https://doi.org/10.22491/2357-9730.106169

Functional effects of aquatic exercise in pregnant women: a systematic review

Bianca Oliveira Santos[1], Camilla Macêdo de Souza[1], Rebeka Gonçalves Santos[1], André Luiz Lisboa Cordeiro[1]

ABSTRACT

Introduction: During pregnancy, there are changes in all systems of the human body, along with anatomical changes. It is common for women to decrease the intensity of physical activities, especially in the last trimester. Water activities during pregnancy have shown positive effects for this population. To review the effects of functional exercises in the aquatic environment for women during pregnancy.

Methods: Systematic review using the PICO methodology, searched on the Pubmed, SciELO, LILACS, and Science Direct platforms, using the descriptors: Pregnancy, hydrotherapy, quality of life, pregnant women, and aquatic environment. Published randomized controlled trials that addressed the functional effects of aquatic exercise in pregnant women, published in English, Spanish, and Portuguese in the years 2010 to 2020 were included. In addition, the Boolean operators “and” and “or” were used. The research was conducted from May to July 2020.

Results: The search initially resulted in 537 articles, of which 95 records remained after removing duplicates, 14 after reading abstracts and titles, and 5 articles were included in the end. The samples ranged from 46 to 140 participants. Of the five studies selected, all obtained positive results, including pain reduction during pregnancy, as well as improved weight control, blood pressure, and sleep quality.

Conclusion: The practice of aquatic exercise for pregnant women acts positively in weight control, improves sleep quality, controls blood pressure, and decreases low back and joint pain.

Keywords: *Pregnancy; Hydrotherapy; Quality of life; Pregnant women; Aquatic environment; Physiotherapy*

Clin Biomed Res. 2021;41(2):339-346

1 Departamento de Fisioterapia, Centro Universitário Nobre. Feira de Santana, BA, Brasil.

Corresponding author:
André Luiz Lisboa Cordeiro
andrelisboacordeiro@gmail.com
Departamento de Fisioterapia,
Centro Universitário Nobre
Av. Maria Quitéria, 2116
44001-008, Feira de Santana,
BA, Brasil.

INTRODUCTION

In pregnancy, all the systems of the human body change along with anatomical changes to meet the metabolic needs of both mother and fetus[1]. Over the course of pregnancy, the risk of injury during the practice of exercise may increase due to changes in the center of gravity, increased weight load, and decreased balance and coordination, causing a threat of injury during physical activity[2].

The changes that occur in pregnant women offer contentment and personal transformation, but many feel discouraged and heavy, presenting complications to move around and perform daily tasks. Overweight concentrated in the upper body causes mechanical overload, especially in the spine and lumbar region, affecting postural stability and mobility[3]. Excess weight in pregnancy has increased worldwide, however it has been proven that physical activity during pregnancy prevents increased blood pressure and excess blood glucose[1].

During pregnancy, it is common for women to decrease the intensity of physical activities, especially in the last trimester[4]. Pregnant women who

continue with an active life by practicing activities during the gestation period achieve better health compared to sedentary pregnant women, as they seek a better health status, which can help labor and recovery[5].

Due to the risk of some activities, health professionals prescribe exercises according to the pregnant woman's condition, assessing her needs. In addition, the risk of injury increases due to the high levels of estrogen and relaxin, which cause the likelihood of ligament laxity and hypermobility[6].

Physical exercise in the aquatic environment, besides being considered safe and comfortable, is the most indicated for pregnant women, presenting several benefits, because when submerged, 2 opposing forces act on the body, gravity on one side and flotation on the other. These forces are balanced in a way that promotes a reduction in body weight, facilitating movements that avoid a greater load on the joints; therefore pregnant women can perform exercises that are not accessible in dry land[7].

Some benefits of water activity are the reduction of joint shock, reduction of edema, increased diuresis, reduction of hypertension, control of overweight, relief of back pain, improved temperature, and reduced risk of miscarriage. Exercising on the water is essential to understand breathing, consciously and spontaneously controlling the rhythm, strength and airways, being very useful at the time of delivery and also favoring the emotional contact with other pregnant women[8].

