

# Effects of the pilates method on the pelvic floor muscles: a systematic review

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## ABSTRACT

**Background:** Among the methods used by physiotherapists for strengthening and controlling the pelvic floor muscles, Pilates method can be mentioned. Although recent studies have investigated the effects of the method on urinary incontinence, no recent systematic literature reviews on the subject have been found. **Objectives:** To conduct a systematic literature review demonstrating the effects of the Pilates method on urinary incontinence. **Methods:** A search was conducted in the databases MEDLINE, Scielo, LILACS, and PEDro, supplemented by a manual search. The search terms included the descriptors: urinary incontinence, Pilates method, pelvic floor strengthening, as well as these terms in English. The studies were analyzed by two independent evaluators, with no language or publication date restrictions. The methodological quality of the studies was evaluated using the PEDro scale. **Results:** Seven articles met the inclusion criteria and were included in this systematic review. Overall, the studies showed that there are significant results in the use of the Pilates method for urinary incontinence and pelvic floor muscle function, as well as improvements in quality of life. However, compared to conventional physiotherapy, the Pilates method is not superior, as both are effective interventions for the treatment of urinary incontinence. **Conclusion:** Although the Pilates method appears to be an effective intervention for the pelvic floor muscles and, consequently, improves urinary incontinence, this method is not superior to specific conventional physiotherapy targeting this musculature. However, these conclusions are based on only seven studies with low to moderate methodological quality.

**Keywords:** Urinary incontinence; exercise and movement techniques; resistance training; pelvic floor disorders.

## BACKGROUND

Urinary incontinence (UI) is defined by the International Continence Society (ICS) as "any complaint of involuntary loss of urine"<sup>(1)</sup>. It is classified based on its symptoms and can be categorized as urgency UI, when an individual experiences frequent and intense urge to urinate with episodes of urine leakage due to involuntary bladder contractions; stress UI, which involves urine leakage during physical activities or exertion; and mixed UI, characterized by a combination of the previous two symptoms<sup>(2)</sup>. Studies indicate that approximately 12.4% of young women, 45% of middle-aged women, and 75% of elderly women report urinary leakage<sup>(2)</sup>. Recent Brazilian research also shows that women, in general, have a higher incidence of UI compared to men of the same age<sup>(1)</sup>. UI can directly impact the quality of life for women, causing frustration, fear, shame, social isolation, introversion, sexual problems<sup>(3)</sup>, and can also affect athletic performance, leading to reduced participation in sports activities<sup>(4)</sup>. Although UI is more prevalent in women, men can also be affected by this problem, resulting in a negative impact on their quality of life, potentially leading to psychological disorders and social restrictions<sup>(5)</sup>. The most common form of UI in men occurs after prostate surgery, specifically radical prostatectomy (complete removal of the prostate)<sup>(5)</sup>. The prevalence of UI after radical prostatectomy can reach 90% of individuals and is related to weakness in the pelvic floor muscles following surgery<sup>(6)</sup>.

According to the Agency for Healthcare Research and Quality, the initial approach to treating UI is conservative management<sup>(7)</sup>. This approach includes education, exercises to strengthen the pelvic floor muscles, electrical stimulation, biofeedback, and the use of vaginal cones<sup>(7)</sup>. Education involves changes in hygiene practices and fluid intake habits, for example. Pelvic floor muscle exercises aim to increase the strength and endurance of the urethral muscles and improve urinary control<sup>(8)</sup>. Electrical stimulation is used when a patient has difficulty contracting and perceiving the pelvic floor muscles, promoting involuntary contractions of these muscles<sup>(8)</sup>. Vaginal cones, specifically for women, are used as devices for training the strength and control of the perineal muscles. Therefore, physiotherapeutic intervention in the treatment of UI is directly linked to training and awareness of the pelvic floor muscles, influencing behavioral conditions and postural perception of the individual<sup>(9)</sup>.

