



A meta-analysis of the effectiveness of yoga-based interventions for maternal depression during pregnancy

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ABSTRACT

Prompt and effective treatment of maternal depression during pregnancy is important as it is an independent predictor of negative maternal and fetal outcomes. Yoga is an increasingly popular non-pharmacological modality. This study thus aimed to undertake a meta-analysis of the efficacy of yoga-based interventions for maternal depression during pregnancy. A total of 8 clinical studies were systematically reviewed, and 6 studies with a total of 405 pregnant mothers were included in the final meta-analysis. Applying per-protocol analysis and a random-effects model, the pooled standardized mean difference (SMD) from baseline depressive score was -0.452 (95% CI: -0.816 to -0.880 , $P = 0.015$), supporting a statistically significant beneficial effect of yoga-based interventions on mood. Overall, yoga-based interventions are a promising non-pharmacological option, however, most trials examined were preliminary, recruited only participants with mild depression, did not blind study participants and had relatively small sample sizes. Larger randomized, controlled trials should be encouraged.

1. Introduction

Perinatal depression is estimated to affect some 12% of women worldwide [1]. For women, there is a significant risk of depression during pregnancy [2]. Prompt and effective treatment of depression during pregnancy is important as depression is an independent predictor of negative maternal and fetal outcomes [3]. However, the clinical management of perinatal depression remains a challenge. In particular, the use of antidepressants during pregnancy to treat antenatal depression continues to be debated. Although the risk of teratogenesis associated with commonly-used selective serotonin reuptake inhibitors (SSRIs) is small [4], studies concerning the use of SSRIs in pregnancy have reported an association between antenatal SSRI exposure and an increased risk of developing persistent pulmonary hypertension of the newborn (PPHN) [5] and spontaneous abortions [6]. Furthermore, patients do express reluctance to initiate and adhere to pharmacological therapy, instead preferring to seek out alternative therapies and treatment options [7].

One promising alternative is yoga-based interventions. Yoga, a long and rich historical practice and healing modality in the East, is gaining

popularity worldwide for its purported general health benefits and as a potential therapy for a myriad of conditions, ranging from diabetes [8] to eating disorders [9].

With the increasing global prevalence of perinatal depression, it is important that complementary and alternative therapies be explored as potential treatment options. A 2013 meta-analysis has reported moderate evidence for the efficacy of yoga in improving depressive symptoms, compared to treatment-as-usual [10]. It is unclear if these benefits may extend to the antenatal period. Hence, this meta-analysis aims to investigate the efficacy of yoga-based interventions for depressive symptoms during pregnancy.

2. Methods

A systematic literature search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Using the keywords [yoga] AND [perinatal OR antenatal OR maternal OR pregnancy] AND [depression OR mood OR sad], a preliminary search on the PubMed, Ovid, PsychINFO, Web of Science and Google Scholar databases yielded 22,739 papers

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published in English between 1-Jan-1988 and 1-Mar-2018. Grey literature was not searched. Title/abstract screening were performed independently by three researchers to identify articles of interest. For relevant abstracts, full articles were obtained, reviewed and also checked for references of interest. If necessary, the authors of the articles were contacted to provide additional data.

Full articles were obtained for all selected abstracts and reviewed by three researchers for inclusion. Any disagreement was resolved by discussion and consensus. The inclusion criteria for this review were: (1) published original clinical trial, (2) study population consisting of pregnant women, (3) with yoga-based intervention, and (4) available outcome measures for depression rating/severity score pre- and post-intervention.

Methodological quality of the eligible clinical trials was appraised using the Cochrane Collaboration's tool for assessing risk of bias [11]. As different scales and scoring systems, e.g. the Edinburgh perinatal depression scale (EPDS) and the Hospital Anxiety Depression Scale (HADS), were used in the various studies to assess depressive symptoms/severity, the primary outcome measure of interest was the standardized mean difference (SMD) for mean reduction in depression scores from baseline with yoga-based intervention, per-protocol analysis. Estimates were pooled and where appropriate, 95% confidence intervals (95% CI) and P-values were calculated.