The objective of this study was to review the effects of physical exercises in the aquatic environment for women during pregnancy.

METHODS

This is a systematic review and the guiding question of this study was: "What are the functional benefits of aquatic exercises for pregnant women?" The research was structured based on the PICO strategy[9] (Chart 1).

Chart 1: PICO research strategy.

Acronym	Description	Definition
P	Patient	Pregnant women
I	Intervention	Water exercise
C	Control	Patients who did not participate in the water activity
O	Results	Pain in the back and joints, weight control, sleep quality and/or blood pressure control

The following databases were systematically searched: Pubmed, SciELO (Scientific Electronic Library Online), LILACS (Latin American and Caribbean Literature in Health Sciences), and Science Direct. The following descriptors were used: Pregnancy, hydrotherapy, quality of life, pregnant women, aquatic environment, physiotherapy; synonyms and related words added by the Boolean operators "AND" and "OR", according to the Health Sciences Descriptors (DeCS). The survey was conducted from April to May 2020.

Eligibility criteria

Eligibility criteria included randomized clinical trials that addressed the functional effects of water exercise in pregnant women, available in English, Portuguese, or Spanish, published between 2010 and 2020, in order to update the topic. Multiple pregnancies, aquatic exercise combined with other activities, high-risk pregnancies, suspected fetal distress, hypertensive pregnant women, and those with pulmonary or heart failure were excluded from the study.

Data extraction

The articles collected using the database searches were selected by tracking the titles (first stage), abstracts (second stage), and complete reading (third stage). Then, an exploratory reading of the selected studies was conducted, followed by selective and analytical reading. The data extracted from the articles were systematized: authors, title, journal, year, summary, and conclusions, in order to enable the obtaining of relevant information for the research.

The process of selection, data extraction from articles, and identification of methodological aspects was conducted by 2 independent reviewers. When there was any disagreement between them, the reviewers read the entire article again for reassessment. If the disagreement persisted, a third independent reviewer assessed and made the final decision. The research followed the items of the PRISMA[10] protocol for systematic reviews.

Methodological quality assessment

The methodological quality of the studies was assessed according to the PEDro scale criteria, which scores 11 items, namely: 1 – eligibility criteria, 2 – random allocation, 3 – hidden allocation, 4 – baseline comparison, 5 – blind individuals, 6 – blind therapists, 7 – blind evaluators, 8 – adequate follow-up, 9 – intention to treat the analysis, 10 – comparisons between groups, and 11 – point estimates and variability[11]. Items are scored as present (1) or absent (0), generating a maximum sum of 10 points, not counting the first item.

RESULTS

After reading the abstract and titles, 14 articles were found, of which only 5 were selected by the inclusion criteria. Those that did not use aquatic exercise physical therapy in pregnant women as the main focus of treatment, articles with a literature review design (3), non-randomized studies (4), or articles unrelated to pregnancy (2) were excluded from the study. The flowchart in Figure 1 shows all the criteria and databases used for the selection of articles.

The methodological quality assessed by the PEDro scale is shown in Chart 2. The 5 studies included in this systematic review discuss the benefits of the aquatic environment during pregnancy, which obtained a mean score of 5, corresponding to moderate methodological quality.

