



Aquatic Exercise to Treat Pregnancy Related Issues in Pregnant Women: A Systematic Review

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ARTICLE DETAILS	ABSTRACT
<p>History Revised format: May 2020 Available Online: June 2020</p>	<p>Background: Wide ranges of physiological changes occur as a result of pregnancy in women that, in certain cases, may cause variety of psychological and physical problems in pregnant women. Aquatic exercises believed to be safe for pregnant women and believed to foster positive effect on psychophysical health.</p> <p>Purpose: This review sought to synthesize qualitatively the existing research evidences concerning association between aquatic exercises and psychophysical problems in pregnant women.</p> <p>Methods: A 1989 records were yielded as result of conducting a systematic search in nine research data bases. After undergoing rigorous screening and assessment procedure of eligibility, and quality appraisal, a total of seventeen research articles were ultimately selected to include in this review.</p> <p>Results: Out of seventeen admissible studies, ten studies found that aquatic exercises exerts positive impact to decreases variety of physical discomforts such as fatigue, pelvic pain, labor pain, and edema. The remaining seven studies presented beneficial effects of aquatic exercises for psychological factors such as body image, stress, depression, feelings, mood, distress, and anxiety in pregnant women.</p> <p>Conclusion: This review found some evidence in support of the efficacy of aquatic exercises to reduce physical discomfort and improve psychological factors in pregnant women.</p>
<p>Keywords Aquatic exercise, exercise in water, pregnancy, pregnant women, pregnancy related outcomes</p>	
<p>JEL Classification:</p>	



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1. Introduction

Women during pregnancy experience variety of mental and physical disorders. For example, psychological issues including depression, obsessive compulsive disorder, anxiety, stress, panic disorder, mood disorders, sleep disorders, and psychological distress appeared to associated with pregnant women (Sharma, Singh, Tempe, & Malhotra, 2017). In particular, recent reviews reported that prevalence of depression (Woody, Ferrari, Siskind, Whiteford, & Harris, 2017) or disorders relating post-traumatic stress (Yildiz, Ayers, & Phillips, 2017) was 11.9% and 3.3 % among pregnant women, respectively. In addition, pregnancy related physical health disorders including sleep disorders, back pain, fatigue, lack of energy, and reduced quality of life were also reported in this population (Olsson & Lena, 2004). Leaving these issues unaddressed could be problematic that have associations with wide range of negative outcomes. For example, psychological disorders (i.e., depression, anxiety, mood disorders) were appeared to be related with variety of preterm labor, obstetric complications, pregnancy symptoms, as well as various negative neonatal and fetal consequences (Alder, Fink, Bitzer, Hösli, & Holzgreve, 2007). A meta-analytical study showed that psychosocial stress was linked with increased risk of negative perinatal and neonatal outcomes (Littleton, Bye, Buck, & Amacker, 2010). Other studies found negative effects of sleep disorders (Chang, Pien, Duntley, & Macones, 2010), fatigue, pain, edema(Reynolds, 2003), and excessive maternal weight gain(Siega-Riz et al., 2009) on maternal and fetal outcomes. Taking together, these findings likely to suggest that addressing pregnancy related negative outcomes are critically essential for better health perspective for pregnant women.

Due to serious concern for maternal and fetal health, professional in health care area have been focusing on interventions that contribute to reduce and/or treat pregnancy related physical as well as psychological issues among pregnant women. Many researchers have been interesting on exercise based interventions for addressing pregnancy related issues in pregnant women (Chan, Au Yeung, & Law, 2019). Aquatic exercises have been considering a form of exercise programs those are planned and developed to perform in water or swimming pools. This type of intervention have been using for therapeutic purpose for many years in health care setting. Regular involvement in aquatic exercise programs has been associated with physical and psychological benefits for women. Aquatic exercise showed indications of reduction in depression, enhanced self-efficacy, improvements in quality of life and physical fitness in women (Lee, Chang, & Ahn, 2007). It appeared to exhibit positive effect on sleep(S. Delevatti et al., 2018), edema(Gianesini et al., 2016), fatigue(Cantarero-Villanueva et al., 2013), weight control(Kasprzak & Pilaczyńska-Szcześniak, 2014), and pain(Munguía-Izquierdo & Legaz-Arrese, 2007) among women. These findings lead us to conclude that aquatic exercise results in beneficial outcomes regarding physical and psychological well-being of the women.

