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Review article

Physical activity and urinary incontinence during pregnancy and postpartum: A systematic review and meta-analysis ☆

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ABSTRACT

To assess the association of physical activity and urinary incontinence, or its recovery, during pregnancy and postpartum.

A search of publications indexed in five major electronic databases (CENTRAL, PubMed, EMBASE, CINAHL and PEDro) was performed from their respective inception dates to the 30 March 2020 with a combination of keywords to identify studies of interest. Google Scholar was used for non-indexed literature. All studies comparing physical activity with standard care in pregnant and postpartum women were selected.

Two reviewers independently selected studies, assessed quality and extracted data. Odds ratios with 95% confidence intervals were calculated using fixed effects or random effects models, for low and moderate heterogeneity between studies, respectively.

Seven studies (n = 12479) were included. Data of four studies could be pooled for meta-analyses; subgroup and sensitivity analyses were not possible. Physical activity, either during pregnancy or postpartum, is not associated with urinary incontinence, OR 0.90 (95% CI: 0.69–1.18) and OR 1.31 (95% CI: 0.74–2.34), respectively. Due to a lack of available data, urinary incontinence recovering could not be assessed.

The available low evidence does not show that physical activity during pregnancy or postpartum is associated with urinary incontinence. Moderate physical activity should therefore be encouraged for the evidence-based benefits on other obstetrical outcomes.

Contents

Abbreviations: CINAHL, Cumulative Index to Nursing and Allied Health Literature; CONSORT, CONsolidated Standards of Reporting Trials; CS, Colin Simonson; DD, David Desseauve; EMBASE, Excerpta Medica database; GRADE, Grading of recommendations Assessments, Development and Evaluation; NvA, Nadine von Aarburg; NVR, Nikolaus Veit-Rubin; OR, Odds ratio; PEDro, Physiotherapy Evidence Database; PFMT, Pelvic floor muscle training; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology; Tra, Transversus abdominis; UI, Urinary incontinence; WHO, World Health Organization.

☆ This article is based on the results of a Master Thesis conducted within the joint Master of Science (MSc) in Health Sciences of HES-SO (University of Applied Sciences and Arts Western Switzerland) and University of Lausanne (UNIL), major in physiotherapy, at HES-SO Master.

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Introduction

Urinary incontinence (UI) is a common condition among women [1], which can lead to substantial reduction in quality of life for affected individuals [2–3]. Pregnancy and childbirth are considered important risk factors for the development of UI [4–6]. Prevalence estimates for any type of UI during pregnancy and the first year postpartum are reported to be 32–64% and 15–30% respectively [1].

According to the World Health Organization (WHO) [7], physical activity is an important and modifiable health factor for all age groups. In adults aged between 18 and 64 years old, there is strong evidence that physical activity improves cardiorespiratory and muscular fitness, and reduces the risk of depression. There is moderate evidence it increases bone density in adults [8]. Additionally, other publications report that mild to moderate physical activity is associated with a reduction of the prevalence of UI in women [9–13].

Previous systematic reviews have been carried out on physical activity and UI in pregnant and postpartum women, but included studies which often assessed interventions combining exercises for pelvic floor muscle training (PFMT) and another physical activity [14–16]. Although antenatal PFMT seems to be effective in preventing urinary incontinence (low-quality evidence) in late pregnancy and (moderate-quality evidence) in the postnatal period. In a population of continent women, its effectiveness to treat urinary incontinence is uncertain. PFMT programs require the intervention of a physiotherapist for patient education and its cost effectiveness is unknown. Therefore, its use in an unselected population of pregnant women cannot be recommended [17].

Physical activity is recommended for pregnant and postpartum women given numerous beneficial outcomes [18]. The aim of this systematic review and meta-analysis is to assess the association between UI, or its recovery postpartum, and physical activity without PFMT in this population.

Methods

The Cochrane criteria for systematic reviews were applied [19].

Data sources

A systematic review of publications indexed in five major electronic databases was performed: PubMed, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), CINAHL Complete in EBSCOhost and PEDro. In addition, Google Scholar was used for grey literature search and contact with study authors was established to identify additional studies. The databases were searched from their respective inception dates to the 30 March 2020. A complete description of the search strategy is provided in Appendix A. The lists of references in the identified publications were manually searched. Only studies in English and French without any temporal or regional restrictions were assessed.

