CHAPTER 6

DISCUSSION

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Chapter 6: Discussion

The primary aim of this study was to assess the feasibility, safety, and effectiveness of antenatal yoga in high-risk pregnancies. In this chapter, we will review the main results of the study.

6.1 Feasibility and Safety

One of the objectives of this preliminary study in high-risk pregnancies was to assess the feasibility of administering yoga interventions as a preventive medicine in women at high risk of pregnancy complications. The hospital administration proved to be very open to the practices of yoga as a mind-body medicine and was quite accommodating to the project. The research staff was able to teach yoga classes without interruptions. There were no reported complaints about the interventions taught and all subjects were able to practice them. The visualization and guided imagery exercises were particularly well received. While in the West, yoga is uniformly practiced by all faiths, we found some hesitation in the Moslem and Christian families to participate in the study, as they associated yoga with the Hindu faith. However, those that joined the study, continued with the sessions.

6.2 Effectiveness of the Yoga Intervention

Our yoga interventions were selected very carefully to ensure the safety of the subjects. They were easy, relaxing, and meditative in nature and intended to reduce maternal stress. Therefore, the parameters that were most affected by psychological stress responded better to our interventions, as will be seen in the sections that follow.

6.2.1 PREGNANCY COMPLICATIONS

Mind-body therapies have been shown to be effective in prevention of pregnancy complications. Previous studies have investigated the effects of acupuncture\textsuperscript{290, 291}, homeopathy\textsuperscript{292}, Ayurveda\textsuperscript{293}, yoga\textsuperscript{54, 55}, and Qigong\textsuperscript{266} during pregnancy.\textsuperscript{294-296} These interventions have been shown to be effective in reducing occurrences of hypertensive disorders of pregnancy\textsuperscript{266, 297}, preventing preterm deliveries\textsuperscript{292, 298, 299}, improving fetal outcomes\textsuperscript{292, 300}, and enhance quality of life\textsuperscript{54, 82}. 

Effects of Yoga in High-Risk Pregnancy - PhD Thesis of Abbas Rakhshani
In the Narendran study, yoga interventions resulted in significantly less incidents of IUGR (22.06% in the yoga group vs. 32% in the control group), PIH (17.65% in the yoga group vs. 28% in the control group), and preterm labor (13.24% in the yoga group vs. 20.75% in the control group). A study of Qi-gong practices, which are similar to yoga exercises, has shown that they can significantly reduce the clinical manifestations of PIH (55% in the yoga group vs. 90% in the control group).

In line with these previous results, the present study also showed that yoga was an effective therapy in preventing PIH, GDM, preeclampsia, IUGR, and preterm deliveries in the yoga group as explained below.

6.2.1.1 Hypertensive Disorders of Pregnancy

There were 11 (36.7%) cases of PIH 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; however, the results were not statistically significant \( (p=0.16, \chi^2) \).

One study has shown that low-dose aspirin administered as early as 14-16 weeks of gestation to pregnant women at high risk of preeclampsia with abnormal uterine Doppler findings may reduce or modify the course of severe preeclampsia. In this study, preeclampsia developed in 35% of women receiving aspirin and 62% of women in the control group \( (p=0.003) \), with severe preeclampsia developing in 8% and 23% of women \( (p=0.215) \), respectively. In another similar study, the relative risk of developing pre-eclampsia was 0.90 (95% CI 0.84-0.97), of delivering before 34 weeks was 0.90 (0.83-0.98), and of having a pregnancy with a serious adverse outcome was 0.90 (0.85-0.96) in the group using aspirin. A review study has claimed that antioxidants can also be effective treatment agents for preeclampsia with as large as two-thirds reduction of the frequency of preeclampsia in high-risk women.

Acetylsalicylic acid has been investigated in prevention of hypertension related complications of pregnancy. One study has shown that the use of acetylsalicylic acid was associated with a statistically significant reduction in the incidence of pregnancy-induced hypertension (11.6% vs 37.2%, RR = 0.31, 95% CI 0.13-0.78), pre-eclampsia (4.7% vs
23.3%, RR = 0.2, 95% CI 0.05-0.86) and the incidence of hypertension before 37 weeks of pregnancy (2.3% vs 20.9%, RR = 0.22, 95% CI 0.05-0.97). The result of these supplements are also similar to ours.