To this end, it can be hypothesized that if women during pregnancy experience specific physical issues (i.e., pain, edema, fatigue, sleep, and weight gain) and negative psychological symptoms (i.e. depression, anxiety, and psychological distress) and aquatic exercise can potentially contribute to improve these conditions, then, it can be logically assumed that aquatic exercise may have the potential to deal with these pregnancy related outcomes. Aquatic exercise programs specifically considered among the most appropriate exercise intervention for pregnant women(Juhl, Kogevinas, Andersen, Andersen, & Olsen, 2010). It has been suggested to be safe, joyful, offer moderate intensity workload and easy to perform during pregnancy (Backhausen et al., 2014; Juhl et al., 2010). In particular, exercising in water reduces 83 % weight of pregnant women that results reducing weight bearing on lower extremities and thus reduces the risk of musculoskeletal injuries during exercise in pregnant women (Alberton et al., 2019). These findings likely to suggest that aquatic exercise programs seem more tailored in connection with conditions associated with pregnant women.

Above discussions lead us to conclude that aquatic exercises can be considered an important therapeutic intervention strategy to deal with variety of pregnancy related outcomes. Best health care practices require evidence based knowledge and evidence based policies for implementations. These approaches encourage clinicians and practitioners for systematic and critical evaluation of the effectiveness of the interventions before implementation. However, there is no review exists that critically assessed existing evidences showing beneficial effects of this intervention for these women. It seems important to present in-depth and critical analysis concerning efficacy of aquatic exercise programs for reduction and/or treatment of some common physical and psychological conditions that women generally experience during pregnancy. Therefore, this review sought to present qualitative syntheses of the existing research on this topic. Another objective of this work was to identify gaps in existing work and suggest some ideas for future research in this area of research. This work may help professionals in health care setting to make decisions concerning implementing non-pharmacological treatment interventions while addressing pregnancy related issues during practice. Aquatic exercise was defined as all type of physical activities and exercise programs those were designed to perform in water.

2. Methods

2.1 Search Strategy

Published research articles were systematically searched in major research data bases including Science Direct, Taylor & Francis, PubMed, Medline Plus, PsycINFO, ProQuest, Wiley Online Library, SAGE Journals, and Springer Link in August 2019. Search strategy consisted of using combination of aquatic exercise related keywords (i.e., aquatic exercise, exercise in water, swimming, water based exercise) along with pregnancy related keywords (i.e., pregnancy, pregnant women, maternal, gestation, antenatal, and prenatal).

2.2 Inclusion and Exclusion Criteria

Eligibility criteria for inclusion were as follow: 1) studies presented data involving aquatic exercise programs effects on pregnancy related physical or psychological outcomes, 2) studies used any research designs including randomized control trials, clinical control trials, cohort, time series designs, case studies, longitudinal designs, qualitative, and cross-sectional designs, 3) studies selected health or patients pregnant women of any age, 4) published in peer review journals in English language, and 5) published in any geographical region or any country. Studies were excluded that met following criteria: 1) unpublished studies, 2) thesis and dissertations, 3) published in languages other than English, and 4) did not exists data related to variables included in this review.

2.3 Data Extraction

According to set criteria, the studies involving titles and abstracts were retrieved and thoroughly screened for relevancy. A second expert again screened the selected articles and only those articles were finally selected that were verified by second expert. Full texts were obtained and in depth and careful screening was carried out based on eligibility criteria set for this review. Data concerning authors, publishing year, country, sample characteristics, study designs, interventions and exercise measures, outcomes measures, data analysis, and results and findings were extracted (see table 1). A systematic review thought to be appropriate due to diverse nature of samples, interventional procedures, study designs, data analysis procedures.

2.4 Quality Appraisal

To evaluate the quality of each selected study, we used “The Quality Assessment Tool for Quantitative Studies” that has been widely employed for assessing study quality in health care (Chan et al., 2019; Project, 1998). The admissible studies were ranked as weak, moderate or strong based on assessment guide and dictionary for this tool on six point criteria including i) selection bias, ii) study design, iii) data collection, iv) confounders, v) rater blinding, and vi) withdrawals. In accordance with guidelines, studies having no weak rating on any of the six categories were rated as strong on overall rating. The studies had one weak rating were considered having moderate methodological quality study. All studies that had more than one weak rating on six point categories were rated as weak methodological quality studies.