Heterogeneity amongst the different studies pooled was examined using the I² statistic and Cochran's Q test. Publication bias was assessed using a funnel plot and Egger test [12]. All analyses were conducted using MedCalc Statistical Software version 14.8.1 (MedCalc Software bvba, Ostend, Belgium; <http://www.medcalc.org>; 2014).

3. Results

Of the 22,739 citations retrieved, 173 full papers were selected for further review. The abstraction process and reasons for exclusion were detailed in Fig. 1.

Table 1 summarized the details of the studies reviewed. A total of 6 studies with a total of 405 pregnant mothers were included in the final meta-analysis. Two studies [13,17] were uncontrolled, pilot trials, and hence, were excluded from the meta-analysis. None of the authors had to be contacted to provide additional data.

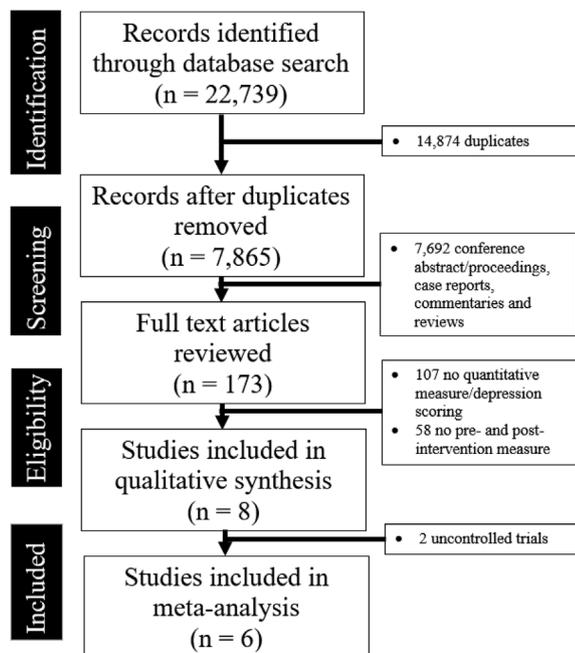


Fig. 1. PRISMA flow diagram showing the studies identified during the literature search and abstraction process.

Table 1
Studies included in this systematic review (arranged alphabetically by first Author's last name).

Author, year	Country	Sample size (N)	Study groups	Study duration	Outcome measures	Conclusions
Battle, 2015 [13]	United States	34	- Yoga (weekly 75-min sessions) - No control group	10 weeks	EPDS, QIDS	No yoga-related injuries reported. Significant decrease in depression severity at the end of study period, based on observed-rated and self-report.
Davis, 2015 [14]	United States	46	- Yoga (weekly 75-min sessions) - Treatment-as-usual	8 weeks	EPDS, STAI, PANAS-N	Yoga reduced depression and anxiety symptoms in pregnant women. Compared to treatment-as-usual, negative affect was significantly improved.
Field, 2013 [15]	United States	92	- Balance exercises of tai chi + stretching exercises of yoga (weekly 20-min sessions) - Waitlist control	12 weeks	CES-D, STAI	Treatment group had statistically insignificant lower CES-D scores, as well as reduced symptoms of depression and anxiety compared to waitlist control.
Field, 2013 [16]	United States	92	- Yoga (weekly 20-min sessions) - Social support	12 weeks	CES-D, EPDS, POMS, STAI	Yoga and social support both improved depression and anxiety (did not differ in terms of effectiveness).
Muzik, 2012 [17]	United States	18	- Mindfulness yoga (weekly 90-min sessions) - No control group	10 weeks	BDI, EPDS	Mindfulness yoga significantly reduced symptoms of depression.
Newham, 2014 [18]	United Kingdom	59	- Yoga (weekly 90-min sessions) - Treatment-as-usual	8 weeks	EPDS, STAI	Greater increase in depression scores in the treatment-as-usual group compared to the yoga group.
Satyapriya, 2013 [19]	India	96	- Yoga (daily 60-min sessions) - Antenatal exercises	17 weeks	HADS	Significant reduction in depression scores in the yoga group compared to the control.
Uebelacker, 2016 [20]	United States	20	- Yoga (weekly 75-min sessions) - Mom-baby wellness workshop	9 weeks	EPDS, QIDS	No yoga-related injuries were reported. Although both groups had reduced depression scores, yoga was preferred.