Among the methods used by physiotherapists for strengthening and control of the pelvic floor muscles, Pilates can be mentioned. Pilates is a method that requires strength, concentration, stability, breath control, fluidity, and body alignment. The exercises focus on activating muscles, particularly in the core region, including the muscles of the hips and thoracic cage<sup>(10)</sup>. Considering that the pelvic floor consists of voluntary contraction fibers, like other muscle groups in the human body, it is believed that the Pilates

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Submission date 27 March 2019; Acceptance date 27 March 2020; Publication date 01 August 2023.



method helps strengthen this muscle group and improves its control<sup>(11)</sup>. Recent studies have aimed to investigate the effects of Pilates on urinary incontinence, reporting promising results in both men and women<sup>(12)</sup>. Lausen et al. investigated the effects of Pilates in combination with conventional physiotherapy in 73 women with UI of all three types and reported positive effects related to urinary symptoms, daily activities, and social participation, compared to a control group that only received conventional physiotherapy<sup>(12)</sup>. For men, Pedriali et al. investigated the effects of Pilates in 85 individuals with UI following radical prostatectomy and found that the experimental group had a higher continence rate and faster acquisition of continence compared to the control group<sup>(5)</sup>.

Although the aforementioned results seem promising, no recent systematic literature reviews on the subject were found. Systematic reviews are considered the best method for synthesizing existing information on a specific topic as they are conducted following systematic and explicit methodologies<sup>(13)</sup>.

## METHODS

### Study design

A systematic literature review of experimental studies was carried out, in Portuguese or English, with no restriction on publication date. The databases consulted were Medline, LILACS, SCIELO and PEDro, and the search terms included the following descriptors: Urinary incontinence, Pilates method, strengthening and pelvic floor, as well as these terms in English, with specific strategies for each database. The searches and selection of articles were carried out by two independent evaluators and, in case of disagreement, a third evaluator was consulted. All studies were selected first by reading the titles, then by reading the abstracts, and finally by reading the full texts. A manual search was also performed in all the reference lists of the included articles.

### Inclusion and Exclusion Criteria

Inclusion criteria were experimental studies, in adults of both sexes, in which the intervention was the Pilates method for training the pelvic floor muscles, evaluating the effects on any outcome measure. Case studies or pilot studies, or studies with samples smaller than or equal to 10 individuals, were excluded. The outcome measures of interest were any related to pelvic floor muscle function and urinary incontinence, in addition to measures of activity and participation (quality of life). The extracted data were: sample

characteristics (such as sex, age, types of incontinence), purpose of the study, intervention protocol (exercises, duration, frequency and intensity), outcome measures used and results found.

### Methodological Quality

The methodological quality of the studies was assessed using the PEDro scale, whose main objective is to help database researchers to quickly and accurately identify the quality of the studies. This scale is composed of 11 items, with each item, except the first, contributing one point to the total score, which ranges from zero to 10 points.

## RESULTS

After the searches carried out in the databases, 16 articles were found, of which four were excluded after analyzing the titles, as they did not cover the proposed theme. Another four were excluded after reading the abstracts, as they also had no relationship with the proposed criteria in their objectives. Thus, eight articles were selected for full text reading and six were included after this analysis. After the manual search, an article was identified that, along with the six already selected in the databases, met the inclusion criteria and were part of this systematic review. Figure 1 represents the study selection flowchart, with each step performed<sup>(5, 12, 14-18)</sup>.