3. Results

3.1 Search Results

As a result undertaking systematic search for related studies, a total 1989 records were appeared. Full search results are presented in Figure 1. After removing the duplicates, 1227 studies left that were selected for carrying out screening process for eligibility. Studies that did not meet inclusion and exclusion criteria set for this review were excluded. This resulted in 17 articles that were finally selected to include in this review.

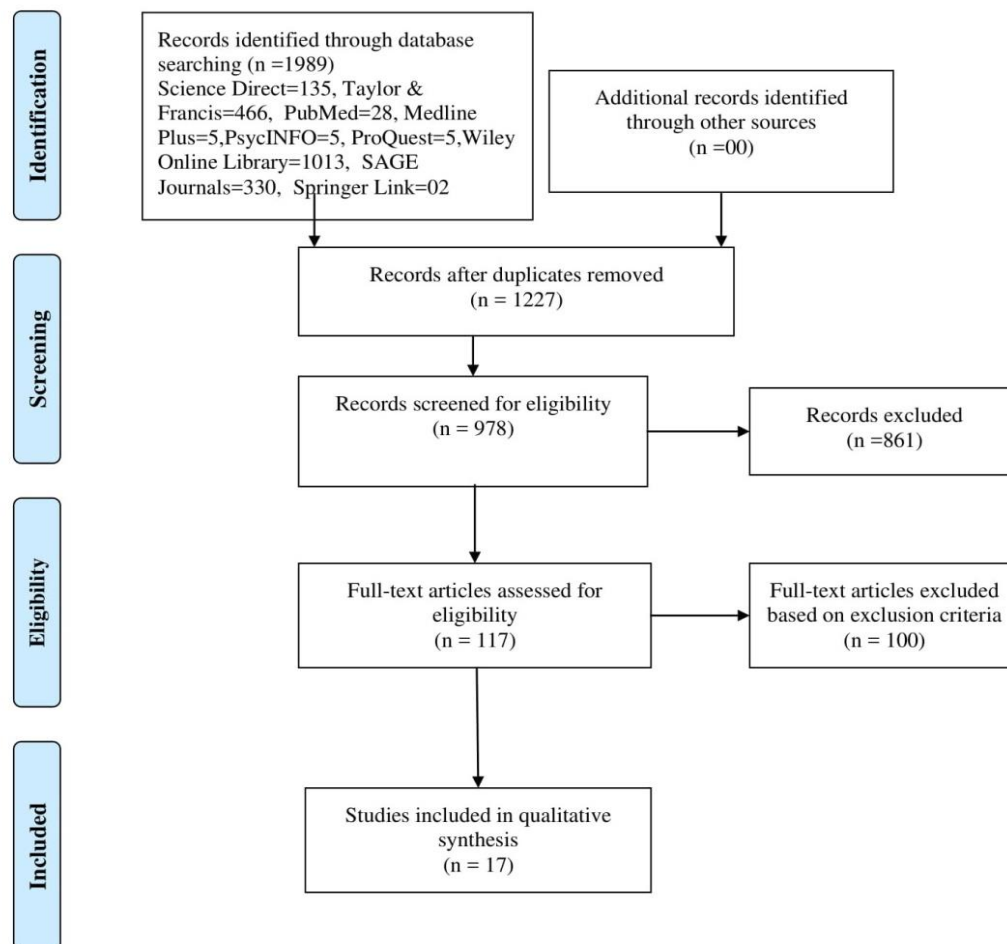


Figure 1. PRISMA flow chart showing procedure for literature search and selection of studies assessed effects of aquatic exercise on pregnancy related outcomes

3.2 Quality of the Included Studies

Among 17 included studies, 3 (17.64%) were rated as strong and 14 (82.35%) as moderate with respect to their methodological quality (see table 1). This shows the quality of studies done in this specific area.

Table 1 Quality appraisal of the included studies assessing aquatic exercise effects on pregnancy issues.

