

## Original Article

# Do perineal exercises during pregnancy prevent the development of urinary incontinence? A systematic review

Andrea Lemos, Ariani Impieri de Souza, Ana Laura Carneiro Gomes Ferreira, José Natal Figueiroa and José Eulálio Cabral-Filho

Instituto Materno Infantil Prof. Fernando Figueira (IMIP), Recife, Pernambuco, Brazil

**Objectives:** The aim of the current article was to conduct a systematic review of the performance of perineal exercises during pregnancy and their utility in the prevention of urinary incontinence.

**Methods:** Randomized controlled studies (RCT) of a low-risk obstetric population (primiparas or nulliparas) who had done perineal exercises only during pregnancy met the inclusion criteria. Articles published between 1966 and 2007 from periodicals indexed in the LILACS, SCIELO, PubMed/MEDLINE, SCIRUS and Cochrane Library databases were selected, using the following keywords: 'urinary incontinence', 'pregnancy', 'pelvic floor' and 'exercise'. The Jadad scale was applied to assess the internal validity of the RCT and two meta-analysis: one of fixed effects and the other of random effects were carried out with data extracted from the RCT, using the Stata 9.2 statistical software and adopting a significance level of 0.05.

**Results:** Four RCTs with high methodological quality, involving a total of 675 women were included. They indicated that perineal muscle exercise significantly reduced the development of urinary incontinence from 6 weeks to 3 months after delivery (odds ratio = 0.45; confidence interval: 0.3 to 0.66). However, when evaluating this effect during the 34th and 35th gestational week, a meta-analysis showed that the results were not significant (odds ratio = 0.13; confidence interval: 0.00 to 3.77).

**Conclusion:** Pelvic floor muscle exercises may be effective at reducing the development of postpartum urinary incontinence, despite clinical heterogeneity among the RCT.

**Key words:** exercise, pelvic floor, perineum, pregnancy, urinary incontinence.

## Introduction

Pregnancy and vaginal delivery are considered major factors for the development of urinary incontinence (UI) because they may cause damage to the fascia, ligaments, nerves and muscles of the pelvic floor.<sup>1-3</sup> There is a decline in perineal muscle strength from the 20th gestational week to 6 weeks postpartum that may interfere with perineal muscle function.<sup>4</sup>

The prevalence of urinary incontinence ranges from 20% to 67% during pregnancy and from 0.3% to 44%<sup>5-9</sup> in the postpartum period. Perineal muscle exercise during pregnancy has been recommended for the prevention of this disorder.<sup>10</sup> Since Kegel<sup>11</sup> first proposed these exercises in 1948 as a method of reducing urinary incontinence, this procedure has been widely documented in published reports,<sup>12-15</sup> showing successful results, namely, increasing muscle strength and reducing or eliminating urine loss. However, doubts have been raised about the effectiveness of perineal exercises and whether it is the optimal protocol for the prevention of UI, both during pregnancy and in the postpartum period.<sup>16</sup>

A variable that affects the success of these exercise programs is the lack of standardized proposals concerning the exercises to be performed. Diverse parameters have been described in published reports. Variations include the number of daily perineal muscle contractions, duration of each muscle contraction, rest interval between muscle contractions and type of contraction to be performed.<sup>10,16-18</sup>

In routine practice, the pregnant woman usually asks the healthcare professional who is responsible for the pre-natal care, not only about

the effectiveness of perineal exercises, but also when to start, how to do them and until what point to continue these exercises.

A systematic review of the peripartum pelvic floor exercise role in preventing pelvic floor dysfunction, including urinary and anal incontinence, has been published.<sup>19</sup> However, this review included studies involving the use of antepartum and/or postpartum pelvic floor exercises associated with other physical modalities such the use of biofeedback. The author concluded that postpartum pelvic floor exercises when performed with a vaginal device appear to be effective in decreasing postpartum urinary incontinence.

