

Effect of physical activity on quality of life during pregnancy: A systematic review and meta-analysis of published randomized controlled trials

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Abstract

Background: Water exercise is a form of physical exercise which is considered ideal for many people including the elderly, obese patients, and patients with arthritis. Recently, several studies have discussed water exercise and its role for pregnant women as it has shown promising effects on maternal and neonatal outcomes

Methods: We followed the standard methods of Cochrane Handbook of Systematic Reviews for interventions and the PRISMA statement guidelines 2020 when conducting and reporting this study. A computer literature search of PubMed, Scopus, Web of Science, and Cochrane Central Register of Controlled Trials was conducted from inception until December 2021. We selected randomized controlled trials (RCTs) assessing the efficacy of water-based exercise on pregnant women, and all relevant outcomes were pooled in the meta-analysis using Review Manager Software

Results: Six RCTs were included in our study with only four RCTs included in the meta-analysis. For maternal outcomes, there was no significant difference between the two groups in terms of “days of gestation” [MD=-0.22 CI 95% (-1.80, 1.36), p=0.78], “vaginal delivery” [RR=0.97 CI 95% (0.90, 1.03), p=0.03], “cesarean delivery” [RR=1.36, CI 95% (0.96, 1.92)], “induced labor” [RR=0.78 CI 95% (0.58, 1.05)], “vaginal tear” [RR=0.95 CI 95% (0.77, 1.16)], and “episiotomy” [RR=0.88 CI 95% (0.66, 1.18)]. For neonatal outcomes, there was no significant difference in term of “neonatal weight” [MD-0.02 CI 95% (0.09, 0.05), p=0.61].

Conclusion

In conclusion, our meta-analysis showed that prenatal exercise was not associated with other labor and delivery outcomes.

Key words: physical activity; pregnancy; exercise; delivery; neonatal.

Introduction

Physical exercise is a fundamental process that should be considered during pregnancy. Moderate exercise for at least 30 minutes and five days per week is recommended by the American College of Obstetrics and Gynecology (ACOG) for pregnant women (1). Physical exercise has many benefits for pregnant women as it can reduce the incidence of complications and facilitate delivery. Also, it can reduce the risk of premature mortality by 20%-30% and enhance wellbeing by releasing beta-endorphin in the body (2,3). Physical exercise is very important as it triggers many physiological adaptations that have a vital role in the growing fetus. These physiological adaptations include increased blood, oxygen, and nutrient supply for exercising muscles, increased ventilation, and stress hormones release (4). A combination of aerobic and resistance exercise is recommended by the recent guidelines provided by the American College of Sports Medicine to increase muscular strength, reduce metabolic abnormalities, improve functional capacity, and improve cardiorespiratory fitness (5).

Multiple forms of physical exercise are available to be performed by pregnant women. One of these forms is water-based exercise. Water exercise is considered ideal for many people, including the elderly, obese patients, and patients with arthritis, as there is less compression on the joints due to water buoyancy. The most common form of water exercise is swimming. Other forms include shallow-water walking, aqua aerobics, and deep-water running (6). According to several studies, water exercise has shown promising results for pregnant women as it can help them to improve their physical development, enhance their ability to work, achieve better sleep and mood patterns, and reduce complications related to pregnancy (3). In our systematic review, we discuss the impact of physical exercise on pregnant women and how it can enhance their quality of life.

Methods

In our systematic review (SR) and meta-analysis (MA) we followed the outlines described in the "Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)" and that in "Cochrane handbook for systematic reviews of interventions.

Search strategy and data collection

We used the following keywords to search PubMed, Cochrane Library, Web OF Science (WOS), and SCOPUS published before December 2021: pregnancy and water exercise. We narrowed our search to papers published in English. In addition, the author checked the citations in the publications' references.

Inclusion and exclusion criteria

We conducted Our meta-analysis according to the PRISMA checklist for Randomized controlled trials, RCTs met the following criteria: (1) pregnant women; (2) undergoing water exercise, (3) compared with control, and (4) in English with available full text

If the above criteria were not met, the study was removed from our research.