Eligibility criteria

The inclusion criteria were defined as follow: 1) Types of study: Given the small number of studies evaluating the benefits of physical activity on the incidence of urinary incontinence during and after pregnancy, there were no restrictions on the eligible types of study design; 2) Types of participants: healthy pregnant or postpartum women (up to 6 months after birth in accordance with the WHO definition) [20]; 3) Intervention: Any type of physical activity corresponding to the definition of the WHO [7] was considered. This includes some activities of daily living (i.e. walking, climbing stairs, cycling for transportation), occupational (i.e. work), household chores and any sports or leisure activities.

Main outcomes

1) Primary maternal outcomes measure: incidence of urinary incontinence during pregnancy and incidence of urinary incontinence in the postpartum period; 2) Secondary maternal outcomes measures: the recovery time of postpartum urinary incontinence symptoms [21,22]. According to the International Continence Society (ICS) we defined the urinary incontinence symptom as "the complaint of any involuntary loss of urine" and its subtypes: Stress urinary incontinence (SUI): "Complaint of involuntary loss of urine on effort or physical exertion including sporting activities, or on sneezing or coughing." Urgency urinary incontinence (UUI): "Complaint of involuntary loss of urine associated with urgency." Mixed urinary incontinence (MUI): "Complaints of both stress and urgency urinary incontinence" [23].

Data extraction

Titles and abstracts of studies identified using the search strategy were screened independently by two reviewers (NvA and NVR) to identify those that met the inclusion criteria, then eligibility was verified reading the full text. Any disagreement over the eligibility

Table 1
Summary of findings.

Outcome	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
Physical activity compared with no physical activity for urinary incontinence during pregnancy						
Population: Pregnant women Setting: Pregnancy Exposition: Physical activity Comparison: No physical activity						
	Assumed risk No physical activity	Corresponding risk Physical activity				
Urinary incontinence during pregnancy	535 per 1000	525 per 1000 (465 to 599)	RR 0.98 (0.87 to 1.12)	960 (3)	⊕⊕⊖⊖ low	–
Physical activity compared with no physical activity for urinary incontinence during postpartum period						
Population: Postpartum women Setting: Postpartum period Exposition: Physical activity Comparison: No physical activity						
Outcome	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk No physical activity	Corresponding risk Physical activity				
Postpartum urinary incontinence	433 per 1000	514 per 1000 (433 to 610)	RR 1.19 (1.00 to 1.41)	742 (2)	⊕⊕⊖⊖ low	–

*Assumed risk estimate and corresponding risk estimate (and its 95% confidence interval) are absolute risks and come from pooled estimated of both control groups and exposed groups.
CI: Confidence interval; **RR:** Risk Ratio
GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

of particular studies was resolved by a third reviewer (CS). All the publications meeting the criteria were selected for full text analysis. Two reviewers (NvA and NVR) independently extracted data and discrepancies were resolved through discussion with a third reviewer (CS). Data Management was performed using the data management tool Zotero.

Assessment of risk of bias

Two reviewers (NvA and NVR) independently assessed the overall quality and the risk of bias of the included studies. The studies' quality was assessed with a tool adapted to the design of each study (the STROBE [24] statement and the CONSORT [25] checklist). The assessment of risk of bias was assessed with the Cochrane instrument. Disagreements between the reviewers over the risk of bias in particular studies were resolved by discussion, with involvement of a third reviewer (CS) when necessary. Information on funding of the included studies was sought.

Assessment of the quality of evidence

The Grading of Recommendations Assessments, Development and Evaluation (GRADE) approach [26] was used to assess the level of quality of the evidence (Table 1). Two reviewers (NvA and NVR) working independently assessed the quality of the evidence and reached a consensus on any downgrading decisions.

Statistical analysis

Primary outcome and secondary outcomes were defined as dichotomous outcomes and summaries of intervention effects for each study were provided by calculating odds ratios (OR) with 95% confidence intervals (CI). The clinical and methodological heterogeneity among included studies were assessed qualitatively. Statistical heterogeneity was assessed using I^2 statistic. Meta-analyses were performed using a random effects analysis model. In case of low heterogeneity ($I^2 < 25\%$), we pooled the estimates of the effects with a fixed effects model. We report the overall effect as pooled odds ratios with their 95% confidence intervals and the statistical significance was determined with a Z score and its P value. In case it was not possible to include one study in a meta-analysis, a descriptive synthesis was done. Statistical analysis was performed using RevMan 5.