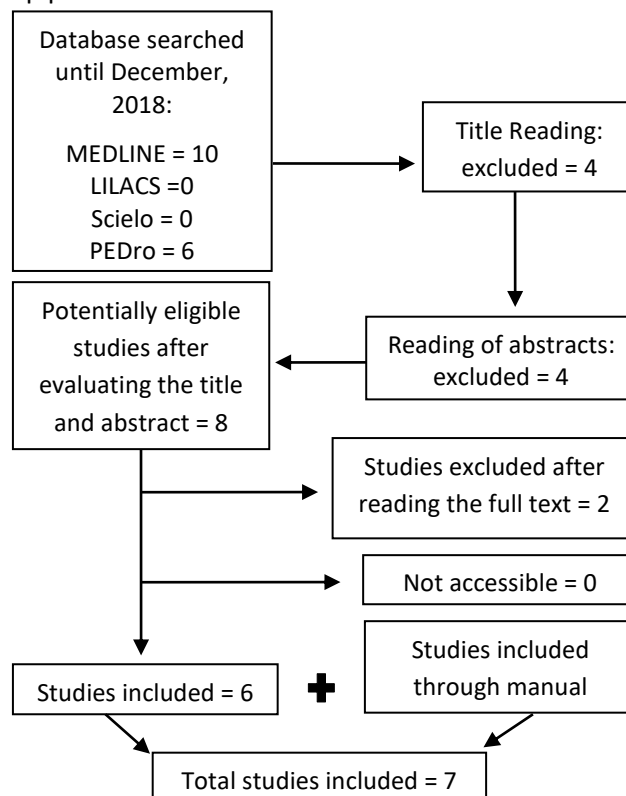


Figure 1. Study flowchart





Among the studies found, six were randomized clinical trials and one controlled study, assessed using the PEDro scale, with an average methodological quality of 5, and 4, ranging from 3 to 7 (Table 1). All studies were carried out with a convenience sample, using the Pilates method to strengthen the pelvic floor muscles, without age or gender limits. The studies included a total of 472 participants, with an average age ranging from 28 to 65 years. In all experimental studies, the training programs included Pilates method

exercises for the intervention groups, compared to the control group that received guidance, performed general rehabilitation exercises for lower and upper limbs, or performed conventional exercises to strengthen the pelvic floor. In addition, two studies had two experimental groups, which also evaluated the effects of electrical stimulation on the pelvic floor muscles, one study had no control group; and one study compared Pilates associated with pelvic floor exercises versus Pilates alone.

**Table 1.** Details of the studies on the PEDro scale.

Criteria	Culligan et al., (2010)	Dias et al., (2017)	Gomes et al., (2017)	Kulaksizoğlu et al., (2017)	Lausen et al., (2018)	Pedriali et al., (2016)	Torelli et al., (2016)
Randomization	1	1	1	0	1	1	1
Blinding of the distribution of participants	1	1	1	0	0	1	1
Initial similarity between groups	1	1	1	0	1	1	1
Blinding of participants	0	0	0	0	0	0	0
blinding of therapists	0	0	0	0	0	0	0
Blinding of evaluators	0	0	1	0	0	1	1
Measures of a primary outcome	0	0	1	1	1	1	0
“Intention to treat”	0	0	0	1	0	0	0
Intergroup comparison of the primary outcome	1	1	1	0	1	1	1
Precision and variability measurements	1	1	1	1	1	1	1
Total	5	5	7	3	5	7	6

Legend: 0 = no / 1 = yes

The outcome measures used were Strength (bidigital palpation - Oxford Scale and manometry), resistance and repeatability of the pelvic floor muscles (bidigital palpation), overactive bladder symptoms (SEAPI-QMM Incontinence Classification System), uroflowmetry, urine loss (number of pads, 24-hour pad test and voiding diary), severity of urinary symptoms (Symptom Severity Index), pelvic floor symptoms (Pelvic Floor Distress Inventory Short Form 20), thickness of pelvic muscles (ultrasound), quality of life (Incontinence Quality of Life Questionnaire, Lower Urinary Tract Symptoms Quality of life, International

Consultation on Incontinence Questionnaire — Short-Form, and Pelvic Floor Impact Questionnaire Short Form 7), and self-esteem (Rosenberg Self-Esteem Scale).