Sr.#	Study/ Design	A Bias in Selection	B Study Design	C Confounders	D Rater Blinding	E Data Collection	F Withdrawal	Overall Rating
1	Backhaus, et al., (2017)	S	S	S	M	S	S	strong
2	Bacchi, et al., (2017)	S	S	S	M	S	M	strong
3	Cavalcante, et al., (2009)	M	S	M	M	S	M	strong
4	Lox et al., (2000) Interrupted time series	M	M	M	W	S	S	moderate
5	Parker, et al., 2003. Cohort	M	M	M	W	S	S	moderate
6	Granath, et al., (2006) CCT	S	S	M	W	S	S	moderate
7	Polman, et al., (2007)	M	M	M	W	S	S	moderate
8	Kihlstrand, et al., (1999) CCT	M	S	S	W	S	M	moderate
9	Cordero, et al., (2018)	S	S	S	W	S	S	moderate
10	Scott & Hellawell, (2018)	M	S	M	W	S	S	moderate
11	Baciuk, et al., (2008)	S	S	S	W	S	S	moderate
12	Backhausen, et al., (2014)	M	M	M	W	S	M	moderate
13	Vallim, et al., (2011)	M	S	S	W	M	M	moderate
14	Smith & Michel, (2006)	M	S	M	W	S	S	moderate
15	Blanquea, et al., (2017)	M	M	M	W	S	S	moderate
16	Juhl, et. al., (2010)	S	W	M	M	S	S	moderate
17	Hartmann, et al., (2005)	W	M	M	M	S	S	moderate

3.3 Study Characteristics

Table 2 Characteristics of the included studies assessing aquatic exercise effects on pregnancy and overall health.

Study	Sample	Design	Aquatic Exercise / Measure	Outcome Measures	Analysis	Results / Findings
Scott & Hellawell, (2018)	23 pregnant women with PGP Age range = 22-37 yrs. Mean = 31.9 ± 3.95 yrs.	RCT	Aquatic exercise of moderate intensity (4 sessions/week)	PGPQ, VAS, PSFS, ASLR, SEES	Independent Student's t-test Box-and-Whisker plot, Shapiro-Wilk test	Group comparison results (water-based vs. land-based) showed the significant difference for the positive well-being ($p = 0.000$), the ASLR ($p = 0.036$), and fatigue subscales of the SEES ($p = 0.011$). Aquatic exercise during pregnancy was considered more beneficial to reduce fatigue, foster well-being, and improve ASLR scores in comparison with land based exercise.
Vallim, et al., (2011)	35 pregnant women (26 vs. 24 yrs.)	RCT	Water aerobics classes for 50 min 3 times/week	Self-Developed Questionnaire WHOQOL-BREF,	MANOVA Water	At the time of admission, 71% pregnant women who were practicing water aerobics expected improvements in physical well-being through exercise. At the end of the study, 65% women believed that water aerobics classes would make childbirth easier for them.
Juhl, et al., (2010)	48,781 pregnant women	Nationwide Population-Based Cohort	Self-reports, interview (yes/no)	Ponderal index Gestational age (days, weight, and length)	Cox, linear and logistic regression.	Risk of giving preterm birth slightly reduced in women who participated in swimming during pregnancy ($R = 0.80$, 95% CI: 0.72–0.88) or the ratio of congenital malformations with childbirth minimized ($R = 0.89$, CI: 0.80–0.98). Aquatic exercise had positive effects in birth related outcomes.
Backhausen, et al., (2017)	516 pregnant women of 18 yrs. or older (gestation 16±17 weeks)	RCT	Twelve-week aquatic exercise (twice a week)	Minnesota Leisure-Time PAQ. Low Back Pain (LBP) Rating Scale	Unsupervised water vs. standard prenatal care group	Intensity of LBP significantly reduced in pregnant women who had aquatic exercise ($R = 2.01$, 95%, CI: 1.75±2.26) than those who did not have aquatic exercise ($R = 2.38$, 95% CI: 2.12±2.64). Aquatic practice was suggested as a beneficial exercise for reducing low back pain in pregnancy.
Smith & Michel, (2006)	40 pregnant women (gestation= 19 weeks)	Quasi-experimental, CCT	Six-week aquatic exercise (3 sessions of 60 min/week).	PBSQ, HPLP, SPDII.	ANCOVA, Independent t-tests	Health-promoting behaviors and less physical discomfort were noted in pregnant women who took part in aquatic exercise compared to non-exercisers. Posttest scores showed women's likeliness towards physical exercise ($p = .006$), stress management ($p = .001$), and health-promoting behaviors ($p = .05$) among exercising women.
Cavalcante, et al., (2009)	71 pregnant women	RCT	Fifty-min moderate water aerobics exercise (3-times a week).	Education level, gestational age, abortions or cesarean sections undergone previously	MANOVA, Chi-square, Student's t-tests	Type of delivery, preterm birth rate, alteration in maternal body composition, neonatal weight or well-being was not associated with water aerobics. Water aerobics proved to be safe and may be considered beneficial for indirect outcomes e.g., the greater percentage (around 10%) of vaginal deliveries.