PROSPERO registration number

CRD42019107880

Results

General characteristics of the studies

The selection of studies was listed in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart (Fig. 1) [27]. A total of 2343 citations have been identified by the database searches. After screening titles and abstracts, seven relevant studies met inclusion criteria [28–34], with 12,479 participants. The details of the seven included studies and the 66 excluded studies are presented in Appendix (Tables A.1 and A.2 respectively). Among the excluded studies, three ongoing studies were identified (detailed in Table A.3 in Appendix). Among included studies, six were observational studies [29–34] and one was an experimental study [28]. Three were cross-sectional studies [29–31], two were cohort studies [32–33] and one was a case-control study [34]. Participants were assessed either during pregnancy (from the 21st to 42nd week of gestation, when specified) [30–31], or during postpartum [29], or both [32–34]. Some participants were elite athletes [34] or runners [29], some were classified as regular and non-regular exercisers [31], or exercisers and non-exercisers [30], doing frequent or occasional exercise [32]. Some were classified as doing low-impact, high-impact or no activities

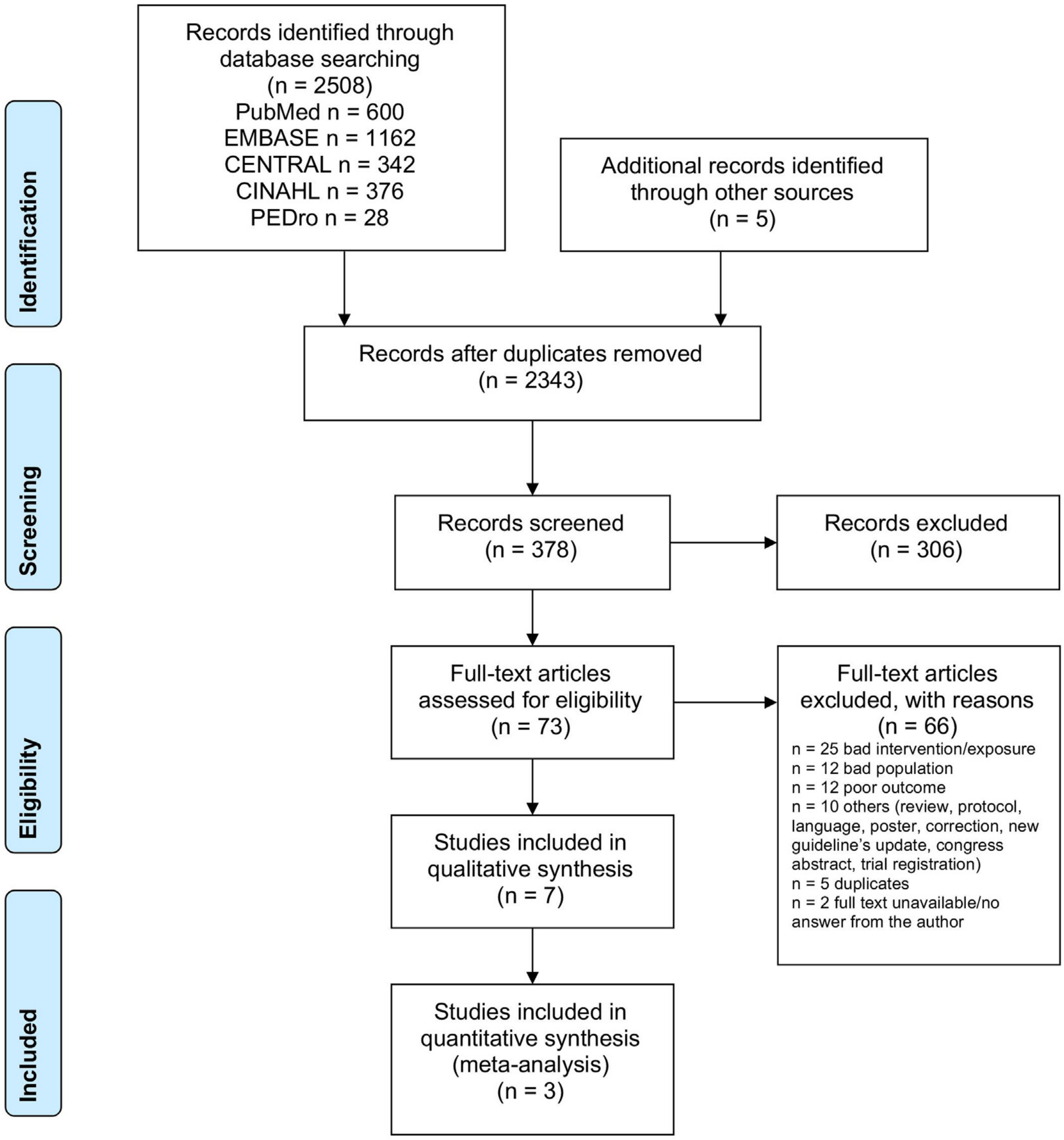

Fig. 1. PRISMA flow chart.

