



ORIGINAL RESEARCH

Yoga and social support reduce prenatal depression, anxiety and cortisol



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KEYWORDS

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Summary The purpose of this study was to compare the effects of yoga (physical activity) versus social support (verbal activity) on prenatal and postpartum depression. Ninety-two prenatally depressed women were randomly assigned to a yoga or a social support control group at 22 weeks gestation. The yoga group participated in a 20-min group session (only physical poses) once per week for 12 weeks. The social support group (a leaderless discussion group) met on the same schedule. At the end of the first and last sessions the yoga group reported less depression, anxiety, anger, back and leg pain as compared to the social support group. At the end of the last session the yoga group and the support group did not differ. They both had lower depression (CES-D), anxiety (STAI), and anger (STAXI) scores and improved relationship scores. In addition, cortisol levels decreased for both groups following each session. Estriol and progesterone levels decreased after the last session. At the postpartum follow-up assessment depression and anxiety levels were lower for both groups.

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Introduction

As many as 49% of pregnant women have reported depressive symptoms, especially ethnic minorities (Field et al., 2009; Gavin et al., 2011), lower income and unmarried

women (Lancaster et al., 2010). Prenatal depression contributes to prematurity (Field et al., 2009), developmental delays (Deave et al., 2008), and behavior problems in childhood (de Bruijn et al., 2009) and adolescence (Hay et al., 2010), highlighting the need for prenatal intervention.

Traditional treatments for depression have been underutilized in the case of prenatal depression for various reasons. For example, antidepressants have been used by a very small percentage (1–5%) of prenatally depressed women because of the mixed data on fetal and neonatal

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outcomes (Einarson et al., 2010; Field, 2010). Limitations of the Einarson et al. and Field studies included small sample sizes, uncontrolled study designs and unknown long-term medication effects. In addition, most women, even those already on antidepressants, have elected to stop taking antidepressants during pregnancy and have expressed a preference for the use of alternative therapies.

Different forms of psychotherapy including cognitive behavior therapy have also received mixed reviews (Butler et al., 2006; Parker et al., 2008) in addition to being unaffordable by most women. Interpersonal Psychotherapy (IPT) has been shown to be effective in at least one study on depressed pregnant women (Spinelli and Endicott, 2003). In this study, the IPT group received 16 weeks of individual sessions, and a comparison group received the same number of sessions focused on parenting education. The IPT group showed significant improvement compared to the control group on ten measures of depression including the Edinburgh Postnatal Depression Scale, The Beck Depression Inventory and The Hamilton Depression Rating Scale, and they also had a lower attrition rate. Problems with this study included a lack of generalizability given that all the women were immigrants from Dominican Republic, and many of the women had been abused. The data on the three depression scores in this study suggested that the significant decrease in depression scores had occurred by the sixth week of the treatment period. In a study by our group, depressed pregnant women who received six weeks of Group Interpersonal Psychotherapy (1 h session once per week) showed increased positive affect and social relatedness, although negative affect also increased (Field et al., 2009). No studies could be found on the use of social support groups with depressed pregnant women.

Alternative therapies including massage therapy and yoga have also been notably effective. For example, moderate pressure massage therapy has been shown to decrease prenatal depression (Field et al., 2009), as well as prematurity (Field et al., 2004). However, unless partners are willing to massage pregnant women, it can be a costly therapy.

Yoga has the advantages of being more affordable, being transportable, and can be learned and practiced using a DVD. Several studies have reported positive effects of yoga on depression (Uebelacker et al., 2010) and anxiety (Javnbakht et al., 2009; Telles et al., 2009). A few studies have reported positive effects of yoga on the well-being of pregnant women including less stress, anxiety and pain (Beddoe et al., 2009), less discomfort (Sun et al., in press), less painful labor and less time in labor (Chuntharapat et al., 2008). Yoga versus walking has led to fewer complications like pregnancy-induced hypertension with associated intrauterine growth retardation and a lower incidence of preterm labor and Caesarean delivery (Narendran et al., 2005). Uterine artery resistance, which would limit transport of oxygen and nutrients to the fetus, would lead to intrauterine growth delays and lower birthweight. However, it is not clear whether the benefits derived from the physical postures, the breathing, the meditation and/or all the components of the yoga sessions.