Bacchi, et al., (2017)	111 pregnant women Mean age = 31.6 ± 3.8 yrs.	RCT	Water aerobics (3-weekly sessions).	Maternal weight gain, BMI, Birth weight	Student's t test	Water activities were helpful in preventing excessive weight gain in pregnant women and preserving birth weight.
Rodriguez-Blanquea et al., (2017)	134 women, Age range 21–43 yrs.	RCT	Three hourly sessions of aquatic exercises per week.	PSQIQ.	Mann–Whitney U test	Number of women with poor sleep in intervention group (44 (65.67%)) was less than women in control group (62 (92.54%)).
Aguilar-Cordero, et al., (2019)	136 pregnant women Age range 21–43 yrs.	Randomized open-label clinical trial	moderate aquatic exercise (hourly sessions, 3 days/week)	Edinburgh Postnatal Depression Scale,	Mann–Whitney U test Student's t test	BMI results revealed significant differences regarding obesity (EG, 7.88 ± 3.01; CG, 11.00 ± 1.90) and overweight (EG, 6.13 ± 4.05; CG, 10.23 ± 2.42). Moderate aquatic exercise might effective in reducing the symptoms of PPD, and weight gain during pregnancy.
Lox & Treasure, (2000)	44 pregnant women Age range 26–41 yrs.	Interventional study, pre-post single group time series design,	Water aerobics for 6 weeks (2 times/week with 45 min. moderate intensity)	SEES	MANOVA	Regular aquatic exercise was associated with improved states of positive feeling, reduced states of negative feeling and fatigue for women during pregnancy.
Polman, Kaiseler, & Borkoles, (2007)	66 women	RCT	RPE	Profile of mood states	Aqua, gym studio, and parent craft class	Aqua and studio conditions significantly increased overall mood states and vigor. Depression was also decreased in aqua class.
Granath, Hellgren, & Gunnarsson, (2006)	390 pregnant women	RCT	Aquatic vs. land-based exercise (1 session/week).	LBP, PGP, or both, Sick leave.	Mann-Whitney 's test, Student's t test	Water aerobics compared to land-based exercise significantly minimized LBP ($p = .04$) and diminished the frequency of sick leave ($p = .03$).
Baciuk et al., (2008)	71 pregnant women	RCT	Fifty-min moderate water aerobics exercise (3 times/week)	VO2 max, CO, skin temperature, physical fitness, labor/delivery outcomes	MANOVA, Friedman's analysis, chi-square test. Student's t	Labor analgesia was significantly lower in pregnant women who did water aerobics ($R = 0.42$ 95%, CI: 0.23–0.77). Aquatic exercise was beneficial in reducing labor pain.
Kent et al., (1999)	18 women with 20–33 weeks' gestation		Water aerobics class for 30 min.			Water aerobics program might be suggested as an effective intervention for women with edema of pregnancy.
Backhausen et al., (2014)	30 women	Cohort (one group pre + posttest design)	Water exercise	In depth Interview	Content analysis	Water exercise was suggested to be beneficial both for physical health and psychological well-being.
Hartman & Huch, (2005)	9 women (with edema) Age range 32–36 yrs.	Cohort (one group pre + posttest design)	45-min Aqua-Fit1 program.	Lower limbs edema		The pregnant women showed strongly positive impressions of reductions in edema after the single session of immersion exercise.
Abbreviations: PGPQ, Pelvic Girdle Pain Questionnaire; RCT, randomized control trial; PSFS, Patient-Specific Functional Scale; ASLR, active straight-leg raise; SEES, Subjective Exercise Experience Scale; VAS, visual analogue scale; PSQIQ, Pittsburgh Sleep Quality Index Questionnaire; GDM, Gestational diabetes mellitus; WHOQOL-BREF, World Health Organization Quality of Life.						