Therefore, this study was aimed at undertaking a systematic review of randomized controlled trials to evaluate the available scientific evidence about the effectiveness of isolated perineal exercise programs, without the use of any other kind of device, during pregnancy for the prevention of urinary incontinence. Furthermore, the purpose of the current study was to investigate the frequency, duration and type of exercise recommended in these studies, in order to delineate an appropriate evidence-based exercise prescription for the daily practice of healthcare professionals who manage this specific type of population.

## Methods

Articles published between 1966 and 2007 from periodicals indexed in the LILACS, SCIELO, PubMed/MEDLINE, SCIRUS and Cochrane Library databases were selected to undertake this review. The keywords used were based on the MeSH list, and the following terms were chosen: 'urinary incontinence' AND pregnancy, pregnancy AND 'pelvic floor', pregnancy AND 'pelvic floor' AND exercise and all terms together for each database. The reference lists from the selected studies were also checked to identify other studies that could have been missed by electronic search.

**Correspondence:** Andrea Lemos PT MSc, Rua Amália Bernardino de Sousa, 454- apto- 101, Recife, PE, Brazil, 51021-150. Email: lemosandrea@bol.com.br

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Title and abstracts identified by electronic searches were examined independently by two researchers on-screen to select potentially relevant studies. Randomized controlled studies based on a sample of a low-risk obstetric population (primiparas or nulliparas) who had only done perineal exercises during pregnancy met the inclusion criteria. Studies that used vaginal cones, electrical muscle stimulation and bio-feedback for perineal muscle strengthening were excluded. The presence of urinary incontinence was defined by self-reported symptoms related by the participants during and/or after pregnancy and other types of outcome measures were: pelvic floor strength, type, frequency, intensity and diligence of the prescribed exercises, quality of life measures.

For the assessment and classification of the internal validity of the studies included, the Jadad<sup>20</sup> system was used and the evaluation of their methodological quality was undertaken by two reviewers (A.L. and A.L.C.G.F.). Any disagreement was resolved by discussion. This system uses scores ranging from 0 to 5. Study quality was regarded as low when the score reached 2 points or less.

Two meta-analyses were carried out to answer the key question posed at the start of the current review, one for the third trimester of pregnancy and another for 6 weeks to 3 months postpartum.

A meta-analysis of fixed effects was carried out with data derived from the studies and a formal heterogeneity test was used. When this test was significant, the meta-analysis of random effects was carried out. The Stata 9.2 software was used for statistical procedures and a significance level of 0.05 was adopted for the tests.

## Results

Among the 1711 articles initially identified through the electronic database searches, 10 were fully retrieved for more detailed evaluation, six of them were then excluded, four due to different primary outcome and two due to previous urinary incontinence. A total of four randomized controlled trials involving 675 women met the selection criteria for the review: Sampsellet *et al.* 1998; Reilly *et al.* 2002;<sup>17</sup> Morkved *et al.* 2003 and Chávez *et al.* 2004 (Fig. 1).<sup>10,16–18</sup> These studies examined the performance of perineal exercises during pregnancy and investigated the frequency of urinary incontinence as a primary outcome.

Concerning assessment of methodological quality, the selected articles scored 3 points, according to Jadad's scale,<sup>20</sup> indicating the high quality of the studies and all of them had adequately concealed group allocation. None of the studies was considered double-blind, although the investigator was blinded to the groups of pregnant women in all of the assessments. In addition, the person responsible for perineal muscle training was blinded to the assessment outcome. However, blinding the patient to the intervention was not possible.

The mean age of the women studied was similar among the studies, ranging from 23 to 29 years. Samples included nulliparas and primiparas (Table 1). Among the four studies found, three (Sampsellet *et al.* 1998; Reilly *et al.* 2002 and Chávez *et al.* 2004)<sup>10,17,18</sup> selected women with no previous history of urinary incontinence. However, a negative history of UI was not cited by Morkved *et al.*<sup>16</sup> as an exclusion criterion and Reilly *et al.*<sup>17</sup> selected women with increased bladder neck mobility for their study.

