

## Abstract

### BACKGROUND

Both pregnancy and labor can be highly stressful events in any woman's life due to many physiological and psychological changes that may cause several problems. The psychological stress is magnified in high-risk pregnancies, where there are higher chances of complications. In spite of mounting evidence with strong correlation between maternal stress and pregnancy outcomes, the present conventional management of the pregnancy complications considers preterm delivery as the most viable treatment option, and this can substantially jeopardize the health of the newborn. Therefore, prevention of these serious pregnancy complications would have high public health and economic significance. In low-risk pregnancies, the effects of exercise and other complementary therapies have been investigated. In particular, there are a few trials, related to the present study, that have used yogic practices in their investigations. These studies have shown yoga to be an effective therapy for treatment of several lifestyle related diseases that are also known to be major risk factors for pregnancy complications including hypertension, diabetes mellitus, and obesity. Therefore, there is a need to look at traditional practices, which help in yogic lifestyle for positive health during pregnancy and offer a strong social acceptance for making pregnancy and childbirth a spiritual experience. Furthermore, yoga has been documented to improve pregnancy outcomes in part by reducing maternal stress. This randomized controlled trial investigated the effects of yoga in prevention of pregnancy complications in high-risk pregnancies for the first time.

### METHODS

Aims: To assess the effects of yoga in high-risk pregnancy through a set of biological, psychological, and scientific parameters. Objectives: The objectives of this study was to investigate whether 16 weeks of yoga practice would: (i) be safe and feasible in hospital settings, (ii) reduce incidence of pregnancy complications in high-risk pregnant women, (iii) improve pregnancy outcomes in high-risk pregnant women as compared to standard care, and (iv) improve the blood flow to the uteroplacental and fetal arteries. Design: This was a single-blind prospective stratified randomized controlled clinical trial on 68 pregnant women at high risk of developing pregnancy complications. Sample size: The sample size was calculated using the data from a Japanese study that investigated simple yoga-like water exercises in prevention of preeclampsia. With  $\alpha$  set at 0.05, probability of type I error at 0.01, and

powered at 0.8, a minimum sample size of 27 per group was obtained. *Settings:* The study was conducted at the obstetric unit of St. John's Medical College & Hospital (SJMCH) and Gunasheela Maternity Hospital (GMH) in Bengaluru, India. All subjects signed the informed-consent form approved by the ethical committee of SJMCH before recruitment. *Interventions:* The yoga group received standard care plus one-hour yoga session three times a week from the beginning of the 13th week to the end of the 28th week of gestation (a total of 28 sessions), while the control group received standard care plus advice for walking for half an hour mornings and evenings (the routine antenatal exercise offered by the hospital) during the period of the study. *Measurements:* Maternal and fetal measurements were assessed at the 12<sup>th</sup> week, 20<sup>th</sup> week, and 28<sup>th</sup> week gestation. Pregnancy outcomes and frequency of complications were recorded at the time of delivery. *Timeline:* The data collection began in February 2010 and continued till April 2011. Data analysis and preparation of the manuscripts started in May 2011.

## RESULTS

*Safety and Feasibility:* No report of adverse events due to yoga interventions were recorded and the yoga practices were received well both by the subjects and the hospital staff. Conducting the yoga classes in the hospital premises was found to be quite feasible. *Pregnancy Complications:* There were 11 (36.7%) cases of pregnancy induced hypertension in the control group and 3 (10.3%) cases in the study group ( $p=0.02$ ,  $\chi^2$ ). The incidents of preeclampsia was also significantly less in the yoga group (0% in the yoga group versus 13.3% in the control,  $p=0.04$ ,  $\chi^2$ ). There were two cases of eclampsia in the control group and none in the yoga group. The yoga group had significantly fewer cases of intrauterine growth restriction ( $p=0.05$ ,  $\chi^2$ ) and preterm deliveries ( $p=0.04$ ,  $\chi^2$ ). There were also fewer occurrences of GDM in the yoga group ( $p=0.05$ ,  $\chi^2$ ). *Fetal Outcomes:* Significantly fewer babies born from the women in the yoga group had low APGAR scores after 1 and 5 minutes of delivery ( $p=0.01$  and  $p=0.04$   $\chi^2$ , respectively). There were significantly lower small for gestational age newborns in the yoga group than in the control group ( $p=0.03$ ,  $\chi^2$ ). However, the number of large for gestational age and low birth weight babies were not significantly different between the groups ( $p=0.12$  and  $0.76$   $\chi^2$ , respectively). *Ultrasound Fetal Measurements:* RM-ANOVA results was significant for fetal biparietal diameter ( $p<0.001$ ), femur length ( $p=0.005$ ), fetal heart rate ( $p=0.006$ ), and estimated fetal weight ( $p=0.019$ ) but near significant in case of abdominal circumference ( $p=0.099$ ). *Doppler*

Measurements: Right Uterine Artery- Systolic/Diastolic (S/D) ratio, Pulsatility Index (PI), and Resistance Index (RI) were significantly better in the yoga than the control group after 16 weeks of intervention ( $p=0.001$ ,  $0.01$ , and  $0.001$  ANCOVA, respectively). Left Uterine Artery- only the RI was significantly better in the yoga group than the control group after 16 weeks of intervention ( $p=0.013$  ANCOVA). Umbilical Artery- the S/D ratio was significantly better in the yoga than the control group after 8 ( $p=0.001$  T-test) and 16 weeks ( $p=0.031$  T-test) of intervention; the PI was highly significant at both measurements in time ( $p=0.001$  Mann Whitney); but RI was only significant after 4 weeks of intervention ( $p=0.011$  Mann Whitney). Fetal Middle Cerebral Artery - the S/D ratio, PI, and RI were significantly better in the yoga than control group after 16 weeks of intervention ( $p=0.01$ ,  $0.013$ , and  $0.045$  Mann Whitney, respectively).

## CONCLUSION

Yoga is an effective tool in the management of high-risk pregnancies and this module of yoga has proven to be safe and feasible. Furthermore, the yoga interventions used in this study has shown to improve the blood flow to the uterine and fetal arteries.

## RECOMMENDATIONS FOR FUTURE STUDIES

Independent RCTs investigating the impact of yoga on each of the risk factors could offer better insight on the mechanism of action of yoga. Also, a study that starts the yoga interventions much earlier in the first trimester, or even before conception, could provide more information on the role of yoga in placentation and oxidative stress.