In the present study, the yoga sessions included only physical poses. A short yoga routine (20 min) was used because better attendance was expected and at the end of

the study it could be practiced at home on a daily basis (Field et al., 2012). The routine is limited to yoga poses that are appropriate for pregnant women, consistent with the Narendran et al. (2005) study conducted on yoga with pregnant women. The purpose of the present study was to compare the effects of yoga (physical activity) versus social support (verbal activity) on prenatal and postpartum depression. Most interventions for prenatal depression have been verbal (psychotherapy) rather than physical interventions, although physical interventions like yoga have been effective with depression (Uebelacker et al., 2010). The effects of these interventions on anxiety and cortisol levels also were explored because both anxiety and elevated cortisol have been comorbid with prenatal depression (Field et al., 2004). Finally, estradiol and progesterone levels were assessed as they have been notably elevated in depressed women and could potentially be lowered by prenatal intervention.

Method

Participants

The sample comprised 92 depressed pregnant women who were recruited by research associates from two prenatal ultrasound clinics at a large university medical center. After giving informed consent, the depressed pregnant women were randomly assigned to a yoga ($n = 46$) or a social support group ($n = 46$) based on a random numbers table (see Fig. 1 for recruitment diagram). This sample size was determined by a power analysis (.80). The inclusion criteria were: 1) depression on the Structured Clinical Interview for Depression (SCID) as diagnosed by the researchers at the first session; and 2) being pregnant with one child. Exclusion criteria were: 1) other psychiatric complications conditions; 2) pregnancy medical illness; 3) maternal age older than 40-years-old and younger than 20; and 4) illicit drug use. The women in the study were not receiving other forms of treatment possibly because of their low income status, and were not attending other yoga or social support groups.

The sample included women ranging in age from 20 to 38 years old ($M = 24.9$ years, $SD = 5.2$). The women were representative of the prenatal clinics in being primarily low income (based on the Hollingshead Index) and Hispanic or African-American women with a high-school education. The groups did not differ on these variables (See Table 1 for the means of women's age, education, socioeconomic status, ethnicity and marital status). The women were medically cleared for participation in the study by their obstetrician/gynecologist at the prenatal ultrasound clinics.

Procedures

The women in the yoga group participated in 20-min sessions once per week for 12 weeks. A trained yoga instructor led group participants through a routine that was specifically designed for women in their second and third trimester of pregnancy. This routine was outlined in a manual and videotaped for DVD demonstrations for the instructor and for the pregnant women. This routine included only basic sitting, kneeling and standing yoga