There were discrepancies in classification criteria for continence and severity of incontinence in the pregnant women studied. All authors assessed the onset of UI based on the women's information about urine loss that was gathered by a questionnaire given during re-evaluation. Only Reilly *et al.*<sup>17</sup> carried out a pad test and explained the type of incontinence that had been included in their study. These same authors excluded pregnant women who had only urge-incontinence.

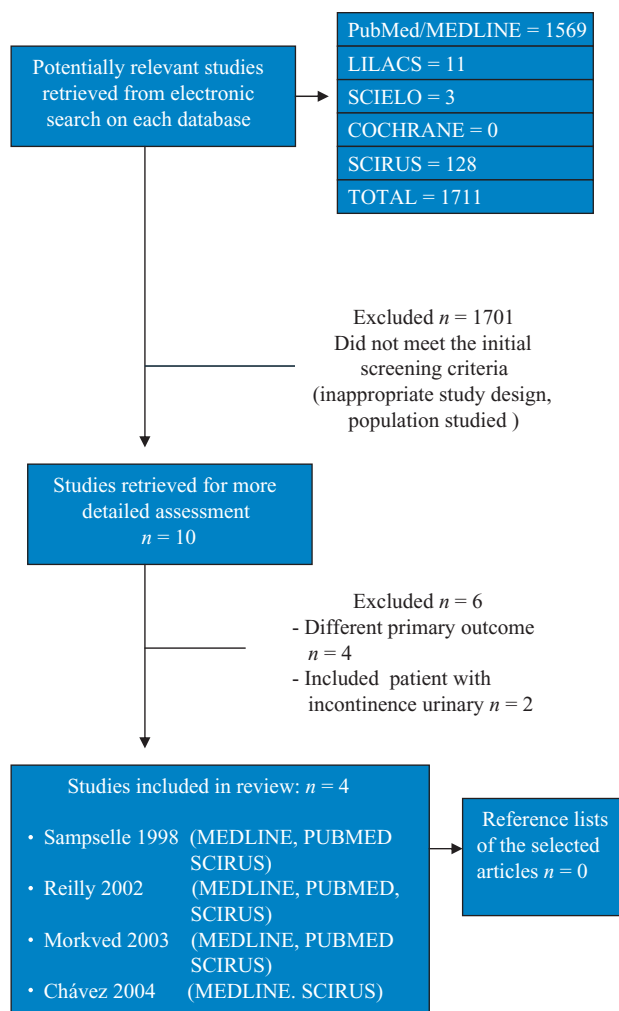


Fig. 1 Search and selection of studies for systematic review.

All of the studies initiated the exercise program in the 20th gestational week. Subsequent evaluations were carried out between the 35th and 36th week of pregnancy and between 6 weeks and 3 months postpartum. Only a study carried out by Sampsellet *et al.*<sup>10</sup> prolonged the re-evaluation period to 6 and 12 months postpartum.

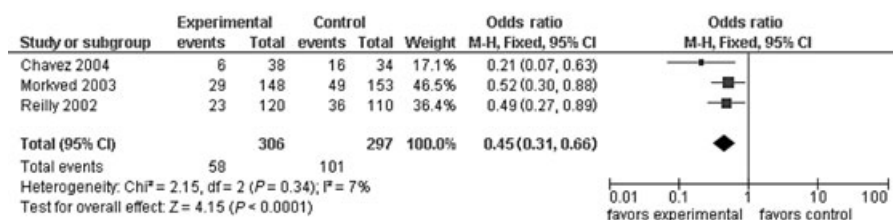
Recommendations concerning exercise protocol and daily instructions on how to perform the exercises differed in each study. In three studies (Reilly *et al.* 2002, Morkved *et al.* 2003 and Chávez *et al.* 2004),<sup>16–18</sup> muscle contractions were sustained for 6–8 s, although there was heterogeneity in the type of contraction and number of repetitions. In a study conducted by Sampsellet *et al.*,<sup>10</sup> instructions on how to do the exercises were based on a protocol proposed by Miller *et al.*<sup>21</sup> This study recommended doing five levels of pelvic floor muscle exercises according to individual capacity, although it did not describe the level of exercise carried out by intervention group patients (Table 1).