In general, the studies showed that there is a significant result in the use of the Pilates method for strengthening the pelvic floor muscles. However, compared to the use of conventional physiotherapy, the Pilates method is not superior, both being an effective intervention for the treatment of UI. The detailed description of the five studies is summarized in Table 2.



**Table 2.** Characteristics of the included studies (n=7).

Study	Design	Participants	Goal	Intervention parameters	outcome measures	Results
Culligan et al.,(2010)	Randomized Controlled Study	62 participants Control group (n = 32) Pilates Group (n=30) Average age: 50 years. Women	To determine whether a Pilates method program and a pelvic floor muscle exercise program would promote similar improvements in pelvic muscle strength.	Pilates Group: Pilates method exercises, twice a week, for one hour, for 12 weeks. Control Group: Pelvic floor strengthening exercises, twice a week, for one hour, for 12 weeks.	Pelvic floor muscle strength (perineometry), pelvic floor symptoms (Pelvic Floor Distress Inventory Short Form 20), and quality of life (Pelvic Floor Impact Questionnaire Short Form 7).	There was no difference in results between the intervention and control groups for all measures evaluated.
Dias et al.,(2017)	Randomized Controlled Study	36 participants Control group (n = 12) Pilates group (n = 24) Average age: 30 years. Women	To verify the efficiency of an exercise program using the Pilates method compared to conventional intervention for strengthening the pelvic floor muscles in pregnant women.	Pilates Group: Pilates in one-hour sessions, twice a week. Control Group: Walking and strengthening exercises for lower and upper limbs and trunk, stretching and relaxation exercises.	Strength of the pelvic floor muscles (manometer and digital palpation - Oxford scale), resistance and repeatability (digital palpation).	There was no difference in the results between the intervention and control groups for the strength measurement through the manometer. However, the strength, resistance and repeatability of the pelvic floor muscles, when evaluated by digital palpation, was greater in the intervention group when compared to the control group.
Gomes et al., (2017)	Randomized Controlled Study	Pregnant women with 14-34 weeks of gestation. 104 Participants Pilates group (n = 34) Electrical stimulation and pelvic floor strengthening group (n=35) Control Group (n=35) Male Average age 65 years.  Urinary incontinence, after radical protastectomy, after four weeks of surgical intervention.	To evaluate the effects of an exercise program using the Pilates method in relation to the conventional protocol in patients with post-prostatectomy urinary incontinence.	Pilates Group: Pilates on the floor, for 45 minutes, in a total of ten sessions. Electrical stimulation and pelvic floor strengthening group: Electrical stimulation combined with pelvic floor training: They performed ten sessions, lasting forty-five minutes. Control Group: None	Urine leakage (Pad test 24 hr), quality of life (International Consultation on Incontinence Questionnaire – Short-Form), and strength, endurance and power of the pelvic floor muscles (perineometry).	Both experimental groups had a greater number of continent individuals at the end of treatment, when compared to the control group.

