, and quality of life among patients with chronic nonspecific low back pain.

Study Design

[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.

- A single center, assessor blinded randomized controlled trail
- Subjects constituted a convenience sample recruited to the study from a physical therapy waiting list, but exact dates of recruitment were not mentioned.[3(61)]
- Subjects were screened by an outside evaluator, and then randomly assigned to the experimental or control group using a concealed allocation procedure.[3(61)]
- The random allocation was computer generated and located in a locked cupboard to ensure secure randomization.[3(61)]
- Outcome measures were collected at baseline, 45 days after baseline, 90 days after baseline (conclusion of the Pilates program), and 90 days after the conclusion of the Pilates program.[3(61)]

- The assessor was blinded, but certification of this blinding process was not mentioned.[3(61)]
- Intention-to-treat analysis was used.[3(62)]
- A priori calculation was conducted to determine sample size, and the study was designed to detect a 20% improvement in the pain VAS score, with 80% power at the 0.05 level.[3(61)]

Setting

[e.g., locations such as hospital, community; rural; metropolitan; country]

In a Pilates studio. The location of this studio was not mentioned.[3(61)]

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

- 60 participants were recruited for the study. The experimental group had 30 participants and the control group had 30 participants.[3(63)]
- The authors did not mention the specifics of their recruitment.
- Inclusion criteria: "diagnosis of chronic low back pain (defined as pain between the lower rib cage and gluteal folds for more than 12 months); nonspecific low back pain characterized by the absence of signs of a serious underlying condition (such as cancer, infection, or cauda equina syndrome), spinal stenosis or radiculopathy, or another specific spinal cause (such as vertebral compression fracture or ankylosing spondylitis),pain that becomes accentuated with physical effort and is relieved with rest; male or female; aged 18 to 50 years; pain between four and seven on a 10-cm visual analog scale; and agreement to participate in the study."[3(60)]
- Exclusion Criteria: "diagnosis of low back pain due to other causes; fibromyalgia; prior spine surgery; lawsuit; having initiated or changed regular physical activity in the previous three months; body mass index > 30; and having undergone treatment with physical therapy or acupuncture in the previous three months."[3(61)]
- Gender[3(64)]
  - Experimental Group: 24 female, 6 male
  - Control Group: 23 female, 7 male
- Age[3(64)]
  - Experimental Group: 47.79 years
  - Control Group: 48.08 years
- Low back pain[3(64)]
  - Experimental Group: 5.50 points on VAS
  - Control Group: 5.79 points on VAS
- There were no statistically significant differences between the groups at baseline in the following measures: gender, race, age, BMI, schooling, employment, smoking status, physical activity status, sit and reach test, pain VAS scale, function measure, and SF-36.[3(62)]
- 2 participants in the experimental group and 1 participant in the control group dropped out of the study.[3(63)]

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control

- The control participants "continued medication treatment with use of non-steroidal anti-inflammatory drug and did not undergo any other intervention."[3(61)]
- The control participants were "instructed to use 50mg of sodium diclofenac at intervals no shorter than 8h when needed (VAS for pain more than 7cm)" and they were instructed to record the number of pills taken per day on a chart.[3(61)]
- The authors did not mention any physical activity intervention for the control participants.

Experimental

- The experimental participants "maintained medication treatment with use of non-steroidal anti-inflammatory drug and underwent treatment with the Pilates method."[3(61)]
- The Pilates sessions "took place in a studio with a certified, physical educator with 10 years of experience in the method."[3(61)]
- Each Pilates session lasted for "50 minutes and followed a pre-established protocol," and took place 2x week for a total of 90 days.[3(61)]

- There were 3-4 participants per Pilates class
- The control participants were "instructed to use 50mg of sodium diclofenac at intervals no shorter than 8h when needed (VAS for pain more than 7cm)" and they were instructed to record the number of pills taken per day on a chart.[3(61)]
- The authors stated that the Pilates protocol description could be found on chart 1 in the supplementary material. However, I could not find this chart.[3(61)]

Outcome Measures (Primary and Secondary)