In three studies (Reilly *et al.* 2002, Morkved *et al.* 2003 and Chávez *et al.* 2004),<sup>16–18</sup> a physical therapist supervised muscle training, giving the control groups information on perineal muscles and how to contract these muscles. Sampsellet *et al.*<sup>10</sup> provided no similar explanation in their study data, although they reported that 20% of the control group had performed perineal exercises. Reilly *et al.*<sup>17</sup> also described that more than half of the control group did this type of exercise. This information was not available in other studies.

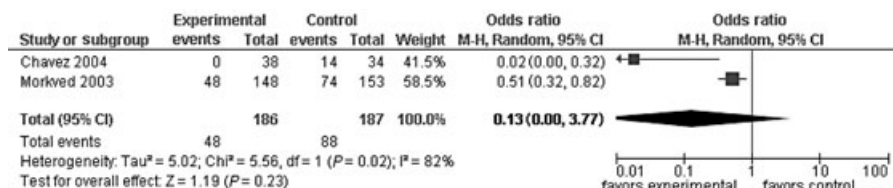
**Table 1** Characteristics of the included studies

| Author   | Samples                                | Location          | Randomization/<br>allocation<br>concealment  | Main and secondary<br>measures   | Age<br>(years)                   | Beginning of<br>exercise<br>program  | Exercise protocol  | Exercise program  | Posture adopted  |
|--|--|-------------------|--|--|----------------------------------|--------------------------------------|--|---|--|
| Sampsel<br><i>et al.</i><br>(1998) <sup>10</sup> | 72 primiparas<br>34 (TG)<br>38 (CG)    | United<br>States  | Computer generated<br>random numbers table.<br>Allocation concealment<br>adequated.                                  | Presence of urinary<br>incontinence.<br>Pelvic floor muscle<br>strength.   | TG: 28.2 ± 5.6<br>CG: 26.3 ± 5.4 | 20th gestational<br>week             | †Based on a protocol<br>by Miller <i>et al.</i> (1994) <sup>21</sup>   | Does not report<br>follow-up for exercise<br>training.<br>Perform 30 contractions<br>per day in maximum<br>intensity.   | Does not inform.   |
| Reilly <i>et al.</i><br>(2002) <sup>17</sup>     | 230 primiparas<br>120 (TG)<br>110 (CG) | United<br>Kingdom | Simple-randomization.<br>Pseudo-random<br>numbers generated by<br>computers.<br>Allocation concealment<br>adequated. | Presence of urinary<br>incontinence.<br>Pelvic floor muscle<br>strength.<br>Bladder neck mobility.<br>Joint hypermobility.<br>Quality of life. | GT: 27<br>CG: 29                 | 20th gestational<br>week             | Three repetitions of<br>eight contractions<br>sustained for 6 s.<br>Rest 2 min between<br>contractions.                            | Monthly visits to the<br>physical therapist from<br>the 20th week until<br>delivery.<br>Follow the protocol<br>twice a day at home.   | Does not inform.   |
| Morkved<br><i>et al.</i><br>(2003) <sup>16</sup> | 301 nulliparas<br>148 (TG)<br>153 (CG) | Norway            | Randomization was<br>done in blocks of a<br>maximum 32.<br>Allocation concealment<br>adequated.                      | Presence of urinary<br>incontinence.<br>Pelvic floor muscle<br>strength.   | TG: 28 ± 5.3<br>CG: 26.9 ± 3.9   | 20th gestational<br>week             | Contraction sustained<br>for 6–8 s.<br>At end of each<br>contraction add three<br>to four contractions.<br>Rest 6 s.               | Weekly visits to physical<br>therapist, lasting 1 h,<br>between the 20 <sup>th</sup> and<br>36 <sup>th</sup> week.<br>Perform 8 to 12<br>contractions twice a<br>day at home. | Supine, sitting,<br>kneeling and<br>orthostatic<br>positions.  |
| Chávez<br><i>et al.</i><br>(2004) <sup>18</sup>  | 72 nulliparas<br>38 (TG)<br>34 (CG)    | Mexico            | Random numbers table.<br>Allocation concealment<br>adequated.  | Presence of urinary<br>incontinence.<br>Pelvic floor muscle<br>strength.   | TG: 25.5 ± 6.1<br>CG: 23.6 ± 7.2 | 20 <sup>th</sup> gestational<br>week | One slow contraction<br>sustained for 8 s<br>followed by three fast<br>contractions sustained<br>for 1 s at an interval of<br>6 s. | Weekly visits to physical<br>therapist, for 1 h, during<br>the 20 <sup>th</sup> to the 28 <sup>th</sup><br>week.<br>Follow the protocol 10<br>times a day at home.            | Supine with lower<br>limbs in flexion,<br>followed by sitting<br>position and<br>orthostatic<br>posture. |