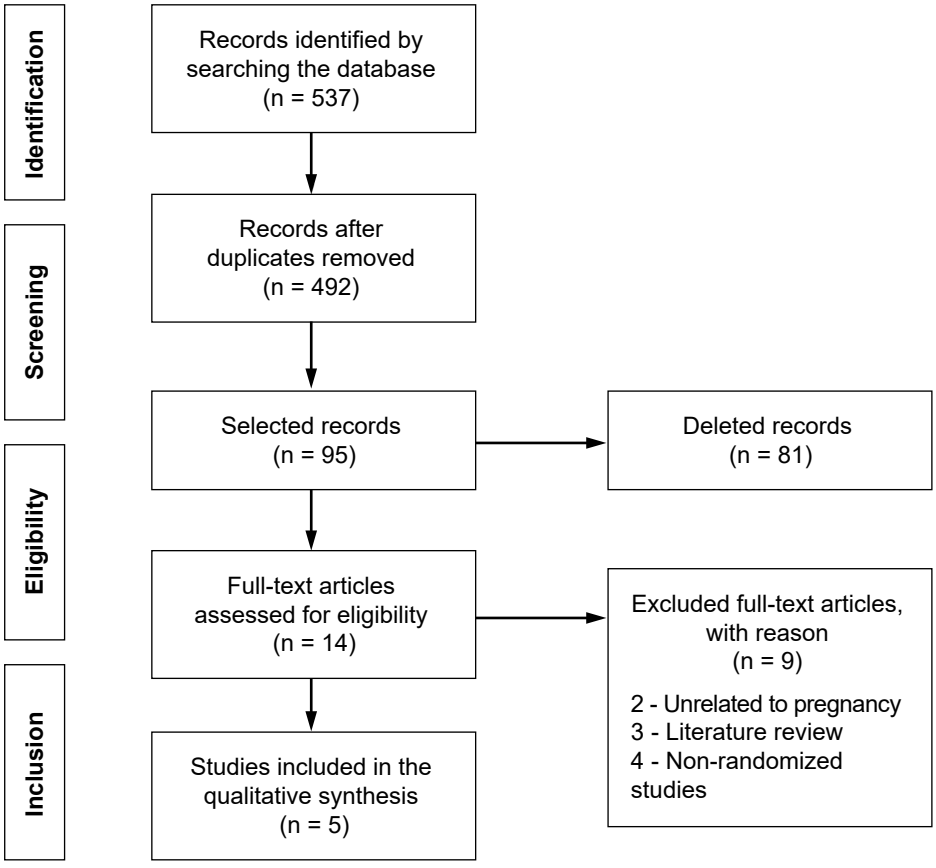

Figure 1: Flowchart of screening for randomized clinical trials for systematic review and PRISMA methodology.

Chart 2: Methodological quality assessment of the studies included in this review, using the PEDro database scale.

		Rodriguez-Blanque et al.[12]	Vásquez-Lara et al.[13]	Backhausen et al.[14]	Sánchez-García et al.[15]	Bacchi et al[16]
1	The eligibility criteria were specified.					
2	Participants were randomly assigned by group (in a crossover study, participants were randomly assigned to groups according to the treatment received).	1	1	1	1	1
3	The distribution of the participants was blind.	0	0	0	0	0

Continue...

Chart 2: Continuation

		Rodriguez-Blanque et al.[12]	Vásquez-Lara et al.[13]	Backhausen et al.[14]	Sánchez-García et al.[15]	Bacchi et al.[16]
4	Initially, the groups were similar with regard to the most important prognostic indicators.	1	1	1	1	1
5	All participants were blinded to the study.	0	0	0	0	0
6	All the physiotherapists who administered the therapy did so blindly.	0	0	0	0	0
7	All evaluators who measured at least one key result, did so blindly.	0	0	0	0	0
8	Measurement of at least one key result was obtained in more than 85% of the subjects initially assigned to the groups.	1	1	1	1	1
9	All participants whose outcome measurements were reported received the treatment or control condition according to the distribution or, when this was not the case, data analysis was performed for at least one of the key results by “intention to treatment”.	0	0	0	0	0
10	The results of inter-group statistical comparisons were described for at least one key result.	1	1	1	1	1
11	The study presented both measures of precision and measures of variability for at least one key result.	1	1	1	1	1
Scores		5/10	5/10	5/10	5/10	5/10

According to Rodriguez-Blanque et al.[12], the quality and time spent sleeping were considered effective for pregnant women who practiced water activities. Vásquez-Lara et al.[13], on the other hand, proved that the final measurements of arterial pressures (systolic, diastolic and mean) were significantly higher in pregnant women who did not practice aquatic exercises. Backhausen et al.[14] reported, that the intensity of low back pain was considerably lower for those pregnant women who performed aquatic exercises. Sánchez-García et al.[15], in his study, observed that aquatic exercises during the gestational period help to control overweight during pregnancy. Bacchi et al.[16] stated in their study that, during pregnancy, water activities with 3 weekly sessions avoid maternal excessive weight gain. The summary of the findings of each article is shown in Table 1.