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

- An assessor who was blinded completed all of these outcome measures at baseline, 45 days after baseline, 90 days after baseline (the conclusion of the treatment), and 90 days after the conclusion of the treatment.[3(61)]
- Primary outcome measures
    - Pain: Pain was measured by the VAS scale that uses a 10 cm line where the patient can indicate his/her current level of pain, "for which 0 represents the absence of pain and 10 represents unbearable pain."[3(61)]
- Secondary outcome measures
    - Function: Function was measured by the Roland-Morris questionnaire. This is a "short, simple, sensitive, and clear measure for quantifying, self-rated disability due to back pain."[3(61)] There are 24 questions the patient answers, and the score ranges from 0-24, for which 0 represents absence of disability and 24 represents severe disability.[3(62)]
    - Quality of life: Quality of life was measured using the SF-36. The SF-36 "is a generic quality of life assessment measure that is easy to administer and understand."[3(62)] There are 8 domains to the SF-36: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health.[3(62)] The SF-36 scores can range from 0-100, for which 100 represents the highest quality of life.[3(62)]
    - Satisfaction of treatment: Satisfaction of treatment was measured using the Likert scale. "Patients answered the question 'How do you feel today in comparison with your last evaluation?', to which the options were 'much better', 'a little better', 'the same', 'a little worse' and 'much worse;"[3(62)]
    - Flexibility: Flexibility was measured using the sit and reach test. This test was performed twice using a Wells bench, and the greater distance was recorded.[3(62)]
    - Non-steroidal anti-inflammatory drug intake: Drug intake was recorded on a chart that was supplied to each participant.[3(62)] The participant was instructed to record on the chart the number of pills taken per day throughout the study.[3(61)]

Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under 'critical appraisal' on next page]

Mean differences[3(65)]

- Pain
    - Baseline to 45 days after baseline: -0.46
    - Baseline to conclusion of treatment (90 days after baseline): -1.12
    - Baseline to 180 days after baseline: -1.63
- Function
    - Baseline to 45 days after baseline: -2.08
    - Baseline to conclusion of treatment (90 days after baseline): -3.80
    - Baseline to 180 days after baseline: -3.62
- Quality of life
    - Baseline to 45 days after baseline
        - Physical functioning: 5.12
        - Role physical: 5.42
        - Bodily pain: 4.25
        - General health: -0.75
        - Vitality: 6.33
        - Social functioning: 2.83
        - Role emotional: 3.35
        - Mental health: 2.27
    - Baseline to conclusion of treatment (90 days after baseline)
        - Physical functioning: 8.54
        - Role physical: 6.34
        - Bodily pain: 8.04
        - General health: 10.88
        - Vitality: 10.58

        - Social functioning: 4.23
        - Role emotional: 6.68
        - Mental health: 8.67
    - Baseline to 180 days after baseline
        - Physical functioning: 5.83
        - Role physical: 16.42
        - Bodily pain: 8.29
        - General health: 3.12
        - Vitality: 5.29
        - Social functioning: 5.63
        - Role emotional: 9.66
        - Mental health: 2.57
- Satisfaction of treatment
    * Note: did not calculate mean differences, but calculated intergroup P-value
    - Baseline to 45 days after baseline: intergroup P= 0.645
    - Baseline to conclusion of treatment (90 days after baseline): intergroup P=0.387
    - Baseline to 180 days after baseline: intergroup P= 0.516
- Flexibility
    - Baseline to 45 days after baseline: 5.63
    - Baseline to conclusion of treatment (90 days after baseline): 6.77
    - Baseline to 180 days after baseline: 6.54
- Non-steroidal anti-inflammatory drug intake
    - Baseline to 45 days after baseline: -5.90
    - Baseline to conclusion of treatment (90 days after baseline): -5.66
    - Baseline to 180 days after baseline: -7.13
- Comparing the groups overtime using the ANOVA test, found a significant difference favouring the experimental group regarding pain ($p<0.001$), function ($p<0.001$), some quality of life measures (functional capacity $p<0.046$, bodily pain $p<0.010$, vitality $p<0.029$), and non-steroidal anti-inflammatory drug intake ($p<0.001$).