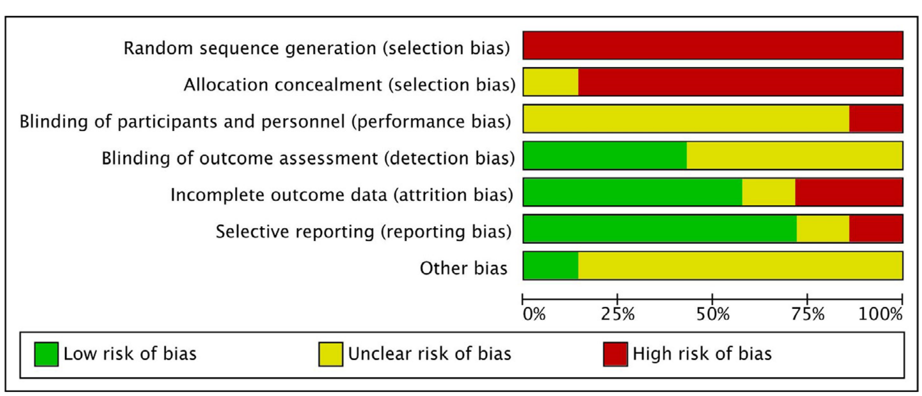

Fig. 2. Risk of bias graph. Review authors' judgements about each risk of bias item presented as percentages across all included studies.

[34]. The experimental study [28] included 3 months to 1 year postpartum women.

The studies were carried out either in the context of pregnancy follow-ups or postpartum consultations in hospitals or clinics [28,30–33] or through sports organizations [29,34]. Three studies have been carried out in Norway [30–31,34], one in Sweden [33], one in United States [29], one in India [28]. The largest study was carried out in China [32].

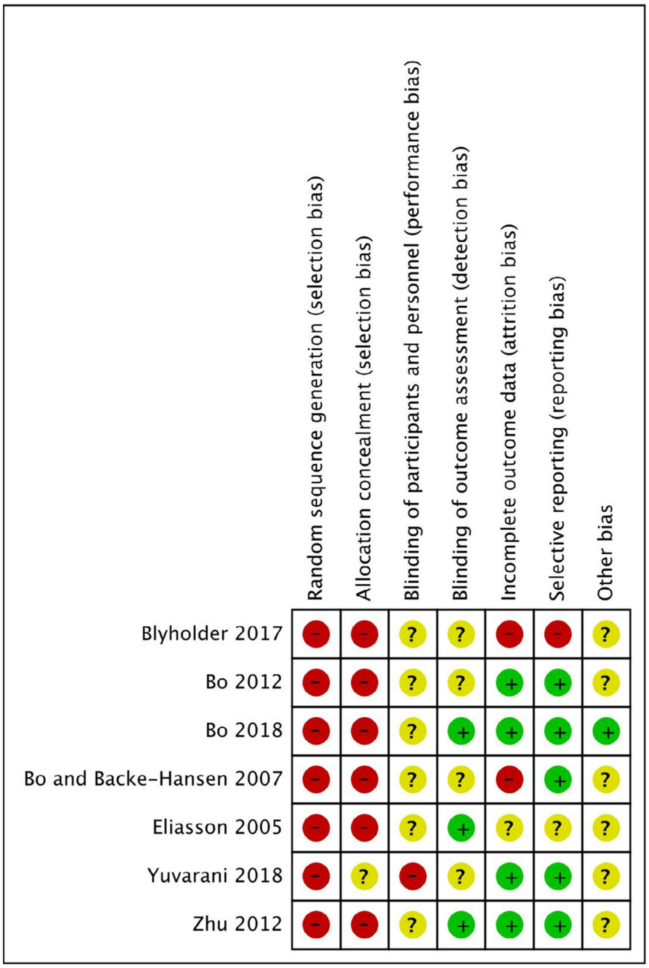

Fig. 3. Risk of bias summary. Review authors' judgements about each risk of bias item for each included study.