Abbreviations: BDI, Beck depression inventory; CES-D, center for epidemiological studies-depression scale; EPDS, Edinburgh perinatal depression scale; HADS, hospital anxiety depression scale; PANAS-N, positive and negative affect schedule-negative subscale; POMS, profile of mood states; QIDS, quick inventory of depression symptoms—clinician rating; STAI, state-trait anxiety inventory.

^a Subsequently one session every 3 weeks up to 28 weeks of gestation, and every two weeks up to 36 weeks of gestation.

Table 2
Results of Cochrane Collaboration's tool for assessing risk of bias.

Study (author, year)	Sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective outcome reporting	Other bias
Battle, 2015 [13]	–	–	–	+	+	+
Davis, 2015 [14]	+	?	–	+	?	+
Field, 2013 [15]	?	?	–	+	?	–
Field, 2013 [16]	?	?	–	+	?	?
Muzik, 2012 [17]	–	–	–	–	?	?
Newham, 2014 [18]	+	+	–	+	?	?
Satyapriya, 2013 [19]	+	+	–	?	?	?
Uebelacker, 2016 [20]	?	?	–	+	?	+

Key: + low risk of bias; - high risk of bias; ? unclear risk of bias.

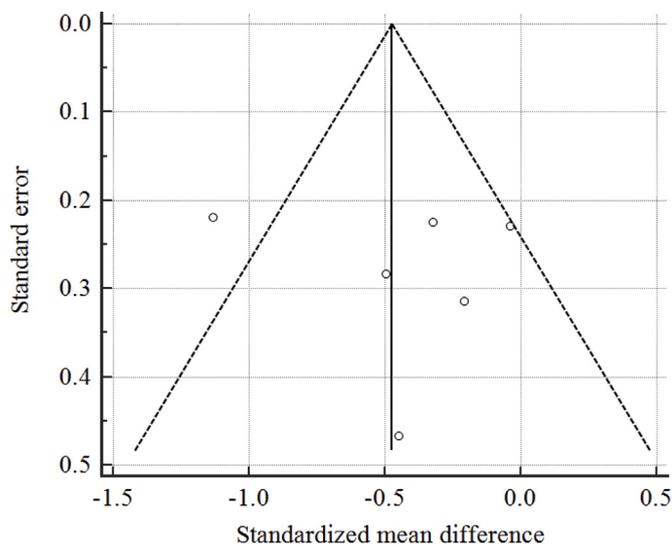


Fig. 2. Funnel plot (with pseudo 95% confidence intervals) to assess publication bias; Egger test for publication bias = -1.24 , 95% CI -10.72 to 8.24 , $P = 0.735$.

Methodological quality of the eligible clinical trials was appraised using the Cochrane Collaboration's tool for assessing risk of bias as shown in Table 2.