Quality assessment

We utilized the 2nd Edition of the Cochrane Handbook for Systematic Reviews of Interventions to evaluate the quality of each research. As part of our methodology evaluation, we looked at how the methodological quality was impacted by biases in selection and performance and detection and attrition biases. "+" indicates that the study met all quality criteria and had a low risk of bias; "?" means that there were one or more ambiguous quality criteria, and "-" indicates that there were few quality criteria, and the study had a high risk of bias. (1)

Data extraction

We collected the following data from each study: (1) the name of the first author and the publishing year of the article, (2) study design, (3) exercise details; (4) inclusion criteria, (5) primary outcome (6) results for each study, (7) sample; (8) age at baseline (9) body mass index; (10) nulliparous percentage, and (11) educational level.

Statistical analysis

We used Review Manager 5.4.0 (Cochrane Collaboration, Oxford, UK) to conduct this meta-analysis. (2) Risk ratio (RR) and 95% confidence intervals (CI) were used to describe the findings (DerSimonian and Laird 1986). (3) With the use of Cochrane's Q tests and I^2 statistics, we determined the level of heterogeneity. P-value ≤ 0.05 or $I^2 \geq 50\%$ referred to significant heterogeneity. A random-effects model was utilized in the research to reduce

the heterogeneity. It was judged statistically significant when the p-value was more than 0.1. We could not do subgroup analysis because of the small number of studies included.

Results

Study selection process and characteristics of studies

Our search strategy found 313 articles in these databases. After reviewing their abstracts and titles, we ruled out 293 articles. Among the remaining 20 articles, 14 articles were excluded. Finally, Six studies were involved. (1–6) Of them, four studies were included in our analysis fig 1. (7,9–11). The summary and baseline characteristics of RCTs were listed in *Table 1 and Table 2 (supplementary 1)*.