The physical activities, when specified, included walking, brisk walking, running, bicycling/spinning, training in fitness centers, strength training, weight training, gymnastics, jumping, swimming, aerobics (low and high impact), aerobic dance/step, prenatal aerobic classes, dancing, cross-country skiing/roller skiing, ball games, horseback riding, skating/rollerblades and other exercises [29,31,33–34]. In the experimental study [28], the intervention was transversus abdominis training in comparison with Pilates exercises. The frequency of exercise was 15 repetitions in one set for 3 months for transversus abdominis training and 5 days a week for 3 months for Pilates exercises.

UI was assessed using self-reported questionnaires of leakage and severity of UI, the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF) [30,31,34], the Bristol Female Lower Urinary Tract Symptoms (BFLUTS) questionnaire [32], or the Sandvik's Severity Index (SSI) [34]. Two studies developed their own questionnaire [29,33]. In the experimental study [28], UI was assessed using Urogenital Distress Inventory-6 (UDI-6) and Incontinence Impact Questionnaire-7 (IIQ-7).

Risk of bias of included studies

The summary of the risk of bias assessment is presented in Figs. 2 and 3. Details and justifications for risk of bias assessments in individual studies are shown in Appendix (Table A.1). Overall, there is low quality evidence from the included, mainly observational, studies regarding the influence of physical activity on urinary incontinence in pregnancy or postpartum period.

The studies included in the meta-analyses of this systematic review have a low or unclear risk to the evaluation of 'incomplete outcome data' bias. Either there is no missing data regarding the chosen outcome or a control of missing data was done or the number of cases not reported is low. Therefore, no additional action was taken regarding the missing data for this review.

Synthesis of the results

Because of the lack of precision in most included studies regarding the exposure, a comprehensive meta-analysis including all studies was not possible. The association between physical activity and urinary incontinence in pregnant and postpartum women was based on the results from three [31,33,34] and two [33,34] studies, respectively (Table 1).

Assessments of publication bias with funnel plots would not be relevant because of the low number (n < 10) of studies included in the meta-analyses. There was not enough data available to perform subgroup analyses for different exposures (types of physical activity) or outcome (types of UI) separately. The aggregation of different type of exposure or outcome was necessary to perform the meta-analyses. It was not possible to perform a sensitivity analysis because of the small number of studies included in the meta-analyses.

There was no statistically significant association between physical activity and urinary incontinence during pregnancy (OR 0.90 [95% CI: 0.69–1.18], p = 0.45), with no heterogeneity between the studies (I^2 = 0%) (Fig. 4). There was 'low' quality evidence from three observational studies [31,33–34] (n = 960) regarding the association between physical activity and urinary incontinence during pregnancy (Table 1).

There was no statistically significant association between physical activity and urinary incontinence during the postpartum period (OR 1.31 [95% CI: 0.74–2.34, p = 0.35]), with moderate heterogeneity between the studies (I^2 = 42%) (Fig. 5). There was 'low' quality evidence from two observational studies [33,34] (n = 742) regarding the association between physical activity and urinary incontinence during the postpartum period (Table 1). The impact of physical activity on the recovery time of urinary inconti-

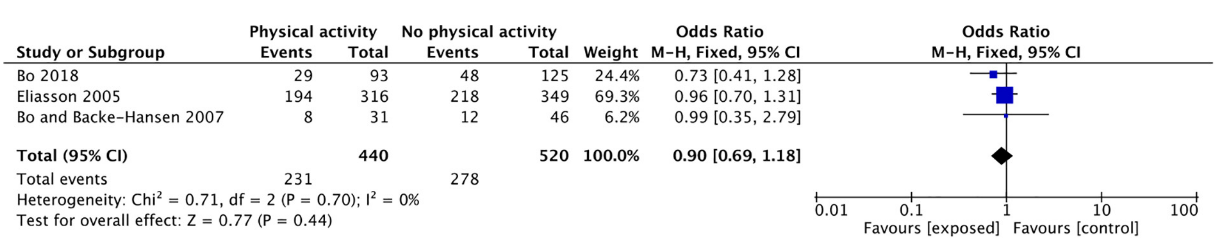

Fig. 4. Association between physical activity and urinary incontinence during pregnancy.

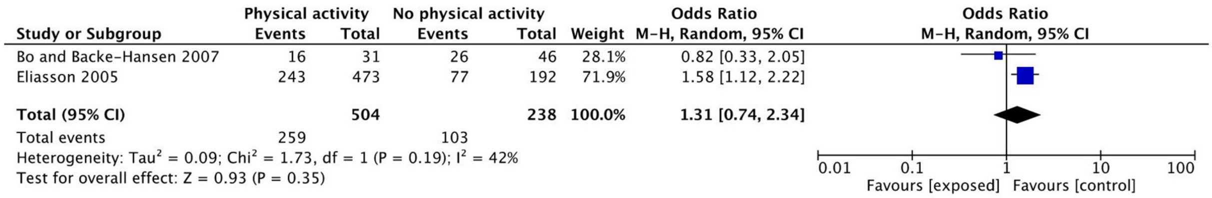

Fig. 5. Association between physical activity and postpartum urinary incontinence.

nence symptoms during the postpartum period was not evaluated in any of the included studies.