Table 1: General data from the included randomized clinical trials, using the aquatic environment with pregnant women.

Author	Sample	Study design	Age	Objective	Intervention	Protocol	Results
Rodriguez-Blanque et al.[12]	140	Randomized study	21 to 43 years	To determine whether there is an association between moderate intensity physical activity in an aquatic environment and to assess the quality of sleep in pregnant women.	Control group: Followed the usual recommendations during pregnancy, consisting of general guidelines for midwives, including emphasis on the positive effects of physical exercise. Exercise group: performed the exercises in the swimming pool of the Faculty of Physical Activity and Sports Sciences at the University of Granada, under the supervision of midwives and specialists in sports sciences, who had previously received a training course on the SWEP (study of water exercise during pregnancy) method.	The exercise program was applied 3 times a week (in hourly sessions in the morning or afternoon), following the SWEP method specially developed for this study. The sessions consisted of 3 phases: warm-up exercises; the main phase (divided into aerobic exercises and strength and endurance exercises), and a stretching and relaxation phase.	The quality and time spent sleeping in the EG group were considered higher compared to the CG group.
Vázquez-Lara et al.[13]	46	Randomized clinical trial study	29 to 31 years	To evaluate the effect of a 6-week physical activity program in an aquatic environment with neck-deep immersion on hemodynamic constants in pregnant women.	Control group: had their blood and urine samples collected during the second and third trimester visits conducted at the health care facility during routine pregnancy control. Exercise group: The samples of pregnant women were collected at the sports center at the beginning and end of the program.	The structure of each session consisted of: warm-up and adaptation exercises to the aquatic environment (5 min), followed by a group of moderate aerobic exercises (20 min), where muscle groups (upper and lower limbs, respiratory dorsal and abdominal work), as well as pelvic work (10 min), ending with a phase of relaxation and recreational exercises (10 min).	When comparing the groups, the initial values did not differ, but at the final measure the CG showed higher mean blood pressure (systolic, diastolic and mean) than that of the EG.
Backhausen et al.[14]	516	Randomized controlled study	30 to 31 years	To evaluate the effect of an unsupervised aquatic exercise program on the intensity of low back pain and on days spent on sick leave among healthy pregnant women.	Exercise group: standard prenatal care, counseling and guidance and access to a water exercise program from 20 weeks of gestation. Control group: received standard prenatal care, counseling and guidance, and access to a water exercise program at 32 weeks of gestation.	A session of 4 swimming laps as a warm-up, followed by 6 exercises in water and finished with another 4 laps. The 6 exercises were performed in 2 series and required 2 foam dumbbells, a swim belt, and a kickboard.	The EG had lower back pain intensity compared to the CG.

Continue...

Table 1: Continuation

Author	Sample	Study design	Age	Objective	Intervention	Protocol	Results
Sánchez-García et al.[15]	129	Randomized controlled clinical study	30 to 32 years	To analyze the evolution of gestational and postpartum weight in pregnant women who performed a moderate program of physical exercises in the aquatic environment.	Both the control group and exercise group had regular visits to health professionals (midwives, obstetricians and family doctors) during pregnancy. Exercise group: performed moderate physical exercise in the aquatic environment, according to the SWEP method.	First, the warm-up phase, which was divided into general dry warm-up and specific warm-up in the aquatic environment, with exercises appropriate to the planned practice. In the main phase, the exercise was divided into an aerobic part in a large pool and a part of strength exercises typical of childbirth in the small pool. Finally, the final phase consisted of stretching and relaxation exercises.	It was observed that the newborn's weight showed significant differences, being lower in the infants of mothers of the EG compared to those of the CG mothers.
Bacchi et al.[16]	111	Clinical, randomized and controlled trial.	30 to 31 years	Examine the influence of a supervised and regular program of water activities during pregnancy on maternal weight gain and birth weight gain.	Control group: received standard care from health professionals and, when requested by telephone interviews, did not report regular physical exercise during pregnancy. Exercise group: received similar standard care and participated in a specific program of aquatic activities.	(A) Aerobic exercise or dance (accompanied by music); (B) Strength exercises and water activities (propulsion exercises) standing, supine and ventral for 15 to 18 minutes; (C) swimming lengths of the pool using all styles except butterfly for 8 to 10 minutes. Finally, a recharge was performed for 10 to 12 minutes at the end of each session, including static stretching, relaxation, breathing, and fluctuation exercises.	There was a higher percentage of women with excessive maternal weight gain in the CG compared to the EG.