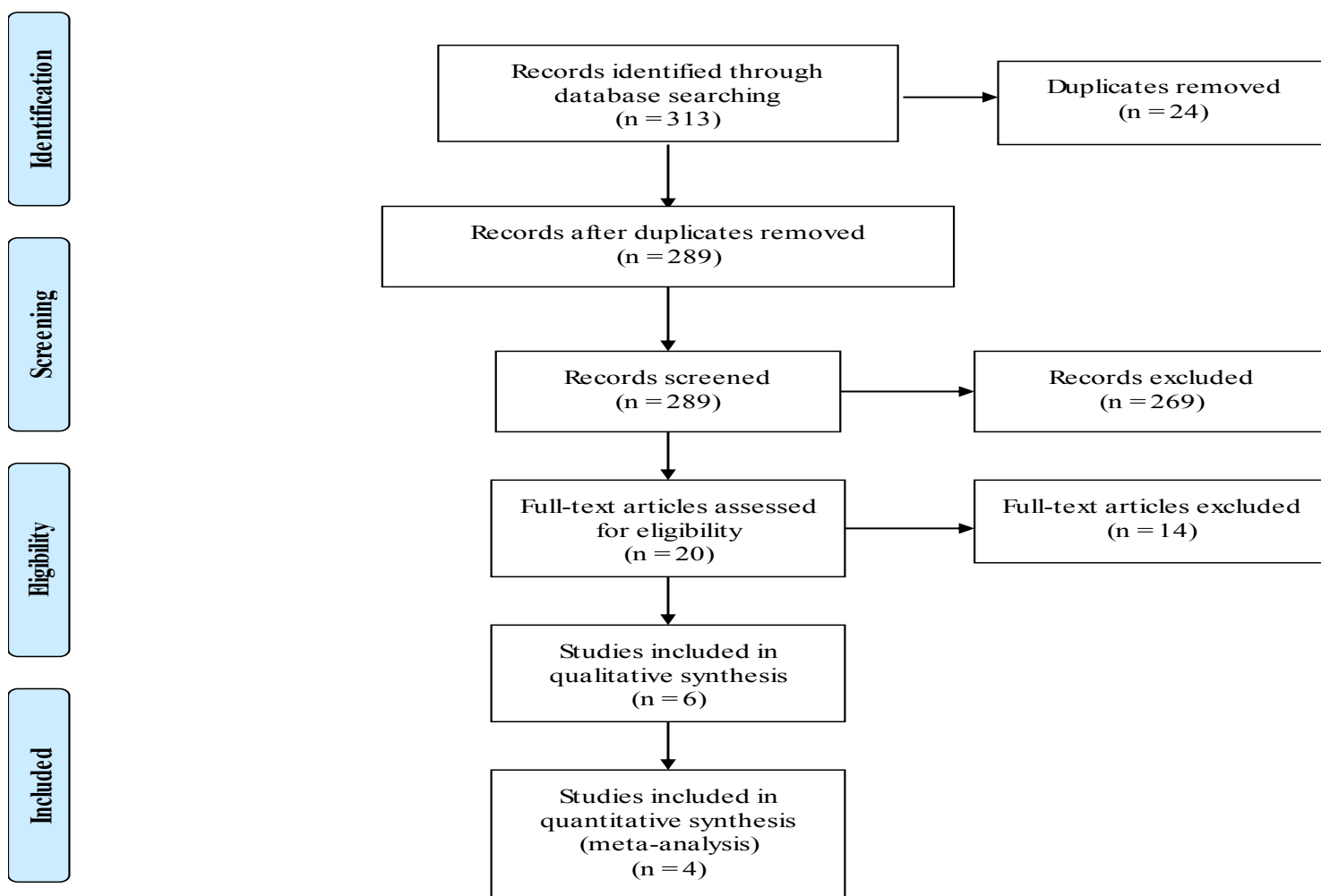


Figure 1 (Prisma flow diagram)

Risk of bias assessment

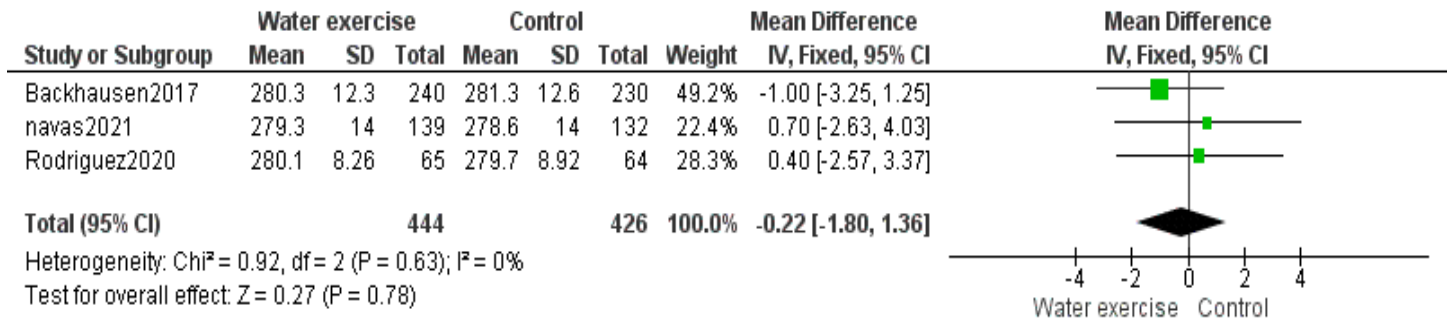
Regarding the quality assessment of included RCTs, all studies were at low risk of randomization allocation, attrition bias, reporting bias, and any other biases. Regarding blinding, all studies reported that participants were not blind, and the nature of the intervention can explain this. Lastly, the assessment blinding was only found in Navas et al. 2021 and Carrascosa et al. 2021. (3,4) (fig 2 & 3)

Maternal outcomes

Maternal outcomes included days of gestation, type of delivery, induced delivery, vaginal tear, and Episiotomy.

