

Effects of Pilates Method on women's static body posture: a systematic review

Efeitos do Método Pilates na postura corporal estática de mulheres: uma revisão sistemática

Efectos del Método pilates en la postura corporal estática de mujeres: una revisión sistemática

Emanuelle Francine Detogni Schmit¹, Cláudia Tarragô Candotti², Ana Paula Rodrigues³,
Catiane Souza¹, Mônica de Oliveira Melo⁴, Jefferson Fagundes Loss⁵

ABSTRACT | The Pilates Method provides improvement in flexibility, coordination and muscle strength, which can reflect the postural alignment. In this sense, the objective of this study was to verify the level of scientific evidence from randomized controlled trials and nonrandomized that evaluated the influence of Pilates Method in postural alignment women when compared to a control group or other intervention based on a systematic review (CRD42015026518). A search was carried out between 25 and 29 September 2015 at BIREME, EMBASE, PEDro, PubMed, Scielo, Science Direct, Scopus and Web of Science, without language restriction and date. For selecting studies, two reviewers applied independently eligibility criteria: exclusive sample of women; intervention with Pilates Method in a group and presence of comparator; variable outcome static body posture; clinical trials. Reviewers obtained data about the studies (participants, intervention and outcomes), applied the methodological quality scale PEDro and determined the strength of the evidence through Best Evidence Synthesis. Four studies were included, three with high quality, but due to the divergence of results there is no scientific evidence about the effects of the Method in postural alignment. The results suggest that from 24 sessions of Pilates Method, applied twice a week, adjustments occur in the frontal alignment of the shoulders and sagittal of the pelvis in adults. And, after 48 sessions, adds to the improvement in the sagittal

alignment of the head. In older, 60 sessions of Pilates Method appear to be effective in reducing the angle of kyphosis thoracic and cervical-thoracic distance, increasing height.

Keywords | Exercise Therapy; Posture; Women; Review.

RESUMO | O Método Pilates proporciona melhora na flexibilidade, coordenação e força muscular, podendo refletir no alinhamento postural. Nesse sentido, o objetivo desse estudo foi verificar o nível de evidência científica dos ensaios clínicos randomizados e não randomizados que avaliaram a influência desse Método no alinhamento postural de mulheres quando comparados a um grupo controle ou outra intervenção através de uma revisão sistemática (CRD42015026518). Foi realizada uma busca entre 25 e 29 de setembro de 2015 nas bases BIREME, EMBASE, PEDro, PubMed, SciELO, Science Direct, Scopus e Web of Science, sem restrição de idioma e data. Para seleção dos estudos, dois revisores aplicaram, independentemente, os critérios de elegibilidade: amostra exclusiva de mulheres; intervenção com o Método Pilates em um grupo e presença de comparador; variável de desfecho a postura corporal estática; ensaios clínicos. Os revisores obtiveram dados acerca dos estudos (participantes, intervenção e resultados), aplicaram a escala de qualidade metodológica PEDro e determinaram a força da evidência pela Melhor Síntese de Evidência.

¹Doctoral candidate in the Graduate Program in Human Movement Sciences of the Federal University of Rio Grande do Sul (UFRGS) - Porto Alegre (RS), Brazil.

²PhD in Human Movement Sciences, Associate Professor of UFRGS - Porto Alegre (RS), Brazil.

³Graduate student in Physical Therapy by UFRGS - Porto Alegre (RS), Brazil.

⁴PhD in Human Movement Sciences by UFRGS, Associate Professor of the University of Caxias do Sul - Caxias do Sul (RS), Brazil.

⁵PhD in Mechanical Engineering, Associate Professor of UFRGS - Porto Alegre (RS), Brazil.

Quatro estudos foram incluídos, sendo três com elevada qualidade, porém devido à divergência de resultados não há evidências científicas acerca dos efeitos do Método Pilates no alinhamento postural. Os resultados sugerem que a partir de 24 sessões desse Método, praticadas duas vezes por semana, ocorrem ajustes nos alinhamentos frontal dos ombros e sagital da pelve, em mulheres adultas, e que após 48 sessões soma-se a melhora no alinhamento sagital da cabeça. Em idosas, sessenta sessões desse Método parecem ser efetivas na redução do ângulo da cifose torácica e da distância cervico-torácica, aumentando a estatura.