Effect sizes and 95% CI for the outcomes that were significantly in the comparison between groups using ANOVA[3(66)]

- Pain: -0.57 (-1.08 to 0.05)
- Function: -0.67 (-1.19 to 0.15)
- SF-36 physical functioning: 0.24 (-0.27 to 0.75)
- SF-36 bodily pain: 0.30 (-0.21 to 0.81)
- SF-36 vitality: 0.23 (-0.28 TO 0.74)
- Non-steroidal anti-inflammatory drug intake: -0.48 (-1.00 to 0.03)

Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

Authors concluded that compared to no exercises, the Pilates method can statistically improve pain, function, and quality of life, and it can decrease the use of non-steroidal anti-inflammatory drugs. There were no significant differences noted in flexibility and satisfaction of treatment. The authors suggested the improvement of low back pain and function was due to increased strength of the core muscles provided by the Pilates training.[3(63)] The authors noted the improvements noted in the quality of life scale were "likely related to the pain (VAS) and function (Roland-Morris) findings."[3(65)] The reduction in pain medications was suggested to reflect an improvement in pain.[3(65)] There were no significant differences in flexibility or satisfaction of treatment between groups. The authors reported that there was no flexibility difference seen because the method they choose, the sit and reach test, was not able to accurately measure flexibility. There was no significant difference between groups regarding satisfaction with treatment, but the authors make note that there were "a greater number of responses of 'much better' on the Likert scale in the experimental group."[3(67)] The authors also highlighted with importance that their Pilates protocol "did not worsen pain in the experimental group demonstrating that this method had no harmful effects on the patients regarding pain."[3(67)]

Critical Appraisal

Validity

[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]

Comment on missing information in original paper.

- PEDro scale score: 9/11 based on eligibility criteria: yes; random allocation: yes; concealed allocation: yes; baseline comparison: yes; blind subjects: no; blind therapist: no; >85% participant outcomes: yes; intention-to-treat analysis: yes; between-group comparisons: yes; point estimates and variability:

yes

- The participants and the therapists were not blinded so this could have biased the outcomes
- Intention-to-treat analysis was to used thus preserving the random allocation
- Since all participants did not all take the same number of non-steroidal anti-inflammatory drugs, a difference between groups could have existed in terms of pain level.
- At initial evaluation a chi-squared test, Student's t test, and Mann-Whitney test were used which appears appropriate to measure the homogeneity of the sample.[3(62)]
- Repeated Measures Analysis of Variance (ANOVA) with an additional post hoc was used and is appropriate to determine differences in the outcome measures between the experimental and control group over time.[3(62)]
- The authors commented on the following limitations: 1) their flexibility test was not able to accurately measure flexibility because there are variations in the arm, leg, and trunk length of the test which can make comparing individuals misleading;[3(66)] 2) the participants and therapist could not be blinded which could cause possible bias;[3(66)] 3) the participants recruited all had volunteered for an exercise treatment indicating that they all have a "positive attitude toward exercise" which could influence the results;[3(66)]

Interpretation of Results

[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean.

The results favoured the Pilates method over no exercises to statistically improve pain, function, and quality of life (physical function, bodily pain, vitality), and decrease the use of non-steroidal anti-inflammatory drugs in those with chronic nonspecific low back pain. Based on the effect sizes, the Pilates method, compared to no intervention, has a moderate effect on pain (-0.57), large effect on function (-0.67), small effect on quality of life (physical function 0.24, bodily pain 0.30, vitality 0.23), and moderate effect on non-steroidal anti-inflammatory drug intake (-0.48).

The authors noted that a minimum of 26 participants were needed per group in order to have 80% power at the 0.05 level, and to see a 20% improvement in the pain VAS score. There was more than a 20% improvement in the pain VAS score indicating statistical significance. The study had 30 participants per group, and there was no loss to follow-up. 2 participants in the experimental group and 1 participant in the control group dropped out, but the last data collected for them was repeated for any subsequent evaluations. The number of participants who dropped out was fairly small (3/60 or 5%), so it is unlikely that these repeated data measurements made a difference statistically.

EVIDENCE SYNTHESIS AND IMPLICATIONS

All evidence reviewed in this critical appraisal suggests that Pilates is safe and effective in reducing chronic, nonspecific low pack pain. The systematic review and one of the RCTs suggest that Pilates is more effective in reducing chronic, nonspecific low back pain in comparison with minimal intervention. The meta-analysis found no statistically significant benefits of Pilates over general exercise. The decision to use Pilates for chronic, nonspecific low back pain should be based on the patient's preferences, and costs. When choosing Pilates for your patient, it is important that Pilates is taught by a trained professional and the type of Pilates is again, based off of your patient's preferences. There are 2 types of Pilates, mat-based and equipment-based. One of the RCTs reviewed found no statistically significant benefits of one type over the other in terms of reducing chronic, nonspecific low back pain.