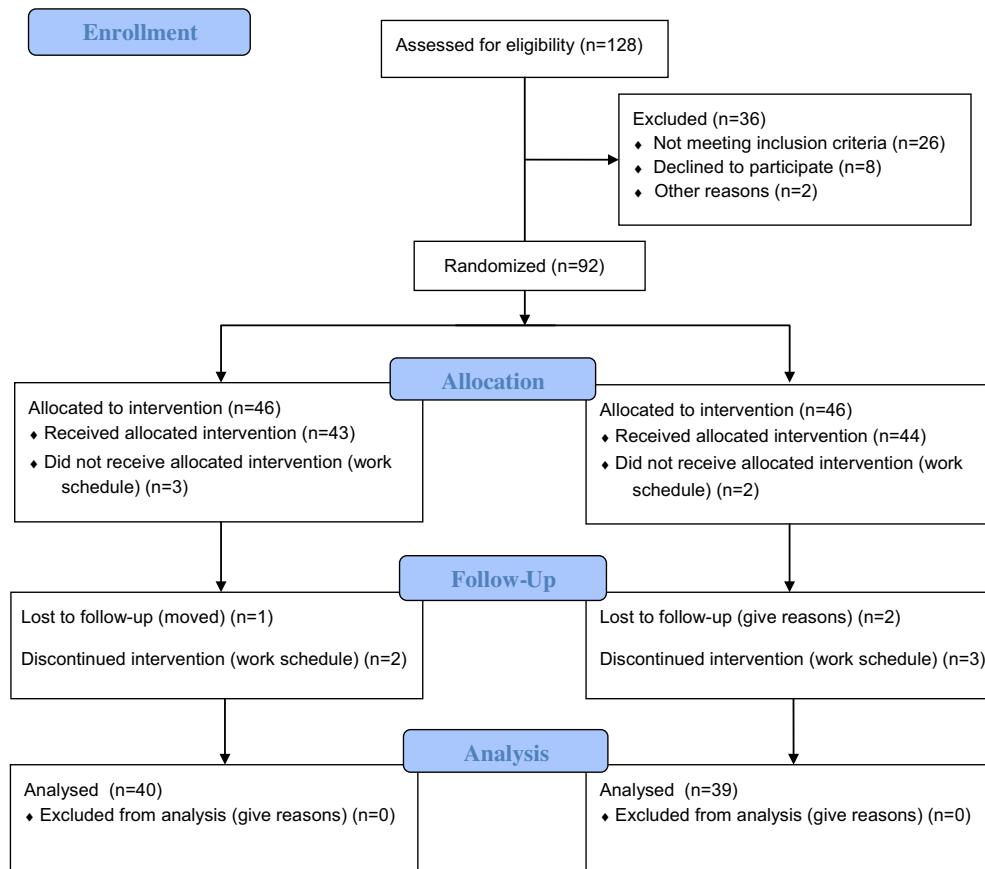


Figure 1 Recruitment diagram.

poses as follows: spinal twist, table pose, cat/cow, kneeling balance, kneeling warrior, runner’s stretch, stork pose, tree pose, eagle pose, warrior 1, warrior 2, reverse warrior, side-angle pose, triangle pose, sitting angular pose, cow’s head pose, butterflies and prayer position.

The social support group was included to control for the possible effects of attention and social support gained by women in the yoga group and to have a comparison

between the effects of verbal and physical activity on prenatal depression. These were leaderless group sessions that featured free-flowing verbal interactions between the pregnant women which were not monitored but were recorded (staff member attended but was silent and did not control the conversations).

The yoga and social support groups were the same size and followed the same weekly schedule. Participants in both groups were paid \$20 for each session to compensate for expenses related to childcare and transportation. Assessments were conducted at the beginning of the intervention period ($M = 22$ weeks gestation), at the end of the intervention period ($M = 34$ Weeks gestation) and again postpartum (at approximately 1–3 weeks post-birth) by trained researchers who were blinded to the group assignment and the study hypotheses.

Measures

Structured Clinical Interview Depression (SCID)

The women were given the SCID interview (research version) at the first assessment ($M = 22$ weeks) for the diagnoses of depression and anxiety disorder and to rule out bipolar disorder, schizophrenia and psychotic disorders. The women were diagnosed with dysthymia or major depression on the SCID based on DSM IV symptoms. The SCID was given by research associates following training and with continuing supervision by a clinical psychologist. In our

Table 1 Means (and standard deviations in parentheses) on demographic variables for depressed yoga and support group pregnant women.

Group	Yoga	Support	P
Age	24.4 (4.7)	24.5 (5.02)	NS
Education	3.8 (4.1)	4.0 (1.0)	NS
SES	4.7 (.9)	4.7 (1.0)	NS
Ethnicity (%)			NS
Hispanic	60.0	49.0	
African American	38.0	50.0	
Non-Hispanic White	2.0	1.0	
Marital status (%)			NS
Single	40.0	40.0	
Boyfriend	46.0	47.0	
Married	14.0	13.0	

experience (including a recent survey sample), the majority of the depressed pregnant women who attend the university ultrasound clinic were not taking anti-depressants and were not receiving other treatments for depression.

The Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977)

The CES-D is a 20-item self-report measure that assesses current depression symptoms (over the past week) (Radloff, 1977). The symptoms include "depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, loss of energy and disturbances of sleep and appetite" (Radloff and Terri, 1986). The Likert ratings include most of the time (6–7 days), occasionally, (3–4 days), some of the time (1–2 days), and rarely (less than a day). Each item is rated from 0 to 3 based on how often the individual felt this way, with higher scores indicating greater frequency. Total summary scores range from 0 to 60, with the cut-off for clinical levels of depressive symptomatology being 16 or higher (Radloff, 1977). The CES-D has had moderate criterion validity among low income, minority women and has been related to a depression diagnosis based on diagnostic interviews (Thomas et al., 2001). In a study on women with prenatal depression internal consistency (Cronbach alpha) ranged from .88 to .93 (Maloni et al., 2005) and the scale had significant test-retest reliability and convergent validity with other depression symptom scales.