Descritores | Terapia por Exercício; Postura; Mulheres; Revisão.

RESUMEN | El Método Pilates mejora la flexibilidad, coordinación y fuerza muscular, y puede traer como consecuencia la alienación postural. En este sentido, el propósito de este texto es verificar el nivel de evidencia científica de estudios clínicos aleatorios y no aleatorios, que evaluaron la influencia de este Método para la alienación postural de mujeres cuando comparados a un grupo control y otra intervención a través de una revisión sistemática (CRD42015026518). Se realizó una búsqueda entre 25 y 29 de septiembre de 2015 en las bases de datos BIREME, EMBASE,

PEdRo, PubMed, SciELO, Science Direct, Scopus y Web of Science, sin cualquier restricción de fecha e idioma. Para la recolección de datos, dos revisores aplicaron de manera independiente criterios de elegibilidad: muestras solo de mujeres; intervención con el Método Pilates en un grupo y presencia de comparador; variable de resultado, postura corporal estática; estudios clínicos. Los revisores tuvieron acceso a los datos sobre los estudios (participantes, intervención y resultados), aplicaron la escala de calidad metodológica PEDro y establecieron la fuerza de evidencia por la Mejor Síntesis de Evidencia. Se incluyeron cuatro estudios, siendo tres con alto nivel de calidad, sin embargo, debido a las divergencias de resultados no fueron encontradas evidencias científicas sobre los efectos de este Método en la alienación postural. Los resultados evidencian que la práctica de más de 24 sesiones, dos veces a la semana, puede posibilitar correcciones en las alienaciones frontal de los hombros y sagital de la pelvis, en mujeres adultas, y que tras 48 sesiones se añade la mejora en la alienación sagital de la cabeza. En adultos mayores son necesarias sesenta sesiones para reducir el ángulo de la cifosis torácica y de la distancia cervical y torácica, aumentando, así, la estatura.

Palabras clave | Terapia por Ejercicio; Postura; Mujeres; Revisión.

INTRODUCTION

Pilates Method uses the body as a mediator of physical and mental development, with emphasis on concentration, awareness, and quality of movements^{1,2}. It includes muscle stretching and strengthening exercises^{3,4} performed in specific equipment or on the floor; it involves concentric, eccentric and, mainly, isometric contractions, highlighting the recruitment of powerhouse muscles, which are responsible for stabilization of the body⁵.

In the health sphere, Pilates Method has been used for the development of constraining physical abilities, therapeutic purposes, posture alignment, welfare, and mental discipline^{6,7}. Whereas Pilates Method prioritizes the activation of postural muscles, professionals believe that the systematic practice of Pilates Method may promote positive adjustments in posture alignment⁸. Posture alignment refers to a state of joint balance, being determined by the relationship between body segments and the force necessary to stabilize joints and promote symmetrical movements⁹.

On the other hand, postural imbalances arising from repeated kinetic patterns can cause a decrease in flexibility and muscle shortenings¹⁰, which bring consequences harmful to the support and mobility function of the body as a whole¹¹. In view of the increased incidence of postural deviations and related problems in recent years^{12,13}, using Pilates Method as a form of intervention in the development of postural balance is highlighted.

Despite the importance of intervention on postural deviations, Cruz-Ferreira et al.¹⁴ mention in their review that there is no evidence about the effects of the Pilates Method on posture alignment, in such a way that health care professionals prescribe exercises of the Pilates Method based on practice. However, they included studies with heterogeneous samples and several methodologies, making unfeasible the specific conclusion of effects relate to gender and age group. Thus, the aim of this study was to verify the level of scientific evidence of randomized and nonrandomized clinical trials that evaluated the influence of Pilates Method on women's posture alignment when compared with a control group or with other intervention.

METHODOLOGY

Type of study and search strategies

This study comprised a systematic review of the literature, which was registered in PROSPERO under number CRD42015026518. Systematic searches were conducted between September 25 and 29, 2015, at BIREME, EMBASE, Physiotherapy Evidence Database (PEDro), PubMed, Scielo, Science Direct, SCOPUS, and Web of Science databases. Search terms used, with their respective Boolean operators, were “Women AND Exercise Movement Techniques OR Pilates AND Posture”. The search strategy used at PubMed can be observed in Table 1. In addition, no language and publication date restrictions were used, and studies were identified from the references of included studies.