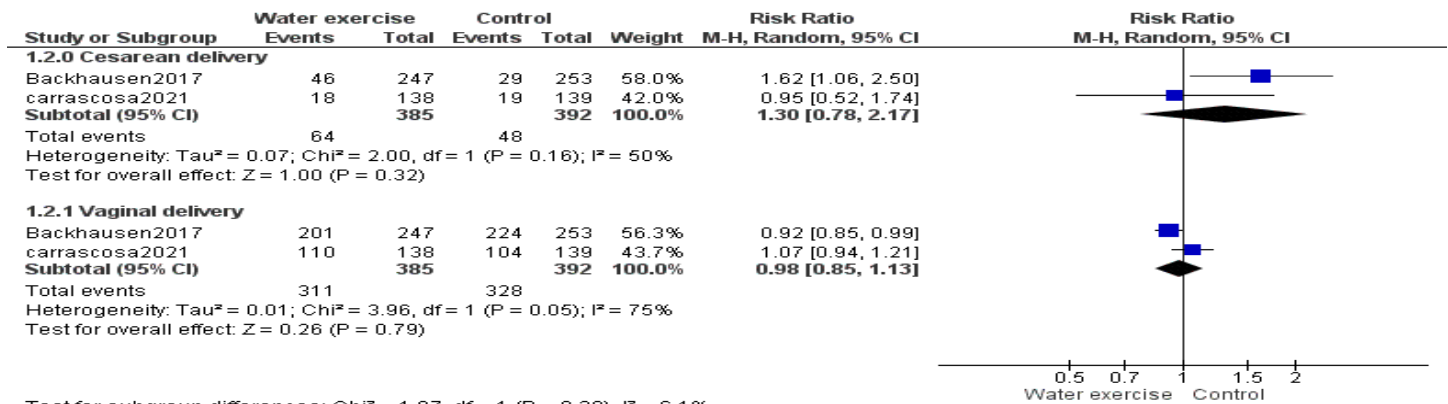
Days of gestation were reported in three trials, and there were no significant differences between water exercise and control as follows: [MD=-0.22 CI 95% (-1.80, 1.36), p=0.78]. the data was homogenous as following; [(P = 0.63), I² = 0%] (fig. 4).

(Fig 4)



Regarding vaginal delivery, there was no significant difference between water exercise and control as follows; [RR=0.97 CI 95% (0.90, 1.03), p=0.03], the data were heterogeneous, and this heterogeneity was not resolved after using the random-effect model as follows; [RR=0.98 CI 95% (0.85, 1.13), p=0.79] (fig. 5).

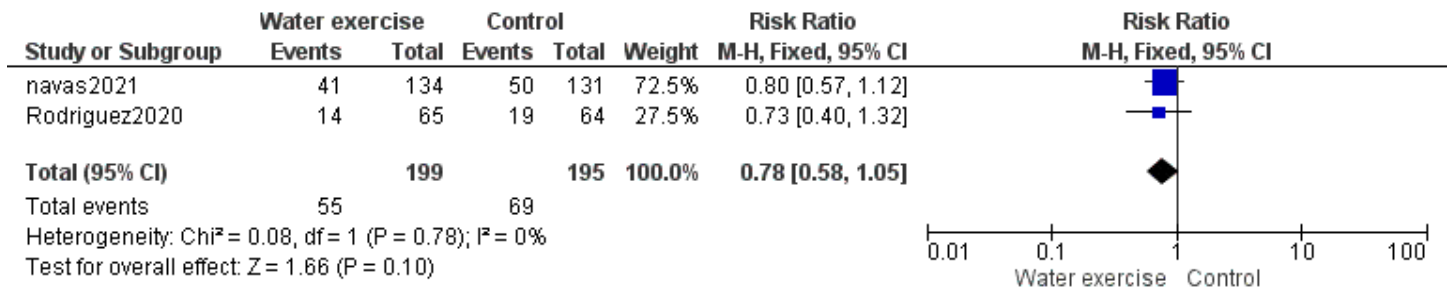
(fig 5)



Regarding cesarean delivery, and there were no significant differences between water exercise and control as follows; [RR=1.36 CI 95% (0.96, 1.92)], and the data was homogenous; [(P = 0.16); I² = 50%] (fig. 5).