3.3.1 Aquatic Exercise Effects on Physical Discomfort (Fatigue, Edema, or Pain)

Ten of the selected articles presented data on the associations of aquatic exercise with physical discomfort. In general, ten studies included in this review consistently showed significantly positive effect of aquatic exercise on reduction in physical discomfort (Baciuk, Pereira, Cecatti, Braga, & Cavalcante, 2008; Backhausen et al., 2014; Backhausen et al., 2017; Granath, Hellgren, & Gunnarsson, 2006; Kent, Gregor, Deardorff, & Katz, 1999; Kihlstrand, Stenman, Nilsson, & Axelsson, 1999; Lox & Treasure, 2000; Scott & Hellawell, 2018; Smith & Michel, 2006). For instance, these studies demonstrated beneficial effects of aquatic exercise for back pain (Backhausen et al., 2014; Backhausen et al., 2017; Granath et al., 2006; Kihlstrand et al., 1999), maternal discomfort (Smith & Michel, 2006), pelvic pain (Scott & Hellawell, 2018), fatigue (Backhausen et al., 2014; Lox & Treasure, 2000; Scott & Hellawell, 2018), labor pain (Baciuk et al., 2008), and edema related discomfort (Hartmann & Huch, 2005; Kent et al., 1999). There was no study that reported adverse effects of aquatic exercise on the above-mentioned variables. In sum, these findings collectively suggest that aquatic exercise interventions can potentially reduce physical discomfort in pregnant women. However, more studies seem essential to increase strength of the evidence in favor of these findings.

3.3.2 Aquatic Exercise Effects on Psychological Health

Seven of the included studies assessed aquatic exercise effects on psychological health and well-being. These studies indicated that aquatic exercises can potentially reduce stress (Parker & Smith, 2003), decrease psychological distress (Scott & Hellawell, 2018), improve stress management and body image (Smith & Michel, 2006), decrease depression (Aguilar-Cordero, Sánchez-García, Rodríguez-Blanque, Sánchez-López, & Mur-Villar, 2019), foster positive feelings (Lox & Treasure, 2000), improve mood and vigor, and decrease depression (Polman, Kaiseler, & Borkoles, 2007), and enhance pleasant feelings and decrease anxiety (Backhausen et al., 2014). In general, these data from these studies provided support for effectiveness of exercises in aquatic environment for reducing negative psychological conditions and enhancing positive psychological outcomes in pregnant women. No study showed negative outcome of aquatic exercises interventions on psychological health of the pregnant women. This highlights that there is some possibility to prescribe exercises intervention in aquatic environment for pregnant women with experiencing negative feelings, anxiety and depression related symptoms.

3.3.3 Aquatic Exercise Effects on Quality of Life

Of the selected studies, there was only one study that investigated the effects of aquatic exercise on 'quality of life' among pregnant women. In this regard, Vallim, A.L., et al., (Vallim et al., 2011) conducted a study involving 35 women in water exercise condition in which intervention group underwent three classes of aquatic aerobic exercises per week whereas control group received normal hath care. The analysis yielded no significant difference on the quality of life measure between both groups. This suggests that there is no relationship between aquatic aerobics and quality of life among inactive women with pregnancy. No final conclusion can be drawn based on insufficient data available from only one study.

3.3.4 Aquatic Exercise Effects on Sleep

We found only two studies that presented data regarding relationship between aquatic exercises and sleep in pregnant women. Both studies reported a significantly positive effect of aquatic exercise on sleep (Backhausen et al., 2014; Rodríguez-Blanque, Sánchez-García, Sánchez-López, Mur-Villar, & Aguilar-Cordero, 2018). Findings from these two studies appeared to favor the idea of utilizing aquatic exercises as an effective mean to improve sleep among pregnant women. However, the existing data is insufficient that hinders drawing definite conclusion regarding effectiveness of this intervention for improving sleep in pregnant women.

3.3.5 Aquatic Exercise Effects on Maternal Weight Control

We found the data regarding association between aquatic exercise and maternal weight control only in four studies selected for this analysis (Aguilar-Cordero et al., 2019; Bacchi, Mottola, Perales, Refoyo, & Barakat, 2018; Backhausen et al., 2014; Vallim et al., 2011). Studies included in this section consistently demonstrated positive impact of involvement in aquatic exercise programs on controlling excessive maternal weight among the samples of pregnant women. These findings highlight the efficacy of aquatic exercise programs for excessive weight control during pregnancy. However, with only four studies provided support for the effectiveness of this intervention for controlling excessive weight gain among these individuals remains unconfirmed unless availability of more data from further studies on this domain.