Pilates and general exercise may be considered equally effective in reducing low back pain, and when making the decision to choose one intervention over the other for a patient described in the clinical question the therapist should take into consideration the following factors: is the therapist professionally trained in Pilates, does the PT clinic have the available Pilates mat or equipment, and would the patient prefer Pilates. If the therapist is a Pilates-based physical therapist working in a Pilates studio then choosing Pilates might be the better option for your patient, assuming they are ok with this preference.

One possible drawback of Pilates is the cost-effectiveness. Both the systematic review and one of the RCTs recommended that future studies should include an economic evaluation to compare Pilates against competing treatment options. The appraiser was not able to determine the number of outpatient physical therapy clinics that had Pilates equipment, but clinical experience suggests that Pilates-based therapy is commonly seen in Pilates studios that host Pilates-based physical therapists. Pilates equipment can be purchased easily, but before doing so the therapist must consider the modest benefits of Pilates over general exercise in the current literature for individuals with chronic, nonspecific low back pain.

There is a need for more high quality and large sample sized studies to be conducted in order to research the effects of Pilates on chronic, nonspecific low back pain. More quality studies that include a long-term follow-up are also needed. Since there are a wide variety of Pilates teacher training programs, further studies should also include detailed information on the Pilates protocol they used.

REFERENCES

1. Yamato, T., Saragiotto, B., Hancock, M., Ostelo, R., Cabral, C., Costa, L., & Menezes Costa, L. (2015). Pilates for low back pain. The Cochrane Collaboration, (7), 1–71.
2. Antônio da Luz Jr, M., Pena Costa, L. P., Fuhro, F. F., Taccolini Manzoni, A. C., Bastos Oliveira, N. T., & Nunes Cabral, C. M. (2014). Effectiveness of Mat Pilates or Equipment-Based Pilates Exercises in Patients With Chronic Nonspecific Low Back Pain: A Randomized Controlled Trial. Journal of the American Physical Therapy Association, 94(5), 623–631.
3. Natour, J., Cazotti, L. de A., Ribeiro, L. H., Baptista, A. S., & Jones, A. (2015). Pilates improves pain, function and quality of life in patients with chronic low back pain: a randomized controlled trial. Clinical Rehabilitation, 29(1), 59–68.
4. Wajswelner, H., Metcalf, B., & Bennell, K. (2012). Clinical Pilates versus general exercise for chronic low back pain: Randomized trial. Official Journal of the American College of Sports Medicine, 44(7), 1197–1205.
5. Wells, C., Kolt, G. S., Marshall, P., & Bialocerkowski, A. (2014). Indications, benefits, and risks of Pilates exercise for people with chronic low back pain: a Delphi survey of Pilates-trained physical therapists. Journal of the American Physical Therapy Association, 94(6), 806–817.
6. Miyamoto, PT, G. C., Costa, PhD, L., Galvanin, T., & Cabral, PhD, C. (2011). The efficacy of the addition of the Pilates method over a minimal intervention in the treatment of chronic nonspecific low back pain: a study protocol of a randomized controlled trial. Journal of Chiropractic Medicine, 10(4), 248–254.
7. Gladwell, V., Head, S., Haggar, M., & Beneke, R. (2006). Does a Program of Pilates Improve Chronic Non-Specific Low Back Pain? Journal of Sport Rehabilitation, 14(4), 338–350.
8. Notarnicola, A., Fischetti, F., Maccagnano, G., Comes, R., Tafuri, S., & Moretti, B. (2014). Daily Pilates exercise or inactivity for patients with low back pain: a clinical prospective observational study. European journal of physical and rehabilitation medicine, 50(1), 59–66.
9. Donzelli, S., Di Domencia, F., Cova, A. M., Galletti, R., & Giunta, N. (2006). Two different techniques in the rehabilitation treatment of low back pain: a randomized controlled trial. Europa Medicophysica, 42(3), 205–210.
10. Rydeard, PT, MSc, R., Leger, PT, PhD, A., & Smith, PhD, D. (2006). Pilates-based therapeutic exercise: effect on subjects with nonspecific chronic low back pain and functional disability: a randomized controlled trial. The Journal of Orthopaedic and Sports Physical Therapy, 36(7), 472–484