Edinburgh Postnatal Depression Scale (EPDS)

The EPDS (Cox et al., 1987) is a 10-item questionnaire on the severity of symptoms experienced in the last 7 days. Each item on the EPDS has a range of 0–3. The EPDS has been well validated in both postpartum and prepartum populations (Cox et al., 1987; Murray and Cox, 1990). The scale has high predictive validity, high sensitivity, and low false positive rates. An added benefit is that it covers the main symptoms of depression but excludes somatic symptoms such as fatigue and change in appetite, which could be present in normal pregnancy (Cox et al., 1987; Thompson et al., 1998).

Profile of Mood States (POMS)

The POMS Depression Scale consists of 12 items on depression. They are rated on 5-point scales ranging from (0) not at all to (4) extremely. The scale has adequate concurrent validity and good internal consistency ($r = .95$; McNair and Lorr, 1964).

State Anxiety Inventory (STAI) (Spielberger et al., 1970)

This scale was included because depression and anxiety are often comorbid. The State Anxiety Inventory scores range from 20 to 90. Characteristic items include "I feel nervous" and "I feel calm". Adequate concurrent validity and internal consistency have been reported ($r = .83$) (Spielberger et al., 1970).

State Anger Inventory (STAXI) (Spielberger et al., 1995)

It is a 10-item inventory that assesses general feelings of anger based on a 4-point Likert scale ranging from 1 (almost never) to 4 (almost always). Typical questions include "I am quick tempered" and "I fly off the handle". Psychometric

properties have been established for the STAXI on diverse ethnic groups including a reliability coefficient of .97.

The Relationship Questionnaire (Figueiredo et al., 2007)

It is comprised of 12 items on a 4-point Likert scale. The questionnaire was designed to be behaviorally focused on positive and negative aspects of the relationship with the significant other. The positive dimensions on the scale include a sense of support and care, as well as satisfaction, closeness and joint interests and activities, and the negative dimensions include anxiety, irritability and criticisms.

Cortisol, estriol, and progesterone

The levels were assayed from saliva samples that were taken mid-morning (to control for diurnal variability) before and after the first and last sessions. The samples were taken using Salivettes and they were frozen and later shipped to Salimetrics for assaying.

Results

The groups did not differ on demographic variables (see Table 1) and baseline measures. Repeated measures by group ANOVAs were conducted with the repeated measures being pre to post session changes on the first and last days of the study. These were followed by post hoc Bonferroni t tests. As can be seen in Table 2, repeated measures by group interaction effects suggested that the yoga group experienced several pre to post session changes in contrast to the support group who did not show any significant changes. These included: 1) decreased depression on the first and last days; 2) decreased anxiety on the first and last days; 3) decreased anger on the first day; 4) decreased back pain on the first and last days; and 5) decreased leg pain on the first day.

As can be seen in Table 3, repeated measures effects suggested that both groups showed significant changes over the course of the intervention period. These included: 1) decreased depression on all measures of depression including the CES-D and its subscales (depressed affect, somatic/vegetative signs, positive affect and interpersonal distress) the EPDS and the POMS; 2) decreased anxiety on the STAI; 3) decreased anger on the STAXI; and 4) improved relationships.

Repeated measures by group ANOVAs were also performed on the biochemical measures with the repeated measures being pre to post session changes on the first and last days. As can be seen in Table 4, the following effects occurred: 1) both groups showed reduced cortisol from pre- to post-session on the first and last days. However, both groups showed increased cortisol from the first to the last day of the study; 2) estriol decreased from pre- to post-session for both groups on the last day, although the levels increased for both groups from the first to the last day; and 3) similarly, progesterone levels decreased for both groups from pre- to post-session on the last day, but the levels increased for both groups from the first to the last day.

Finally, repeated measures by group ANOVAs were conducted on the depression and anxiety measures from the first session to the postpartum visit. As can be seen in Table

Table 2 Mean scores (and standard deviations in parentheses) for short-term effects (pre vs. post session on 1st and last days) of yoga versus support group participation.