The complete descriptive synthesis is provided in Appendix B. The study designs represented a serious risk of bias [28–34] and one study had serious imprecision of results [28]; the overall quality of studies included in the narrative synthesis was ‘low’ to ‘very low’.

Discussion

Main findings

The results of our systematic review do not show an association between physical activity and urinary incontinence in pregnant and postpartum women. The effect of physical activity on the recovery time of urinary incontinence symptoms during the postpartum cannot be assessed because of a lack of available data.

Overall completeness and applicability of evidence and comparison with existing literature

To our knowledge, there is no other review assessing the influence of physical activity alone (without pelvic floor muscle training (PFMT)) on urinary incontinence during pregnancy and postpartum. A recent review and meta-analysis studying prenatal exercise (including but not limited to PFMT) and UI during and following pregnancy concluded that prenatal PFMT alone or in combination with other forms of exercise is effective in reducing the occurrence and symptom severity of UI during pregnancy and the postpartum period [15].

Implication for clinical practice and field of knowledge

Women who engage in physical activity are more compliant in doing pelvic floor muscle training at home [35], PFMT being recommended to prevent and treat UI in pregnant and immediate postpartum women [31]. Physical activity could therefore be considered a facilitator for evidence-based PFMT. Physical activity is also recommended to positively influence other important outcomes related to pregnancy (i.e. weight, gestational diabetes, hypertension, low back pain) [36–38]. For this reason, moderate physical activity [39] should be encouraged for the evidence-based benefits associated with these outcomes [31].

There is a knowledge gap about the impact of physical activity on urinary incontinence. Further research, assessing the impact of physical activity alone (without PFMT) during pregnancy and in the postpartum period as well as the optimal dose of physical activity is warranted. A feasible design would be a cohort study, which could provide data on UI and on the physical activity of women before and during their family planning as well as data on the practice of physical activity by pregnant and postpartum women.

Limitations of the review

This review has limitations. First, as this review mainly includes observational studies there is a high risk of confounding factors. Then, because of the small number of studies included, subgroup analyses for different exposures (types of physical activity) or outcomes (types of UI) were not possible. Moreover, there was heterogeneity between studies used for the meta-analysis regarding the impact of physical activity on UI postpartum, resulting from different study designs, different postpartum timing measurements, different participants (athletes or not) and different measuring tools.

In the field of UI, prevalence varies widely from study to study [1,40]. Consequently, the applicability of the evidence provided by this meta-analysis must be weighted according to the modalities and timing of data collection regarding the symptoms of urinary incontinence, the variability in the definition of UI, the potential selection bias, recall bias, and non-response bias.

According to the body of evidence identified, results of this meta-analysis have to be interpreted cautiously. The most critical aspects regarding the completeness and applicability of the evidence of this review are the wide definitions of ‘physical activity’, ‘postpartum’ and ‘urinary incontinence’ that were accepted in the inclusion criteria.

This review highlight the lack of data on the impact of physical activity alone on urinary incontinence during pregnancy and postpartum. Also, no data are available about its impact on urinary incontinence recovery during and after pregnancy.

Conclusion

With an overall low quality of evidence, this review was unable to provide any conclusions regarding the effects of physical activity alone on UI or the recovery in pregnant and postpartum women. Physical activity is, however, recommended for its benefits on other important outcomes related to pregnancy.

Author contributions

NVA wrote the review protocol, developed and ran searches, selected studies, extracted and interpreted data, assessed the overall quality and risk of bias of included studies, assessed the quality of evidence, performed the analyses, and wrote the review.

NVR selected studies and extracted data, assessed the overall quality and risk of bias of included studies and assessed the quality of evidence.

CS and DD contributed as advisory group to the protocol, the development of searches and data interpretation, DD wrote the revised version of the manuscript.

MB and JB contributed for the study concept and manuscript editing.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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In memory of our too soon disappeared friend, Dr Nikolaus Veit-Rubin.

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We would be grateful if people who are aware of studies potentially relevant for this review could contact N. von Aarburg.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejogrb.2021.11.005.

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