Kulaksizoğlu et al., (2017)	Randomized Controlled Study	59 Participants Women Average age: 38 years old  Overactive bladder in the last twelve months.	To evaluate the effects of pelvic floor muscle training on overactive bladder symptoms.	Intervention group: Pilates in eighteen one-hour sessions, three times a week. Each exercises four or five repetitions. There was no control group	Overactive bladder symptoms (SEAPI-QMM) and uroflowmetry.	There was increased functional bladder capacity and improvements in overactive bladder symptoms.
Lausen et al., (2018)	Randomized Controlled Study	73 participants Control group (n = 37) Pilates group (n = 36) Average age: 52 years Women  Stress, urge or mixed incontinence.	To verify the efficiency of the six-week course of the Pilates method for the treatment of stress UI.	Group Pilates: Six weeks of group Pilates classes plus one-hour conventional physical therapy. Control group: Guidance on lifestyle and conventional physiotherapy to strengthen the pelvic floor.	Urinary symptoms (Symptom Severity Index), quality of life (Incontinence Quality of Life Questionnaire and Lower Urinary Tract Symptoms Quality of life) and self-esteem (Rosenberg Self-Esteem Scale).	The intervention group showed significant improvements in self-esteem, social embarrassment and were less affected by urinary incontinence in their activities of daily living compared to the control group.
Pedriali et al., (2016)	Randomized Controlled Study	90 participants Pilates group (n = 28) Electrical stimulation and pelvic floor strengthening group (n = 31) Control group (n = 31) Male Average age: 63 years.  Patients with urinary incontinence undergoing radical prostatectomy.	To evaluate the effects of an exercise program using the Pilates method in relation to the conventional protocol in patients with post-prostatectomy urinary incontinence.	Pilates Group: Pilates, once a week, ten sessions of one hour, and guidance on three home exercises. Electrical stimulation and pelvic floor strengthening group: Muscle training combined with anal electrical stimulation, once a week, in ten one-hour sessions. Control Group: Conventional exercises to strengthen the pelvic floor, once a week, in ten sessions of one hour.	Number of pads, urine loss (pad test 24 hr) and quality of life (International Consultation on Incontinence Questionnaire – Short-Form).	Both experimental groups improved on all outcome measures, with no significant difference between them. Compared to the control group, the Pilates group improved the number of pads and quality of life.
Torelli et al., (2016)	Randomized Controlled Study	48 participants Pilates group (n = 24) Pilates group and pelvic floor exercises (n = 24) Average age: 28 years old Women Nulliparous, healthy and physically inactive women.	To evaluate the effectiveness of adding voluntary pelvic floor muscle contraction exercises to a Pilates method program.	Pilates group: Pilates, without instructions for pelvic floor contraction, twice a week, for one hour, for 12 weeks. Pilates and pelvic floor exercises group: Pilates associated with voluntary contraction exercises of the pelvic floor, twice a week, for one hour, for 12 weeks.	Pelvic floor muscle strength (perineometry and digital palpation - Oxford scale) and pelvic muscle thickness (ultrasound).	Relative to the Pilates group, the Pilates group plus voluntary pelvic floor muscle contraction exercises improved all outcome measures after treatment.





## DISCUSSION

This review aimed to analyze the effects of the Pilates method in strengthening the pelvic floor muscles. Currently, the Pilates method has been used more frequently in rehabilitation in general and can bring great benefits to the health of its practitioners, as it is a method that requires strength, concentration, stability, breath control, fluidity and body alignment. The exercises cover muscle activation, primarily in the core, including the muscles in the hips and ribcage. In general, the description of the results suggests that Pilates has positive effects when compared to no intervention. However, when Pilates was compared to other intervention methods, such as conventional strengthening exercises for the pelvic floor muscles and electrostimulation, no significant differences were found, showing that both Pilates and the other methods are effective in the treatment of male UI and female<sup>(5, 14, 16)</sup>.

Regarding the possible gain in strength of the pelvic floor, it is believed that, due to the Pilates method, the woman develops an ability to consciously contract these muscles before and during the increase in intra-abdominal pressure<sup>(19)</sup>. Four studies investigated the effects of Pilates on the strength of this musculature<sup>(14-16, 18)</sup>. Dias et al. evaluated strength in two different ways, namely manometry and digital palpation, and performed non-specific exercises for the pelvic floor in the control group. For the first form of evaluation (manometry), no significant results were found, while for the second (digital palpation), which also evaluated resistance and repeatability, the authors reported significant results for the experimental group in relation to the control<sup>(15)</sup>. The studies by Gomes et al., and Culligan et al., who evaluated this variable through perineometry, did not find significant effects of the Pilates method when compared to the control group, which did not undergo any treatment, or underwent conventional training of this musculature<sup>(14, 16)</sup>. The fourth study compared Pilates versus Pilates associated with voluntary contraction exercises of the pelvic floor muscles, finding positive results for the group in which there was an association of treatments<sup>(18)</sup>. Thus, as we can observe, Pilates seems to be more effective only when compared to conventional physiotherapy, in which non-specific exercises for the pelvic floor are performed. However, Pilates alone, when compared to specific pelvic floor muscle training or compared to Pilates itself associated with pelvic muscle training, demonstrates similar results<sup>(5, 14, 16, 18)</sup>. Thus, although Pilates alone does not seem to be a more effective method than specific