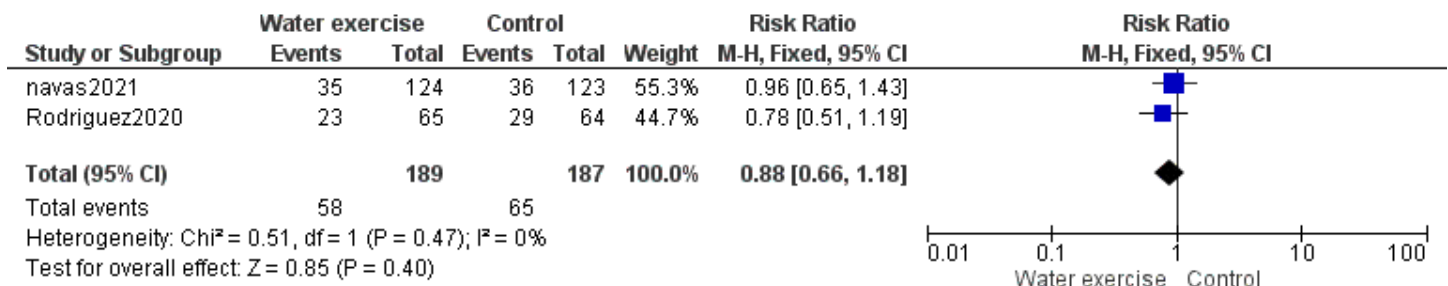
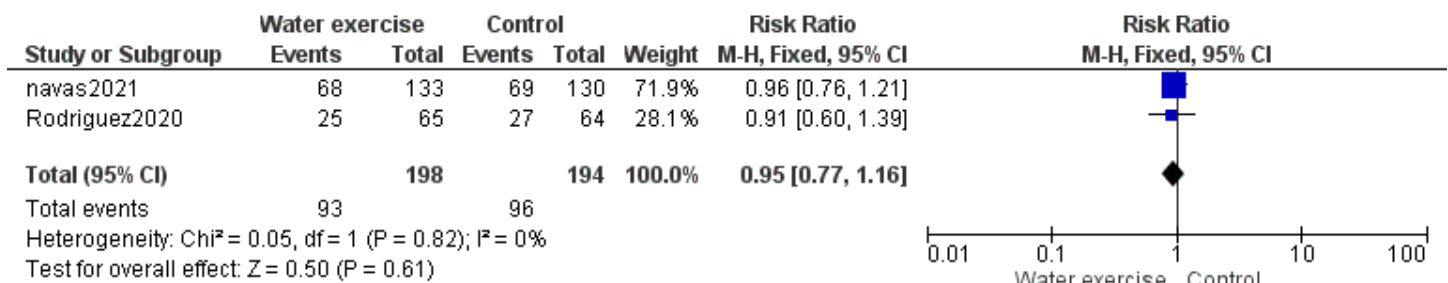
There was no significant difference between the two groups in the number of induced labors as follows; [RR=0.78 CI 95% (0.58, 1.05)], and the data were homogeneous [(P = 0.78); I² = 0%] (fig. 6).

(fig. 6)



Also, there were no significant difference between the two groups in the number of Vaginal tear and Episiotomy as following, [RR=0.95 CI 95% (0.77, 1.16)] and [RR=0.88 CI 95% (0.66, 1.18)], respectively, and the data was homogenous as following [(P = 0.82); I² = 0%], and [(P = 0.47); I² = 0%], respectively (fig. 7 and fig. 8).