CG: control group; EG: exercise group.

DISCUSSION

Based on the results obtained in this systematic review, it can be seen that aquatic exercise for pregnant women is effective in reducing back and joint pain[14], controlling weight[16] and blood pressure[13], and improving sleep quality[12].

Aquatic exercise has many benefits for pregnant women, such as reducing overload and preventing injuries[12,15]. Thus, water acts as a support for the body, eliminating the impact of movements on the joints, facilitating movement, improving circulation, reducing back pain and at the time of delivery[14]. Water relieves stress and tension, whether emotional or muscular, and some movements can accentuate this relaxing sensation, but one of the greatest benefits of exercising in water is the work of breathing according to the movements[12-14].

Bacchi et al.[16] observed positive results related to the application of an aquatic exercise program on weight control during pregnancy. Sánchez-García et al.[15] also reported positive results related to weight control during pregnancy in their study. The aquatic environment provides fluctuation generating less gravity than on the ground, preventing body weight on the joints, thus, the exercise in the water becomes mild for the joints, the muscles work harder, allowing greater fat burning and better muscle toning, as it is against water resistance.

During pregnancy, the increased mobility of the pelvic girdle ends up generating instability, which can trigger lower back pain and, consequently, hinder the ability of these women to conduct their daily activities. Thus, exercise in water becomes a strong ally for pregnant women, as it is considered a comfortable and safe environment that allows women to perform exercises or movements that would be limited on land, aiming to strengthen muscle groups[15]. Backhausen et al.[14], in their findings, stated that the aquatic exercise, even if not supervised, resulted in the reduction of lower back pain.

Vásquez-Lara et al.[13] verified that during pregnancy, arterial vasodilation occurred with increased artery compliance, which favored a decrease in BP, and a consequent increase in sodium excretion, contributing to increased blood volume. When water immersion occurs, the arterioles dilate, promoting a decrease in peripheral resistance, therefore blood pressure decreases, and the practice of aquatic exercises offers a hypotensive effect.

Rodriguez-Blanque et al.[12] reported that during pregnancy, women may progress to severe insomnia, and may occasionally experience nightmares, night terror, and even postpartum psychosis. Throughout pregnancy, a woman's body undergoes physiological and hormonal changes, and there is an increase in hormone levels. Thus, while progesterone is essential for fetal growth and stability, it has numerous implications, resulting in exhaustion and exorbitant sleep. Aquatic physiotherapy addresses techniques that promote physical and mental relaxation, working on breathing which improves the body's oxygenation, reducing levels of stress and insomnia.

Sleep is considered a physiological state of self-regulation and women undergo a series of physiological states from puberty to menopause, which can cause sleep dysregulation and disorders. These sleep disorders during pregnancy can start with excessive sleepiness and progress to severe insomnia, resulting in a decreased sense of well-being, characterized by changes in mood and motivation, and lack of attention and concentration. Activities in the water control the rhythm of breathing and anxiety, demand greater effort from the body, thus promoting body fatigue. However, pregnant women experience drowsiness, as it requires greater respiratory demand, promoting a feeling of relaxation, especially if the water is warm[12].

This review's strong point is the possibility of grouping the main benefits associated with water exercise for pregnant women. Since pregnancy is extremely prevalent in the world, this gives the present work great external validity. As limitations, we have that the clinical trials analyzed address aquatic exercises for pregnant women with divergent approaches, objectives, and interventions, thus with different protocols, as well as the limited methodological quality of the studies included.

CONCLUSION

It was concluded that physical exercise in the aquatic environment is beneficial for women during pregnancy.