Variable	Group							
	Yoga				Support			
	1st day		Last day		1st day		Last day	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Depression (POMS)	26.7 (13.9)	19.5 ² (16.9)	18.6 (13.5)	15.9 ¹ (15.7)	27.3 (14.0)	25.5 (16.6)	22.1 (16.5)	21.2 (16.7)
Anxiety (STAI)	55.0 (8.8)	46.6 ⁴ (8.7)	48.3 (8.1)	45.5 ¹ (8.2)	53.4 (7.8)	51.0 (8.7)	47.4 (8.4)	46.1 (8.5)
Anger (STAXI)	25.0 (7.6)	23.7 ³ (7.5)	20.9 (8.1)	20.7 (8.5)	22.4 (7.3)	21.3 (7.5)	20.7 (7.0)	21.0 (7.6)
Back pain	4.4 (2.8)	3.3 ¹ (2.8)	4.4 (3.0)	3.5 ¹ (2.9)	4.3 (2.6)	3.9 (2.7)	4.4 (3.8)	3.9 (2.9)
Leg pain	3.0 (2.7)	2.4 ¹ (2.7)	3.8 (3.3)	3.5 (3.4)	3.3 (3.0)	2.9 (2.7)	3.2 (2.6)	3.3 (2.4)

Superscripts in column 2 = pre-post session differences on 1st day for yoga group and in column 4 for pre-post session differences on last day of treatment period (Superscripts ¹*p* = .05, ²*p* = .01, ³*p* = .005, ⁴*p* = .001).

5, both groups showed: 1) decreased CES-D depression summary and subscale scores; 2) decreased POMS depression scores; and 3) decreased STAI anxiety scores from the first day to the follow-up postpartum assessments.

Discussion

Our data suggest that yoga may be an effective intervention for reducing depression and anxiety. Increased vagal activity following yoga may account for the observed effects. In another yoga study, prenatal stress decreased by 32% in the yoga group and vagal activity increased in the yoga group from baseline by 64% in the 20th week gestation and by 150% in the 36th week, suggesting increased relaxation (Satyapriya et al., 2009). The increased vagal activity suggests that pregnancy-related stress may be significantly

reduced by yoga. This, in turn, would likely lead to lower cortisol levels and a lower incidence of preterm delivery. However, the cortisol levels did not decrease across pregnancy in their study.

The immediate decrease in cortisol from pre- to post-sessions in the current study is consistent with previous data suggesting that yoga leads to decreased cortisol (Field et al., 2012). This may happen via increased vagal activity, as increased vagal activity has been associated with decreased depression and decreased cortisol (Field et al., 2012). The relationships between cortisol, progesterone, and estriol are unclear as the data are inconsistent on those. Sampling more than once per day may provide more accurate data. These data nonetheless, suggest that yoga and support groups may be cost-effective therapies for reducing depression, anxiety, and anger as well as improving relationships.

Table 3 Mean scores (and standard deviations in parentheses) for long-term (1st vs. last day) effects of yoga versus support group participation.

Variable	Group			
	Yoga		Support	
	1st day	Last day	1st day	Last day
Depression (CES-D)	33.0 (10.2)	23.8 ² (9.3)	35.1 (9.8)	25.2 ⁴ (10.4)
Depressed	9.9 (3.6)	6.4 ⁴ (3.5)	10.1 (13.3)	6.7 ⁴ (3.4)
Somatic/vegetative	10.7 (3.7)	7.5 ⁴ (3.5)	11.3 (3.7)	8.4 ⁴ (3.7)
Positive affect	5.1 (2.5)	4.9 ² (2.6)	6.3 (2.7)	4.7 ² (2.7)
Interpersonal distress	2.6 (1.9)	1.9 ⁴ (1.8)	2.7 (2.0)	2.0 ³ (2.0)
Depression (EPDS)	12.5 (5.0)	8.5 ³ (5.3)	16.4 (4.5)	11.5 ³ (6.5)
Depression (POMS)	26.7 (13.9)	18.8 ⁴ (13.2)	27.3 (14.0)	22.1 ⁴ (16.5)
Anxiety (STAI)	55.0 (8.8)	48.3 ⁴ (8.1)	53.4 (7.8)	47.4 ⁴ (8.4)
Anger (STAXI)	25.0 (7.5)	20.9 ⁴ (8.0)	22.4 (7.3)	20.7 ⁴ (7.0)
Relationship quality	.4 (0.9)	.6 ¹ (0.7)	.2 (0.9)	.5 ¹ (0.7)

Superscripts in column 2 = 1st day – last day differences for yoga group and in column 4 for 1st day – last day differences for support group (Superscripts ¹*p* = .05, ²*p* = .01, ³*p* = .005, ⁴*p* = .001).