4. Discussion

Pregnant women, in many cases, appeared to experience wide range problems concerning physical discomfort (edema, pain, fatigue), and psychological issues (anxiety, stress, depression, disturbed mood). Women also reported to exhibit problems in sleep and excessive weight gain during pregnancy. In this connection, effective interventions required to develop for the purpose of improving these conditions that further could enhance quality of life in these individuals. Past research has demonstrated that aquatic exercise programs appeared to be particularly beneficial to boost physical and psychological well-being. It can be hypothetically assumed that exercise programs in an aquatic environment particularly tailored with the needs and interests of pregnant women would be more effective to deal pregnancy related physical and psychological issues. This work serves to present qualitative synthesis of evidence based on published research assessing efficacy of water based exercise interventions on the alleviation and/or enhancement of wide range physical and psychological pregnancy related outcomes.

One main finding emerged from this data is effectiveness of aquatic exercise programs on improvement in various symptoms of physical discomfort in pregnant women. This finding found to be consistent in demonstrating such effect across all of the included studies. None of the studies presented adverse outcomes of the intervention on the any of the physical discomfort variables. In addition, there were no conflicting results reported in any of the included study. In this regard, aquatic exercise appeared to be beneficial for improvements in back pain, maternal discomfort, pelvic pain, fatigue, labor pain and edema related pain. More data from future research would add strength of the evidence for the effectiveness of this intervention. Another main findings emerged from this data is positive effect of aquatic exercise on improving level of variety of psychological variables in pregnant women. This effect appeared to be consistent across all of the included studies in this review. The positive effects were emerged for variety of the psychological outcomes including stress, psychological distress, body image, positive feelings, mood, vigor, depression, and anxiety. These findings likely to suggest that aquatic exercise programs can be used to as an effective interventional strategy to improve physical pain, to enhance positive psychological outcomes and to treat negative psychological symptoms (i.e. anxiety, depression, stress, negative body image) in pregnant women. This could potentially contribute to physical and psychological well-being of this population.

Furthermore, we found evidence from four included studies exhibiting beneficial effects of aquatic exercise for excessive maternal weight gain. All of the four studies demonstrated consistent positive effects for controlling weight in pregnant women. Although this data is promising with respect to such effect on pregnancy related weight gain, however, this data seems inadequate that hinders drawing of definite conclusion. This indeed fosters the idea of conducting further studies that would help to reach final conclusion. This review found no evidence for beneficial effects of aquatic exercise for the measures of quality of life. However, we found little support from two studies for positive effects of aquatic exercise for pregnancy related sleep problems. Based on insufficient data obtained from two studies in favor of beneficial effects of aquatic exercise for sleep related issues, we are not confident to suggest this intervention to address sleep related issues in these individuals.

In sum, based on above discussion, it can be concluded that aquatic exercise may be suggested as an intervention to address issues concerning physical discomfort, psychological symptoms, and managing maternal weight in pregnancy. In addition, this review study found no effect of aquatic exercise on measures of quality of life or insufficient support for sleep related problems in the samples of pregnant women. However, these findings needed to be verified with more studies addressing these issues.

5. Limitations

Studies in English language were included in this review that led to exclude studies published in other languages. This review focused only a few common physical and psychological outcomes including edema, fatigue, pain, sleep, quality of life, maternal weight gain and other psychological variables. This resulted in studies limited to the variables of our interest in this review. Future review should broaden the scope of the reviews to include birth related outcomes, newborn health, and pregnancy related defects regarding effectiveness of aquatic exercise programs for women with pregnancy.

6. Practical Implications and Recommendations

Existing evidence regarding positive effects of aquatic exercise on some pregnancy related outcomes likely to suggest that there is some possibility to use this intervention to reduce and/or treat some issues concerning physical discomfort, psychological health, and maternal weight management in the population of pregnant women. However, these implications should be interpreted with caution because these are based on a few published studies on this topic.

It is evident that exercise with various intensities, durations, and frequency have different impact on physical and psychological health. It has been suggesting that only the appropriate dose of exercise is essential for optimal health related benefits. The findings emerged from this review need to extend using aquatic exercise intervention with various intensities, duration, frequency, and different exercise dosages. It would be more interesting to investigate differences with respect to effects on pregnancy related outcomes comparing samples of professional swimmers versus non-swimmers. This paradigm would highlight the impact of long-term training versus short-term training on the pregnancy related variables. In particular, this view identified that studies with strong methodological quality are lacking. Insufficient or no data exists on the investigating effects of this intervention on sleep and quality of life. These issues need to be addressing in future research.

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