CG, control group; TG, treated group. †Protocol: level 1: 10 short contractions; five sets/day with 30-s interval between sets of activities; level 2: 10 more intense short contractions; five sets/day; level 3: 10 maximum contractions sustained for 3–6 s with 10-s interval between contractions; three times/day; level 4: five maximum contractions sustained for 5 s followed by 5 s more with 50% maximum voluntary contractions; level 5: maintenance level recommending 5 contractions, one to two sets of activities per week.



**Fig. 2** Effect of perineal exercises on the development of urinary incontinence from 6 weeks to 3 months postpartum in randomized controlled studies and resultant meta-analysis using fixed effects models. CI, confidence interval.



**Fig. 3** Effect of perineal exercises on the development of urinary incontinence in the 34<sup>th</sup> and 35<sup>th</sup> gestational week in randomized controlled studies and a resultant meta-analysis using random effects models. CI, confidence interval.

Only two studies (Reilly *et al.* 2002 and Sampsel *et al.* 1998)<sup>10,17</sup> demonstrated that diligent perineal training exercise influenced the frequency of postpartum incontinence. For Reilly *et al.*,<sup>17</sup> patients who did these exercises for 28 days or more had a lower risk of developing UI symptoms (relative risk [RR] = 0.56; confidence interval [CI] 95%: 0.30 to 0.99). In contrast, Sampsel *et al.*<sup>17</sup> found no statistically significant difference in outcomes of more diligent patients, for example, those who exercised 75% of the time.

Only studies conducted by Sampsel *et al.*<sup>10</sup> and Reilly *et al.*<sup>17</sup> investigated the influence of type of delivery on outcome, showing no difference in the development of incontinence. Only one study, carried out by Reilly *et al.* correlated perineal exercise with its effect on quality of life. Patients responded to the SF-36 and the King's Health Questionnaires, showing a significant improvement ( $P = 0.004$ ) in the general health domain of the SF-36 Questionnaire 3 months postpartum in the exercise training group.

A meta-analysis of three studies including 515 participants (Reilly *et al.* 2002; Morkved *et al.* 2003 and Chávez *et al.* 2004)<sup>16–18</sup> was done to show the effect of performing perineal exercises during pregnancy on the prevention of urinary incontinence from 6 weeks to 3 months postpartum. Since a study carried out by Sampsel *et al.*<sup>10</sup> failed to provide data required for application in this meta-analysis, it was excluded. Despite variation in the results of individual studies, the statistical heterogeneity test revealed homogeneity ( $P = 0.342$ ). This analysis indicated that perineal exercise had a protective effect on the development of postpartum urinary incontinence (odds ratio [OR] = 0.45, CI: 0.31 to 0.66) (Fig. 2).