Table 4 Mean scores (and standard deviations in parentheses) for short-term (pre-post session) and long-term (1st day vs. last day) hormonal effects of yoga versus support group participation.

Variable	Group							
	Yoga				Support			
	1st day		Last day		1st day		Last day	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Cortisol	.35 (.23)	.27 ⁴ (.27)	.47 ⁴ (.20)	.32 ⁴ (.10)	.28 (.17)	.15 ⁴ (.11)	.41 ⁴ (.25)	.29 ⁴ (.17)
Estriol	575.9 (445.8)	479.9 (359.0)	1455.3 ⁴ (878.2)	1260.4 ¹ (679.7)	407.7 (467.0)	405.0 (385.9)	1331.4 ⁴ (815.5)	1226.2 ¹ (780.5)
Progesterone	718.1 (350.0)	652.6 (332.8)	1310.0 ⁴ (663.2)	1084.1 ² (542.1)	490.4 (325.7)	494.3 (393.9)	1081.8 ⁴ (780.8)	843.3 ² (508.4)

Superscripts in column 2 = pre-post differences on 1st day for yoga group, in column 3 = differences first and last day for yoga group, in column 4 = pre-post differences on last day, in column 6 = pre-post differences on 1st day for support group, in column 7 differences first and last day for support group and in column 8 = pre-post differences on last day for support group (Superscripts ¹ $p = .05$, ² $p = .01$, ³ $p = .005$, ⁴ $p = .001$).

Table 5 Mean scores (and standard deviations in parentheses) for first day vs. follow-up day (postpartum) effects of yoga vs. support groups.

Variable	Group			
	Yoga		Support	
	1st day	Follow-up day	1st day	Follow-up day
Depression (CES-D)	33.8 (11.2)	24.3 ² (14.0)	33.8 (10.0)	24.5 ³ (10.3)
Depressed	10.2 (9.6)	6.6 ³ (4.8)	9.6 (3.5)	6.5 ³ (4.1)
Somatic/vegetative	10.5 (3.7)	8.0 ³ (4.1)	10.7 (3.6)	8.3 ³ (3.6)
Positive affect	5.5 (2.1)	4.3 ³ (2.4)	6.5 (2.8)	4.4 ³ (2.3)
Interpersonal distress	2.4 (1.8)	2.2 ¹ (2.3)	2.6 (2.0)	1.9 ¹ (2.1)
Depression (POMS)	26.8 (14.2)	18.8 ² (14.5)	25.3 (13.0)	17.5 ² (15.9)
Anxiety (STAI)	55.8 (9.6)	47.3 ³ (12.7)	52.8 (6.9)	47.2 ³ (7.4)

Superscripts ¹ $p = .05$, ² $p = .005$, ³ $p = .001$.

Although there were immediate effects of the yoga sessions on depression and cortisol levels and longer term effects for both the yoga and social support groups, the study has limitations. The SCID was administered only at the start of the study. It was not given again at the end of the study because changes were not expected across this short period of time. The use of a standardized interviewer-administered scale such as the Hamilton Rating Scale for Depression or the Inventory of Depression Symptomatology might have been better measures of depression severity outcome in this intervention study. In addition, this study is not readily comparable to other yoga studies because the yoga sessions were shorter than those used in the previous research that documented the positive effects of yoga on depression (Uebelacker et al., 2010). The shorter sessions of this study were expected to lead to more compliance both with respect to attendance and to continuing yoga practice at home as the women watched the DVD demonstration of the yoga routine. Further research is needed to correct these problems and to determine whether these interventions lead to lower rates of prematurity and low birthweight and any longer term effects.

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