conventional exercises for strengthening this musculature, the mean methodological quality of the studies<sup>(5, 14, 16)</sup> was six, a moderately low value, which makes caution necessary in interpreting such results.

Two studies evaluated the quantification of urine loss using the 24-hr pad test, which is also known as the pad test<sup>(5, 16)</sup>. Both studies showed significant results compared to the control group (non-specific conventional physiotherapy for the pelvic floor or no treatment). However, in both studies there was also no significant difference between the two experimental groups, which also compared Pilates with electrostimulation associated with conventional pelvic floor strengthening exercises. Thus, apparently, Pilates is effective in reducing urine loss when compared to no treatment or only conventional physiotherapy without specific exercises for the pelvic floor, although it is not superior to specific conventional exercises associated with electrostimulation. As a possible explanation for such effectiveness, we know that the Pilates Method comprises exercises that are performed in coordination with breathing, with concomitant recruitment of trunk muscles in various positions<sup>(21)</sup>. Such exercises are important, since continence (leakage of urine) is associated with the functions of respiratory mechanics and maintenance of intra-abdominal pressure<sup>(22)</sup>. Thus, when compared to conventional non-specific exercises for the pelvic floor, Pilates can provide greater control of continence. However, this effect alone is not superior when compared to specific exercises. Finally, again, more studies are needed to prove these results, since such interpretations are based on only two studies of moderate methodological quality and in one of the studies the period of improvement was spontaneous.

Four studies evaluated the effects of Pilates on the quality of life of incontinent individuals<sup>(5, 12, 14, 16)</sup>. Among these, two studies showed significant results in relation to the control group, which underwent conventional physical therapy with non-specific exercises<sup>(5, 12)</sup>. On the other hand, two other studies, which compared the effects of Pilates versus pelvic floor strengthening exercises<sup>(14)</sup>, or Pilates versus electrical stimulation plus exercises versus nothing<sup>(16)</sup>, found no significant difference between the different interventions (Pilates, conventional strengthening exercises and electrical stimulation). Thus, it is possible to observe, from all the studies described, that Pilates seems to be effective in improving quality of life. Thus, once again, Pilates is superior to non-specific conventional pelvic floor physiotherapy, but not when



compared to a specific conventional intervention for this musculature. The possible effect of Pilates on quality of life is possibly due to the previously reported effects on strength and continence, in addition to being a shared activity in which personal relationships, social embarrassment and improved self-esteem are worked on<sup>(23)</sup>. Such findings can be proven by the study by Lausen et al., 2016, which evaluated the effects of Pilates specifically on the self-esteem of incontinent women, and found significant results when compared to conventional exercises<sup>(12)</sup>.

Four studies also investigated the effects of Pilates on urinary symptoms<sup>(12)</sup>, overactive bladder symptoms and uroflowmetry<sup>(17)</sup>, pelvic floor symptoms<sup>(14)</sup>, and pelvic muscle thickness<sup>(18)</sup>. Regarding urinary symptoms and pelvic floor symptoms, no differences were found between the experimental group, which performed the Pilates method, and the control group, which performed specific conventional strengthening exercises. Furthermore, considering the thickness of the pelvic floor muscles, the study compared Pilates versus Pilates plus specific strengthening exercises, finding inferior results for the first group (Pilates alone). Finally, although the study by Kulaksizoglu et al. found positive results for symptoms of overactive bladder and uroflowmetry, this is a clinical trial without the presence of a control group, which compromises the quality of such findings. Thus, as noted, all reported findings do not demonstrate Pilates's superiority over other treatment methods, although such results are based on data from only one study for each of these measures, which makes such interpretations unreliable.