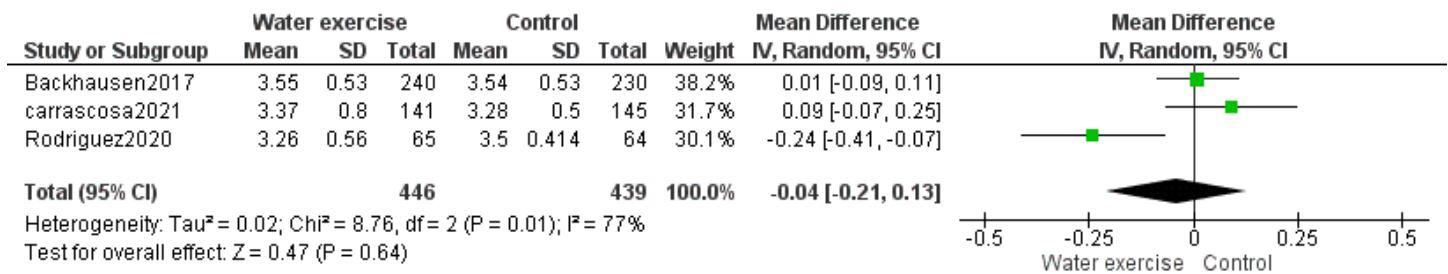
(fig. 7 and fig. 8)



Neonatal outcome

There was no significant difference between the two groups in the neonatal weight as following, [MD-0.02 CI 95% (0.09, 0.05), p=0.61], and the data was heterogenous [(P = 0.01); I² = 77%], and this heterogeneity was resolved by using random effect model and excluding Rodriguez et al. 2020, but the results still insignificant as following [MD=0.03 CI 95% (-0.05, 0.11), p=0.44], and the data was homogenous [(P = 0.39); I² = 0%] (fig. 9).

(fig. 9)



Systematic review

In Rodriguez et al. 2017(12), they examined the sleep quality and concluded that the women who are overweight or obese might benefit more from regular, moderate physical activity during pregnancy. As a result of moderate water-based exercise, from weeks 20 to 37 of pregnancy, the quality of sleep of pregnant women is improved. They were increasing the quality, quantity, and regularity of their sleep.

In Rodriguez et al. 2020 (7), Pregnant women who did the physical activity in the water had a shorter labor and delivery time. They found that the intervention group had shorter durations for the first and second phases of labor. It was also beneficial since it boosted the rate of eutectic delivery, which allowed the mother to recuperate more rapidly and get to know her baby more immediately via skin-to-skin.

Discussion

Summary of the findings

Our systematic review includes six RCTs. Of them, four RCTs were included in our meta-analysis. The results of our meta showed that there is no significant difference between the water exercise group and the control group in terms of maternal outcomes, which are days of gestation, type of delivery, induced delivery, vaginal tear, and Episiotomy. Also, there is no significant difference between the two groups in terms of Neonatal weight.

Agreements and disagreements with previous studies

Recently, the influence of physical exercise on pregnancy outcomes has been widely debated. The results of our meta-analysis are in the same direction as the former meta-analysis conducted by Margie et al. (13), who showed that there is no association between prenatal exercise and cesarean section, induction of labor, length of labor, and vaginal tears. On the other hand, our study showed there is no significant association between physical exercise and cesarean delivery rate, which is inconsistent with LEON et al.'s study 2014 (14) and Barakat et al. 2012 (15) provided evidence that physical exercise can significantly reduce cesarean delivery rates. Also, LEON et al. (14) showed that physical exercise could slightly increase the frequency of normal delivery. Regarding episiotomy incidence, our results are consistent with Chen et al. (16), who reported that the incidence was similar between the water exercise and control groups.

Strength points and limitations

Our study has several strength points (1) we conducted all steps in strict accordance with the Cochrane Handbook of Systematic Reviews for interventions, (2) we followed the standard reporting guidelines of PRISMA statement to report this work, (3) we ran a comprehensive search of multiple electronic databases to identify all relevant studies, and finally (4) Our study reported class 1 evidence that no association between the physical exercise and maternal or neonatal outcomes. Nonetheless, our study has a few limitations. We noticed a lack of studies investigating the effect of prenatal exercise on labor and delivery outcomes in obese women and women with gestational diabetes mellitus. Also, there are very limited RCTs with controversial conclusions examining the impact of physical therapy on different maternal and neonatal outcomes. We recommend future well-designed RCTs to investigate this impact, address an unmet clinical need, and fill this evidence gap in the literature.