Table 1. PubMed search strategy

#1	“Women” [Mesh] OR “Women” OR “Woman” OR “Women’s Groups” OR “Group, Women’s” OR “Groups, Women’s” OR “Women Groups” OR “Women’s Group”
#2	“Exercise Movement Techniques” [Mesh] OR “Exercise Movement Techniques” OR “Movement Techniques, Exercise” OR “Exercise Movement Technics” OR “Pilates-Based Exercises” OR “Exercises, Pilates-Based” OR “Pilates Based Exercises” OR “Pilates Training” OR “Training, Pilates” OR “Pilates”
#3	“Posture” [Mesh] OR “posture” OR “postures”
#4	#1 AND #2 AND #3

Selection of studies

Two researchers independently selected potentially relevant studies based on titles and abstracts. When the latter did not provide enough information to exclude the study, the complete text was verified. Then, the same reviewers independently evaluated complete studies and made the selection according to eligibility criteria, which were: (1) intervention based on the Pilates Method in at least one group, in addition to presenting control group (without intervention or submitted to another practice); (2) the outcome variable considered was the static body posture, assuming its equivalence with static posture alignment; (3) studies should be randomized or nonrandomized clinical trials; and (4) the sample should be composed only of women. The

discordant cases were resolved by consensus or by a third researcher¹⁵.

Data extraction, quality analysis, and risk of bias

Only included studies were submitted to data extraction, quality analysis, and risk of bias. Extracted information included authors’ name, publication year, participants (total and per group, age), intervention and evaluation protocol, and results of interest. Evaluation of quality and risk of bias was independently performed by two researchers through PEDro scale, which consists of 11 criteria, being the score of each criterion only assigned if the same was clearly satisfied¹⁶. This scale score ranges from zero to 10, due to the fact that the participants’ eligibility is not part of the total amount¹⁷. It is worth mentioning that in studies involving physical activity oriented as a form of intervention, as in the case of this review, the maximum score to be obtained is eight, since it is not possible to blind subjects and therapists. As PEDro scale does not provide cutting values, we used as parameters the sum less than seven for low quality, and sum higher than or equal to seven for high quality^{14,17}.

Data synthesis and analysis

Due to insufficient data, the diversity of types of intervention and different outcomes, a statistical analysis could not be performed. Thus, a summary of the characteristics of studies and outcomes was presented in a chart (Chart 1). Descriptive analysis of the results was also presented in topics. The strength of the scientific evidence was analyzed qualitatively by the Best Evidence synthesis (BES), based on four levels¹⁵: (1) strong evidence, consistent findings in multiple high-quality tests; (2) moderate evidence, consistent findings in a trial of high quality and/or one or more low-quality trials; (3) limited evidence, consistent findings in one or more low-quality trials; (4) no or insufficient evidence, if no trial was found, or if results are conflicting.

RESULTS

Selection of studies

The initial search identified 143 articles, of which six were detailed analyzed. Of these, two were excluded

for not including women only. However, four were considered potentially relevant. Figure 1 demonstrates

the flowchart of the included studies, and Chart 1 summarizes the characteristics of these studies.