Since this effect was analyzed during pregnancy between the 34<sup>th</sup> and 35<sup>th</sup> gestational week, a study conducted by Reilly *et al.*<sup>17</sup> was excluded because its assessment was only carried out 3 months after delivery, resulting in a sample of 376 pregnant women. Homogeneity of effects was not evident in this case ( $P = 0.018$ ) and therefore a meta-analysis of random effects was carried out, indicating no significant outcome (OR = 0.13; CI: 0.00 to 3.77, Fig. 3).

Although the study conducted by Sampsel *et al.*<sup>10</sup> was excluded from statistical analyses, it showed a significant decrease in the frequency of incontinence in the 35<sup>th</sup> gestational week ( $P = 0.043$ ); 6 weeks postpartum ( $P = 0.032$ ) and 6 months postpartum ( $P = 0.044$ ) in the perineal training group, a difference that did not persist 12 months postpartum.

Perineal muscle strength was another assessment criterion in the respective studies. Improvement in muscle strength was found throughout pregnancy and the postpartum periods (Table 2). Nevertheless, a

meta-analysis could not be carried out, since there was no homogeneity in the method of evaluation chosen by these studies.

## Discussion

The current systematic review indicated that the performance of perineal exercises had a protective effect against the development of postpartum urinary incontinence. However, despite the adequate randomization and concealed allocation done by the studies, analysis of the external validity, that reflects knowledge of the clinical condition, should be considered in some aspects, due to heterogeneity of specific issues.

In the study samples, some women were predisposed to developing urinary incontinence. One study (Morkved *et al.* 2003)<sup>16</sup> did not regard a history of previous urinary incontinence as an exclusion criterion and another study (Reilly *et al.* 2002)<sup>17</sup> included women with increased bladder neck mobility.

The studies did not demonstrate homogeneity in the exercise programs recommended or in exercise frequency per day. Exercise measurements differed in duration and intensity. None of the studies justified the reasons for choosing the exercises on the grounds of muscle physiology. Only a study carried out by Morkved *et al.*<sup>16</sup> gave exercise instructions based on a standardized training protocol recommended by the American College of Sports Medicine<sup>22</sup> highlighting the intensity and frequency of training.

The interval between contractions that were sustained for 6 s coincided in three studies. However, fast-twitch and slow-twitch pelvic floor muscle fibers were worked by some women, while only tonic muscle fibers were targeted by others by using a similar rest interval between contractions. In some studies, physical therapists strongly encouraged a more frequent practice of pelvic floor muscle exercise, with 1-h weekly follow-up visits.

In these studies, the time chosen for re-evaluation ranged from 6 weeks to 3 months postpartum. However, there is no support to extrapolate findings from these studies to others beyond this time period. Only one study followed these women for a period of 6 months and 1 year.

Another important aspect to be explored is the contamination that may have been produced by a proportion of control group women who did the exercises, since they had received information about exercising. Theoretically it could reduce the effect difference between the groups, but these data were not explored by the respective studies selected and only the percentage doing the exercises was reported. However, a more