Conclusion

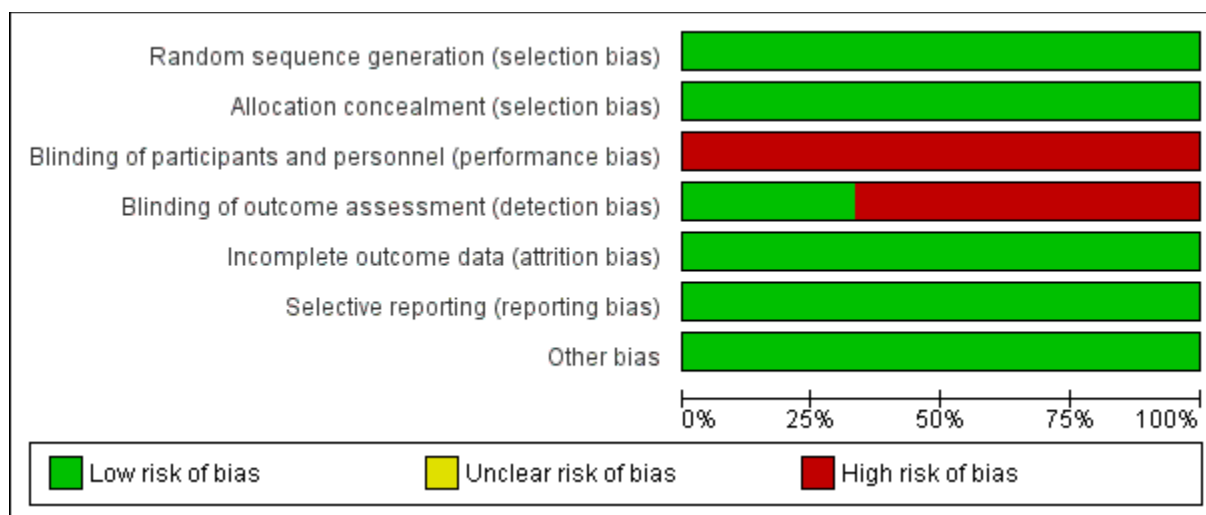
In conclusion, our meta-analysis showed that prenatal exercise was not associated with other labor and delivery outcomes. This finding should reassure pregnant women and healthcare providers that prenatal exercise does not increase the risk of premature delivery or musculoskeletal injury.

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(Supplementary 1) Figure 1 & 2 (risk of bias assessment)



	Backhausen2017	carrascosa2021	nawas2021	Rodriguez2017	Rodriguez2019	Rodriguez2020	
Random sequence generation (selection bias)	+	+	+	+	+	+	
Allocation concealment (selection bias)	+	+	+	+	+	+	
Blinding of participants and personnel (performance bias)	-	-	-	-	-	-	
Blinding of outcome assessment (detection bias)	-	+	+	-	-	-	
Incomplete outcome data (attrition bias)	+	+	+	+	+	+	
Selective reporting (reporting bias)	+	+	+	+	+	+	
Other bias	+	+	+	+	+	+	

(Supplementary 2) tables 1 & 2 (summary and baseline characteristics)