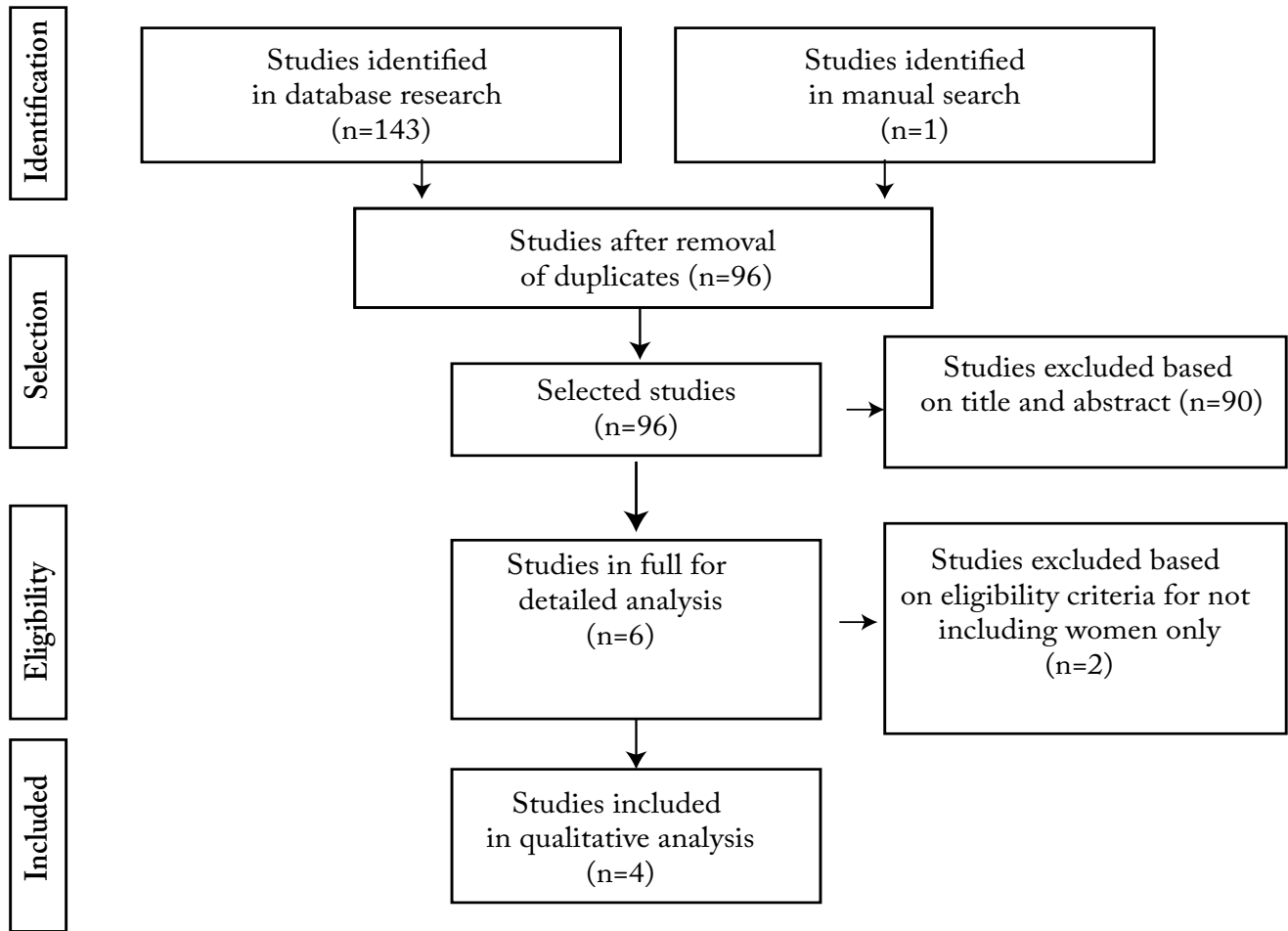


Figure 1. Flowchart of studies included in the systematic review

Chart 1. Descriptive characteristics of studies included

Author, year	Sample data	Intervention	Results
Dona-hoe-Filmore et al., 2007	Age: 25-35 years PG: n = 6 CG: n = 5	Duration: 10 weeks PG: Pilates Method on the floor without supervision (3x/week - unspecified exercises) + general PE initial guidelines CG: initial guidelines for general PE	No difference in the pelvic tilt (photogrammetry) in both groups.
Junges et al., 2012	Age: 59 ± 9 years PG: n = 22 CG: n = 19	Duration/frequency: 30 weeks, 2x/week, 60 min/session PG: Pilates Method in equipment and unspecified exercises CG: without intervention	PG: in radiography, ↓ Cobb angle of thoracic kyphosis; in photogrammetry, ↓ cervical-thoracic distance in the position of right and left profile; ↓ shoulder height and shoulder blades in the back position and stature CG: without difference
Cruz-Ferreira et al., 2013	Age: 34.9 ± 16.4 years PG: n = 40 CG: n = 34	Duration/frequency: 24 weeks, 2x/week, 60 min/session PG: Pilates Method on the floor - 34 initial exercises (Body Control Pilates), with progressions and inclusion of free weights CG: without intervention	PG: in photogrammetry, there was a difference in the frontal alignment of the shoulders and in the sagittal alignment of the head and pelvis CG: without difference
Sinzato et al., 2013	Age: 18-25 years PG: n = 14 CG: n = 19	Duration/frequency: 10 weeks, 2x/week PG: Pilates Method on the floor and unspecified exercises CG: without intervention	No difference in variables (photogrammetry) in both groups.