REFERENCES

1. Alberton CL, Bgeginski R, Pinto SS, Nunes GN, Andrade LS, Brasil B, et al. Water-based exercises in pregnancy: Apparent weight in immersion and ground reaction force at third trimester. *Clin Biomech (Bristol, Avon)*. 2019;67:148-52.
2. Rodríguez-Blanque R, Sanchez-Garcia JC, Sanchez-Lopez AM, Expósito-Ruiz M, Aguilar-Cordero MJ. Randomized Clinical Trial of an Aquatic Physical Exercise Program During Pregnancy. *J Obstet Gynecol Neonatal Nurs*. 2019;48(3):321-31.
3. Vallim AL, Osis MJ, Cecatti JG, Baciuk EP, Silveira C, Cavalcante SR. Water exercises and quality of life during pregnancy. *Reprod Health*. 2011;8(1):14.
4. Silva JR Jr, Borges PS, Agra KF, Pontes IA, Alves JGB. Effects of an aquatic physical exercise program on glycemic control and perinatal outcomes of gestational diabetes: study protocol for a randomized controlled trial. *Trials*. 2013;14(1):390.
5. Vázquez Lara JM, Rodríguez Díaz L, Ramírez Rodrigo J, Villaverde Gutiérrez C, Torres Luque G,

Gómez-Salgado J. Calidad de vida relacionada con la salud en una población de gestantes sanas tras un programa de actividad física en el medio acuático (PAFMAE). *Rev Esp Salud Publica*. 2017;91:e201710042.

6. Melzer K, Schutz Y, Boulvain M, Kayser B. Physical activity and pregnancy: cardiovascular adaptations, recommendations and pregnancy outcomes. *Sports Med*. 2010;40(6):493-507.

7. Aguilar Cordero MJ, Rodríguez Blanque R, Sánchez García JC, Sánchez López AM, Baena García L, López Contreras G. Influencia del programa SWEP (Study Water Exercise Pregnant) en los resultados perinatales: protocolo de estudio. *Nutr Hosp*. 2016;33(1):156-61.

8. Artal R, O'Toole M, White S. Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and the postpartum period. *Br J Sports Med*. 2003;37(1):6-12.

9. Santos CMC, Pimenta CAM, Nobre MRC. The PICO strategy for the research question construction and evidence search. *Rev Lat Am Enfermagem*. 2007;15(3):508-11.

10. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med*. 2009;6(7):e1000097.

11. Shiwa SR, Costa LOP, Moser ADL, Aguiar IC, Oliveira LVF. PEDro: a base de dados de evidências em fisioterapia. *Fisioter Mov*. 2011;24(3):523-33.

12. Rodriguez-Blanque R, Sánchez-García JC, Sánchez-López AM, Mur-Villar N, Aguilar-Cordero MJ. The influence of physical activity in water on sleep quality in pregnant women: A randomised trial. *Women Birth*. 2018;31(1):e51-8.

13. Vázquez-Lara JM, Ruiz-Frutos C, Rodríguez-Díaz L, Ramírez-Rodrigo J, Villaverde-Gutiérrez C, Torres-Luque G. Efecto de un programa de actividad física en el medio acuático sobre las constantes hemodinámicas en mujeres embarazadas. *Enferm Clin*. 2018;28(5):316-25.

14. Backhausen MG, Tabor A, Albert H, Rosthoj S, Damm P, Hegaar HK. The effects of an unsupervised water exercise program on low back pain and sick leave among healthy pregnant women – A randomised controlled trial. *PloS One*. 2017;12(9):e0182114.

15. Sánchez-García JC, Aguilar-Cordero MJ, Menor-Rodríguez MJ, Paucar Sánchez AM, Rodríguez-Blanque R. Influencia del ejercicio físico en la evolución del peso gestacional y posparto: Ensayo clínico aleatorizado. *Nutri Hosp*. 2019;36(4):931-8.

16. Bacchi M, Mottola MF, Perales M, Refoyo I, Barakat R. Aquatic activities during pregnancy prevent excessive maternal weight gain and preserve birth weight: A randomized clinical trial. *Am J Health Promot*. 2018;32(3):729-35.

Received: Aug 5, 2020
Accepted: June 28, 2021