**Table 2** Evaluation of perineal muscle strength between the control group and the perineal exercise training group in randomized controlled trials and respective results found by the authors

| Author                                       | Method of evaluation of muscle strength   | Results   |
|--|---|---|
| Sampselle <i>et al.</i> (1998) <sup>10</sup> | <ul style="list-style-type: none"> <li>Strength speculum developed for the study</li> <li>Strength measured in Newtons</li> </ul> | Increase in strength in numerical terms in the 6th gestational week and 6 months postpartum that showed no significance†  |
| Reilly <i>et al.</i> (2002) <sup>17</sup>    | <ul style="list-style-type: none"> <li>Perineometer</li> <li>Strength measured in cmH<sub>2</sub>O</li> </ul>                     | No significant difference was found among the groups ( $P = 0.38$ )   |
| Morkved <i>et al.</i> (2003) <sup>16</sup>   | <ul style="list-style-type: none"> <li>Pressure transducer – strength measured in cmH<sub>2</sub>O</li> </ul>                     | Increase in strength in the exercise training group:<br>36th gestational week ( $P = 0.008$ )<br>6 weeks postpartum ( $P = 0.048$ )                                       |
| Chávez <i>et al.</i> (2004) <sup>18</sup>    | <ul style="list-style-type: none"> <li>Electronic vaginal myograph</li> </ul>   | Increase in strength in the exercise training group:<br>28th gestational week ( $P = 0.08$ )<br>35th gestational week ( $P = 0.00$ )<br>6 weeks postpartum ( $P = 0.00$ ) |

†The author did not describe the  $P$  value.

detailed analysis on a probable bias generated by this aspect was not carried out. In this case, a control group that does not perform any type of exercise is extremely difficult to create in practice. In addition, it is ethically impossible, since there is no way to control information about perineal muscle training during pregnancy.

The influence of type of delivery on study outcome was also another factor that was not fully explored in the studies. No conclusion could be reached on the extent to which this variable interfered with the respective studies.

All studies that were aimed at investigating the occurrence of urinary incontinence were based on patient complaints. Only one study, carried out by Reilly *et al.*,<sup>17</sup> reported the type of incontinence included. None of the studies carried out urodynamic assessment to standardize classification. The exclusion of urodynamic assessment was discussed in a study conducted by Morkved *et al.*,<sup>16</sup> who chose measurements that caused a minimum amount of discomfort to patients. Although urodynamic study is regarded as an objective method that is efficient in the diagnosis and prognosis of incontinence,<sup>23–26</sup> there are authors<sup>27,28</sup> that do not recommend this exam in daily routine practice and patient management was based on clinical symptoms. Due to the invasive nature of urodynamic testing and published reports<sup>29</sup> that 23% of the women have described moderate discomfort, it is understandable that current review studies choose clinical evaluation. The samples comprised healthy pregnant women and the International Continence Society also recommends using this method for assessing treatment effects.<sup>30</sup>

Although three studies (Sampselle *et al.* 1998; Morkved *et al.* 2003 and Chávez *et al.* 2004),<sup>10,16,18</sup> demonstrated an improvement in muscle strength after perineal training, the lack of consistency regarding the methods of measurement and parameters used to measure muscle activity prevented an in-depth analysis and thus a more robust conclusion.

With this systematic review, it was not possible to investigate whether the performance of perineal exercises exerted any effect on quality of life in women doing these exercises, since only one study<sup>17</sup> evaluated this association.

The review of these studies has implications for clinical practice. It has been suggested that pregnant women who do perineal exercises during pregnancy may benefit from this procedure decreasing the prevalence of UI symptoms until 3 months following delivery, although caution is necessary when interpreting data from the present review due to the clinical differences found.

Future studies on this subject area are needed to better delineate exclusion criteria for samples, eliminate other risk factors for urinary incontinence and carefully analyze the influence of perineal muscle exercise on the control group, as well as a regular practice of these exercises, type of delivery and impact of exercise on quality of life. A specific exercise protocol should be designed to strengthen the pelvic floor muscles, based on the functional demands on this skeletal muscle group. Furthermore, follow-up assessment must be longer than 3 months.

## Conclusion

A systematic review of randomized controlled studies on the performance of perineal exercises during pregnancy showed that these exercises may be effective in reducing the development of urinary incontinence from 6 weeks to 3 months after delivery, despite clinical heterogeneity among the studies. Data from the current review were inconclusive concerning the effect of exercises during pregnancy.

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