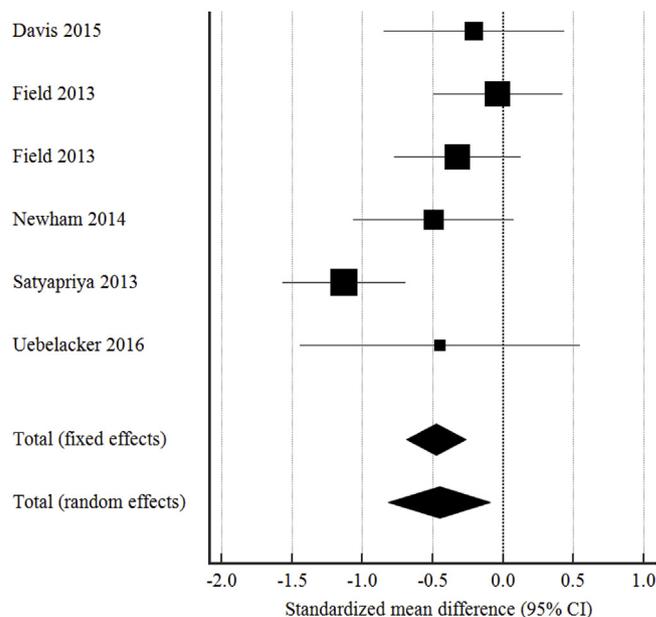
In our assessment of potential publication bias, visual inspection of the funnel plot revealed a roughly symmetrical distribution of studies (Fig. 2) and Egger test was not significant for publication bias ($P = 0.735$). However, the reliability of Egger test is limited by the small number of studies analysed (< 10) [21].

As seen in the forest plot (Fig. 3), applying per-protocol analysis and a random-effects model, the pooled SMD from baseline depressive score was -0.452 (95% CI: -0.816 to -0.880 , $P = 0.015$), which supports a statistically significant beneficial effect of yoga-based interventions on mood, compared to control.

4. Discussion

The results of this meta-analysis suggest that yoga is a beneficial non-pharmacological intervention in the management of antenatal depression. The studies examined in this paper are in concordance that yoga improves the psychological health of a patient ailing from perinatal depression. This is significant as reduced levels of stress and anxiety have been found to confer improved pregnancy and fetal outcomes [14].

Pregnancy can be a period of immense physiological and psychological stress for a woman, and may result in anxiety and depression [19]. Additionally, increased responsiveness and activity of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic-adrenal-medullary (SAM) system have been associated with higher levels of stress



Test for heterogeneity

Q	13.85
DF	5
Significance level	$P = 0.0166$
I^2 (inconsistency)	63.90 %
95% CI for I^2	12.75 to 85.06

Fig. 3. Forest plot showing overall standardized mean difference for change in baseline depressive score after yoga-based intervention.

[22,23]. Several studies hypothesize that yoga dampens the hyperactivity of these systems, which in turns reduces the stress levels experienced by these women [19,24]. Yoga has also been shown to reduce sympathetic arousal and increase parasympathetic tone [19,24]. The resultant autonomic stability allows for a quicker return to a basal state of relaxation after a stress response [25], thus reducing the symptoms of antenatal depression in expectant mothers [17]. This hypothesis is supported by a study conducted by Kusaka et al., which demonstrated reduced levels of salivary cortisol and alpha-amylase, as well as improved mood after yoga sessions [25]. Uterine Doppler investigations in pregnant women with high levels of stress and anxiety have demonstrated increased uterine artery resistance and increased risk of several complications, including pre-eclampsia, preterm labour and intra-uterine growth restriction [15]. Therefore, by improving the psychological state of a mother, yoga indirectly improves her physical health and results in better pregnancy and fetal outcomes [20].

In addition to its boost to mental health, yoga is also beneficial for other aspects of pregnancy [26]. Regular practice of yoga reduces pain experienced during labour, prevents excessive weight gain as well as promotes an uncomplicated course of pregnancy [26]. A randomized,

controlled trial involving 68 women with high-risk pregnancies also demonstrated that yoga reduced hypertensive related complications of pregnancy and improved fetal outcomes [27].

Despite its manifold benefits, some mothers might be hesitant to undertake yoga during pregnancy due to the risk of physical injury. Large studies conducted to investigate the side effects of yoga have reported that yoga-related injuries and adverse events are rare [28]. Moreover, yoga has been trialled in mothers with high-risk pregnancies [27], and poses and exercises can be modified during pregnancy to help prevent injuries and yoga is generally safe in pregnancy [29].