Finally, similar to this study, three reviews were found with objectives similar to the present study. The first is a narrative review of the literature, which aimed at the benefits of the Pilates method in strengthening the pelvic floor during the gestational period<sup>10</sup>. Although the study concludes that the Pilates method can be used to strengthen the perineal muscles, helping the pregnant woman in the prevention or treatment of dysfunctions that can be caused during pregnancy, the authors themselves suggest that additional studies be carried out. In addition, narrative reviews, as they do not present a judicious method of search, selection and inclusion of studies, may present results with bias of interest of the authors<sup>(24, 25)</sup>. The second study is a systematic review of the literature with meta-analysis, which aimed to evaluate the effects of the Pilates method on the function of the pelvic floor muscles<sup>(26)</sup>. Although it is a recent review, which did not report significant evidence of improvement in the function of the pelvic floor muscles in healthy women,

this review was based on only two studies, according to established criteria, and the level of evidence of the reported results was also weak. Finally, another systematic review also investigated the effects of alternative pelvic floor exercises, including Pilates, concluding that there is no evidence that such exercises can improve pelvic floor dysfunctions<sup>(27)</sup>.

According to the results, we could observe that, although the Pilates method seems to be effective for the pelvic floor muscles, it is only superior when compared to non-specific exercises for this musculature. However, when compared to the specific training of such muscles, the effects of Pilates become equal or inferior. It is important to remember that pelvic floor muscle training is considered the first option for the treatment of urinary incontinence<sup>(28, 29)</sup>. In Pilates, the pelvic floor muscles are not specifically trained. Although it is hypothesized that the co-contraction of these muscles will counteract the negative effect of increased intra-abdominal pressure, preventing urine leakage and thus strengthening the pelvic muscles<sup>(30)</sup>, it is known that 30% of women do not contract effectively the pelvic floor muscles during the first assessment<sup>(31)</sup>. This means that, without prior muscle training, the Pilates method does not seem to be effective for these muscles.

Among the limitations of this review, we can mention the inclusion of only seven significantly heterogeneous studies. Most studies carried out different training protocols, evaluating different outcome measures, with two studies having two intervention groups and one not having a control group. In addition, all articles had low to moderate methodological quality in the PEDro scale score (scores three to seven), which may also influence the results found. Thus, further studies are needed to investigate the benefits of the Pilates method in patients with UI. Randomized clinical trials, with larger samples and similar protocols, of adequate methodological quality, would prove the possible benefits of this intervention in this population.

## CONCLUSION

This systematic review aimed to investigate the effects of the Pilates method on the pelvic floor musculature of individuals with UI. The results showed that the Pilates method seems to be effective in the treatment of UI when compared to no treatment in the following outcome measures: strength, resistance and repeatability of the pelvic floor muscles, symptoms of overactive bladder, uroflowmetry, urine loss, severity of symptoms urinary tract, pelvic floor symptoms, pelvic muscle thickness, quality of life and self-esteem.



However, the method is not superior to conventional exercises, especially when associated with electrostimulation. Although the results are promising, these conclusions are based on only seven studies of low to moderate methodological quality. Thus, there is still a need for more randomized clinical trials that evaluate these and other possible benefits of Pilates in this population, in order to scientifically prove its effects, in addition to a possible superiority or not, so that it can be recommended appropriately and reliable in the treatment of urinary incontinence.

**Authors' contribution:** LSCG, DRR and KKPM elaborated the study design; LSCG and DRR performed the data collection; KKPM, PRA and HSC performed the critical intellectual revision of the manuscript. All authors read and approved the final manuscript.

**Financial support:** The study did not have any financial support.

**Conflict of interest:** This study has no conflict of interest.

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