Caption: PG: Pilates Method Group; CG: Control Group; PE: Postural Education

Quality analysis and risk of bias

The score of PEDro scale (Table 2) varied between three and eight. The study that obtained the lowest value was considered of low quality¹⁹. Remaining studies^{7,18,20} were considered of high quality; the criteria more frequently met were the subject's distribution randomness, similarity and initial evaluation of the groups, blinding of the reviewers, acceptance of intervention, and analysis and presentation of results.

Based on the results reported in Chart 1 and Table 2, we may affirm that there is no scientific evidence to promote the use of Pilates Method for women's posture alignment benefits. Although, among the four studies reviewed, two high-quality studies have shown that the method is able to promote general effects on posture alignment^{18,20}; and a high-quality study found no changes⁷. Hence, results are conflicting.

Table 2. Evaluation according to PEDro scale. We excluded criteria 5 and 6 concerning blind participation in the study

Criterion	Donahoe-Fillmore et al.	Junges et al.	Cruz-Ferreira et al.	Sinzato et al.
Eligibility criteria were specified.	1	1	1	1
Subjects were randomly distributed per groups.	1	1	1	1
Subject's distribution was blind.	0	0	1	1
Initially, the groups were similar concerning the most important indicators.	1	1	1	1
All reviewers that measured at least one key outcome did it blindly.	0	1	1	1
Measurements of at least one key outcome were obtained in more than 85% of the subjects initially distributed per groups.	1	1	1	1
All subjects from which measurements of results were presented received the treatment or control condition, according to the distribution or, when this was not the case, the data analysis for at least one of the key outcomes for "treatment intention" was performed.	0	1	1	1
The results of statistical comparisons intergroups are reported for at least one key outcome.	0	1	1	1
The study presents both accuracy measures and variability measures for at least one key outcome.	0	1	1	1
PEDro Scale total score	3	7	8	8

Caption: 0 indicates that the study did not comprise the criterion, and 1 indicates that the study contemplated it

DISCUSSION

Research on the effects of Pilates Method practice on static posture alignment present methodological differences, but do not make their comparisons unfeasible. Regarding the sample, three studies were conducted predominantly with young adult women^{7,18,19}. Regarding quality, three studies were highly rated, being these conducted with more than 30 individuals^{7,18,20}, however, only one had exclusively chosen female older adults²⁰. Donahoe-Fillmore et al.¹⁹ also focused on the young adult age group, but conducted a low-quality study, with only 11 individuals, and we must be careful when interpreting the results of their study.

In the intervention, three studies adopted Pilates Method exercises on the floor^{7,18,19} and only one study added equipment²⁰. The preference may be due to low cost, ease of performance regarding physical space, and the fact that the exercises can be taught in larger groups. In addition, overall, the exercises were instructed by trained professionals and performed under supervision; only Donahoe-Fillmore et al.¹⁹ used videotapes and

initial instructions in their intervention, being the practice performed individually at home.

The exercises performed by the experimental group are not clearly described in the studies^{7,19,20}. Only Cruz-Ferreira et al.¹⁸ briefly mention the performance of 34 floor-based exercises proposed by Joseph Pilates, focusing on pelvic and scapular stability, mobility of the spine, and stretching. The lack of information about the intervention makes it difficult to compare the results obtained by the studies, as well as the extrapolation for conducting other studies with the same protocol, or even, the guidance for clinical practice.

The frequency of sessions, mostly, consisted of two weekly interventions with duration of 60 minutes^{7,18,20}. Only one study¹⁹ conducted three sessions per week, in addition to being the only one to include another therapy in the experimental group and to intervene with the control group with initial instructions for postural education.