Study ID	Country	Trial registration	Study design	Inclusion criteria	Exercise details	Primary outcome	Results
Backhausen et al. 2017	Denmark	NCT02354430	RCT	"Pregnant women were eligible for participation if they were healthy, 18 years or older, Danish speaking and between 16–17 gestational weeks."	"The exercise was initiated by an introductory session at a public indoor swimming pool, followed by 12 weeks of unsupervised exercises twice a week."	Low back pain	"Unsupervised water exercise results in a statistically significant lower intensity of low back pain in healthy pregnant women, but the result was most likely not clinically significant. It did not affect the number of days on sick leave, disability due to low back pain nor self-rated health."
Carrascosa et al. 2021	Spain	ISRCTN14097513	RCT	"Pregnant women aged 18 to 40 years having a fetus with a gestational age of 14 to 20 weeks, singleton pregnancy, and low obstetric risk were eligible."	"Women in the exercise group participated in 45 min of water aerobics classes 3 times per week in an indoor pool (28 to 30 °C) for 5 months"	Use of epidural analgesia during labor	"Aquatic aerobic exercise during pregnancy had no effect on the use of epidural analgesia during labour, whereas pain perception was lower after aquatic exercise compared to usual care in pregnancy. The intervention was safe for

							pregnant women and their newborns."
Navas et al. 2021	Spain	ISRCTN14097513	RCT	"Pregnant women aged 18 to 40 years having a fetus with a gestational age of 14 to 20 weeks, singleton pregnancy, and low obstetric risk were eligible."	"Women in the exercise group participated in 45 min of water aerobics classes 3 times per week in an indoor pool (28 to 30 °C) for 5 months "	Maternal outcomes	"Moderate-intensity aquatic exercise during pregnancy decreased postpartum anxiety and depressive symptoms in mothers and was safe for mothers and their newborns."
Rodriguez et al. 2019	Spain	NCT02761967	RCT	"Pregnant women, aged between 21 and 43 years"	"The Study of Water Exercise during Pregnancy method was applied from weeks 20 to 37 of pregnancy and consists of three 60-minute sessions per week, each with 45 min' activity followed by 15 min' relaxation."	Duration of stages of labor	"The women who exercised in water during their pregnancy presented a shorter duration of labor than those who did not. The difference was especially marked with respect to the duration of the first and second stages of labor."
Rodriguez et al. 2020	Spain	NCT02761967	RCT	"Pregnant women, aged between 21 and 43 years"	"The Study of Water Exercise during Pregnancy method was applied from	Quality of life	"Physical activity programs in water, such as (Study of water exercise during

					weeks 20 to 37 of pregnancy and consists of three 60-minute sessions per week, each with 45 min' activity followed by 15 min' relaxation."		pregnancy), enhanced the HRQoL of pregnant women."
Rodriguez et al. 2017	Spain	NCT02761967	RCT	"Pregnant women, aged between 21 and 43 years"	"The Study of Water Exercise during Pregnancy method was applied from weeks 20 to 37 of pregnancy and consists of three 60-minute sessions per week, each with 45 min' activity followed by 15 min' relaxation."	Sleep quality	"The Study of Water Exercise in Pregnancy method improved the quality of sleep in pregnant women, both subjectively and in terms of latency, duration and efficiency."

Table 1: Summary of included studies. Abbreviations: RCT; Randomized control trial, and HRQoL; Health related quality of life.

Study ID	Study arms	Sample	Age (years), m (sd)	Body mass index (kg/m), m (sd)	Nulliparous, N (%)	Educational level, N (%)	
						Pre university	university
Backhausen et al. 2017	Water exercise	258	31.4 (4.3)	23.8 (3.7)	190 (74)	22 (9)	217 (91)
	Control	258	30.6 (4.1)	23.5 (2.5)	185 (72)	16 (7)	226 (93)
Carrascosa et al. 2021	Water exercise	148	31.1 (4.1)	23.5 (3.2)	98 (67.6)	69 (48.9)	78 (53)
	Control	146	31.5 (4.2)	23.4 (3.1)	98 (69.5)	68 (47.6)	74 (51.7)

& Navas et al. 2021							
Rodriguez et al. 2019, Rodriguez et al. 2021 & Rodriguez et al. 2017	Water exercise	65	32.12 (4.43)	24.03 (4.54)	45 (69.23)	NR	NR
	Control	64	30.58 (4.75)	24.12 (3.64)	47 (73.44)	NR	NR

Table 2: Baseline characteristics of included studies.