Compared to conventional pharmacological therapies such as SSRI antidepressants, yoga-based interventions are viewed more favourably and preferred by expectant mothers as they are perceived to be free from any potential teratogenic effects associated with pharmacotherapy [7]. With increasing worldwide popularity of yoga, classes are also becoming cheaper and easily accessible to mothers. With the advent of online yoga tutorials, yoga can be accessible even to those who are unable to attend physical classes. Additionally, attending prenatal yoga classes can provide a social opportunity and help mothers forge a support system with other expectant mothers, thereby improving emotional and social well-being [30]. Given the general receptivity and numerous potential benefits of yoga in this patient population, yoga-based interventions should be further researched and considered in the holistic management of maternal depression during pregnancy.

Nevertheless, the limitations of the current meta-analysis should be discussed. The results of this study should be interpreted as cautiously optimistic due to the fact that most trials examined in this meta-analysis were preliminary, did not blind study participants and had relatively small and mixed samples. The type of yoga intervention also varied amongst the studies that were included, often involving breathing exercises and the frequent use of props and modifications of poses. More robust evidence in the form of well-conducted, randomized control trials is necessary before the efficacy of yoga-based interventions for maternal depression during pregnancy can be definitively stated. However, it is also practically difficult and unrealistic to blind study participants due to the inherent nature of the intervention under investigation.

In addition, all the studies available on this topic only included patients with mild depressive symptoms, calling into question the efficacy of yoga-based interventions for patients with moderate-to-severe depression, psychotic depression or even those with significant suicide risk.

Even with its pitfalls, the results of this meta-analysis are supportive of yoga-based interventions as a potential complementary and alternative treatment modality for perinatal depression. Future studies should focus on robust randomized, controlled, prospective trials, which examine the effects of yoga in patients with varying severity of depression. Additionally, these patients should be followed up to assess if the benefits of perinatal yoga are stable and possibly extend into the postnatal period, thus combating postnatal depression as well. In addition, future trials could study the potential adjuvant role of yoga-based intervention to conventional pharmacological therapy, as well as the possible synergistic effects of yoga-based interventions and mindfulness. Both yoga and mindfulness involve breath and movement synchronicity, which aids in quieting the participant's mind and allows for introversion [17]. In the study by Mizuk et al. [17], participants were taught a variety of yoga poses as well as mindfulness techniques, including breathing, guided visualization and relaxation. Existing trials have proven the efficacy of mindfulness in reducing anxiety and depression in perinatal depression [31,32]. Hence, future trials can be conducted to see if a combination therapy of both yoga and mindfulness could lead to superior outcomes in the treatment of depressed pregnant women.

5. Conclusion

Current evidence suggests that yoga-based interventions are a promising non-pharmacological modality in the management of maternal depression during pregnancy. Improved psychological health of expectant mothers benefits pregnancy and fetal outcomes. The safety, accessibility and low cost of yoga make it an appealing choice to patients and clinicians. As currently available studies had small sample sizes and recruited only patients with mild depressive symptoms, this limits the evidence-base of the present meta-analysis. Larger randomized, controlled, prospective trials including patients with varying severity of symptoms are required to confirm the benefits of yoga-based interventions for perinatal depression.

Authors' statement

Qin Xiang Ng conceived, designed and carried out the study, and the relevant data analysis and interpretation. Wayren Loke and Nandini Venkatanarayanan carried out the study, and the relevant data analysis and interpretation. Wee-Song Yeo, Donovan Yutong Lim, Hwei Wuen Chan and Wen Shan Sim contributed to the data analysis and interpretation. All authors contributed to the writing and proofreading of the final manuscript. The final manuscript was approved by all authors.

Author disclosure statement

The authors declare that there are no conflicts of interest. The authors alone are responsible for the content and writing of the article. Dr Qin Xiang Ng and Dr Wayren Loke are employees of MOH Holdings Pte Ltd (MOH Holdings is the holding company for Singapore's healthcare institutions; MOH Holdings Pte Ltd was not involved in the writing or preparation of this manuscript). This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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