Photogrammetry was the postural evaluation method consensually adopted^{7,18,20}, although it differs regarding anatomical points of interest and analysis. For instance, Donahoe-Fillmore et al.¹⁹ evaluated only

the pelvic alignment in the sagittal plane, and did not observe any differences after 30 sessions of the Pilates Method.

Junges et al.²⁰ photographs of sagittal planes (right and left profiles) were acquired to investigate cervical-thoracic and front (back and front) distances to analyze the height of shoulders and shoulder blades, but they did not specify the anatomical points demarcated. After 60 intervention sessions, the group submitted to Pilates Method showed decreased cervical-thoracic distance in the sagittal plane, increased shoulder height and shoulder blades in the back posture, and stature gain. In addition, they used x-rays to measure Cobb angle of thoracic kyphosis, which significantly reduced after practicing the Pilates Method. However, it is worth noting that the average difference of eight Cobb degrees (pre $63.50 \pm 9.78^\circ$ and post $55.50 \pm 11.97^\circ$) found by the authors, despite being statistically significant ($p < 0.001$), may present no clinical relevance if we consider the reference adopted by the authors – that a normal kyphosis presents Cobb angles between 20° and 40° –, being that all participants presented hyperkyphotic curvatures.

It is noteworthy, still regarding the Cobb method for thoracic kyphosis evaluation, that it presents limitations, for despite having good intra- and inter-researchers agreement values²², with error values ranging from 3 to 10° , it has MDC (Minimum Detectable Change) values ranging between 9 and 10° ²³. Such MDC values reflect the amount of change in the evaluation required to determine that there was a true change and not just a measurement error²⁴, i.e., the eight degrees of difference found in the study of Junges et al.²⁰ may be a measurement error and not clinical change one. In addition, Mac-Thiong et al.²⁵ reported that thoracic kyphosis angle values can be influenced mainly by deformities in the coronal plane and by the pelvis alignment, which may be erroneous clinical interpretations-generating factors.

Cruz-Ferreira et al.¹⁸ also performed postural evaluations through photography, in frontal and sagittal planes. In the frontal plane, they evaluated the alignment of thoracic and lumbar spine, pelvis, and shoulders. However, in the sagittal plane, they investigated only the alignment of the head and pelvis. Researchers conducted three evaluations throughout the study (prior, after 24 and 48 sessions) comparing intra and intergroups in different evaluation times¹⁸. In the experimental group, changes were observed when comparing the pre-intervention with intermediate and

final periods, in frontal alignment of the shoulders and sagittal pelvic alignment, and by comparing initial and intermediate with final evaluation moments, regarding the sagittal alignment of the head. In the control group, changes were not observed. In intergroups comparisons, there were only differences regarding frontal alignment of the shoulders and sagittal alignment of the head after the 48 sessions.

In the study conducted by Sinzato et al.⁷, the method of image acquisition and analysis of the Posture Assessment Software – SAPO²⁶ was used, in which, from predefined points, they calculated horizontal alignments of the head, acromia, pelvis and anterior superior iliac spine, horizontal asymmetry of the scapula in relation to T3, frontal angles of lower limbs, vertical alignment of the body, knee angle and Q angle, and asymmetries of the center of gravity in frontal and sagittal planes (based on the anthropometric model proposed by Zatsiorsky and Seluyanov adapted by Leva²⁷). When comparing pre- and post periods (after 20 sessions), intra- and intergroup, they did not observe any difference regarding the variables analyzed.

Considering that the studies did not use the same methodology and neither evaluated the same variables, some observations should be made. Specifically regarding female older adults, 60 sessions of the Pilates Method seem to be effective in reducing the angle of thoracic kyphosis and cervical-thoracic distance, consequently increasing stature²⁰. Concerning the effects of the Pilates Method in young adult women, 20 sessions seem to be effective⁷, but 24 sessions would be able to promote improvements in frontal alignment of shoulders and sagittal pelvic alignment, and the latter seems to be observed if the intervention frequency is twice a week. After 48 sessions, these posture adjustments remain, and, in addition, changes in the sagittal alignment of the head are also perceived¹⁸. These results need to be confirmed by other high-quality studies in such a way that evidences can be considered acceptable.

CONCLUSION

Based on the Best Evidence Synthesis criteria, the results of this systematic review indicates that there is no scientific evidence about the effects of the Pilates Method on posture alignment of healthy women.

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