6.2.1.2 OTHER COMPLICATIONS
The yoga group had significantly fewer cases of IUGR ($p=0.05$, $\chi^2$) and preterm deliveries ($p=0.04$, $\chi^2$), which are prevalent issues in India(Park, 2000). There were also fewer occurrences of GDM in the yoga group ($p=0.05$, $\chi^2$). There was one dropout due to abortion in the control group. There were no cases of miscarriages, fetal deaths, or congenital anomalies in either group.

6.2.2 PREGNANCY OUTCOMES
6.2.2.1 PRETERM DELIVERY AND C-SECTION
Recent research has associated maternal psychological stress with preterm delivery and shorter gestation. Women with high-risk pregnancies have a higher level of stress than those with normal pregnancies. Is it any wonder that mind body interventions that are aimed at giving the practitioners skills to manage lifestyle stress are becoming more and more popular in the modern societies? The effectiveness of mind body techniques on maternal stress reduction and improvements of pregnancy outcomes was highlighted in a recent study. More specifically, a clinical study of out-patient women with preterm labor indicated that relaxation interventions would significantly prolong gestational weeks. Furthermore, a more recent randomized controlled trail found significant psychological stress reduction in pregnant women with preterm labor who practiced relaxation techniques.

The interventions used in the present study was also aimed at reducing the maternal stress. Therefore, in line with the results of the previous studies mentioned above, the preterm deliveries in our study were significantly lesser in the study group compared with those in the control group ($p=0.04$, $\chi^2$). However, although there were fewer C-Section deliveries in the yoga group compared to the control group, the results were not statistically significant (52% in the yoga group vs. 58% in the control group). Similarly, Narendran et al observed that the number of C-section deliveries in their study was 14 (20.59%) in the yoga group, compared to 20 (37.74%) in the control group but not statistically significant.
6.2.2.2 Fetal Development

SGA is a prevalent issue in India and it has been argued that it is a key indicator of the health trajectory of a child, and numerous adverse health outcomes in childhood have been associated with low birthweight. The present study has shown that there were significantly lower SGA newborns in the yoga group than in the control group ($p=0.03$, chi$^2$).

It is interesting to note that although the number of SGA babies was significantly lower in yoga than in the control group, the number of LBW babies were not significantly different between the groups ($0.76 \text{ chi}^2$). This appears to be due to the fact that we adopted WHO’s definition of LBW, which is babies weighing less than 3000 grams. The average weight of an Indian full-term newborn is about 2,800 grams, while in developed countries, it is about 3,000 grams. Therefore, the definition of LBW given by WHO, adopted by the present study, may be too broad to serve the Indian population and that could be one reason that our results for LBW was not significant. Narendran adopted a different strategy and measured the number of babies with birthweight above 2500 g, which proved to be highly significant in the yoga group, compared to the control ($p<0.001$) et al.

Our result for the estimated fetal weight on the ultrasound scanning was significant ($p=0.019$, RM-ANOVA), which is in line with our birthweight results and those obtained by Narendran et al in normal pregnancies which showed higher birthweight of babies in yoga group than that of the control group with conventional antenatal care ($p=0.018$). These results support the hypothesis that yoga interventions could play a significant role in the development of the fetuses in low-risk as well as high-risk pregnancies and should be considered as part of the routine antenatal therapies.

It is estimated that 40% of the global 22 million LBW delivered annually occur in India. This figure constitutes about 33% of all live births in the country and more than half of these are babies that are born after full gestation. Another words, one third of the babies born in India are considered LBW by WHO’s definition and more troubling than that is that half of these babies are born full term. These data goes to point out the urgency for a pregnancy intervention to improve infant birthweight in India and the importance of the observations of the present study.
Significantly fewer babies born from the women in the yoga group had low APGAR-1 and APGAR-5 scores ($p=0.01$ and $p=0.04$ chi$^2$, respectively). Better APGAR scores is now a widely accepted indicator of the wellbeing of the newborn. The APGAR score results along with the birthweight results gives a positive outlook for this set of yoga interventions. Our results are similar to previous studies that have used other mind-body therapies during pregnancy. In a study of acupuncture therapies, the investigators found that the mean APGAR-5 improved significantly in the acupuncture group.$^{291}$

A glance over the tables 5.16 to 5.21 in chapter 5, shows that the yoga interventions of this study clearly had a positive impact on the fetal development of the subjects in the yoga group. Nearly every parameter showed improvements; however, not all of them were statistically significant. Except for abdominal circumference, we obtained highly significant results in all other fetal measurements. Fetal biparietal measurements had improved in the yoga group significantly more than the fetuses in the control group ($p=0.001$, RM-ANOVA). Similarly, there was a highly significant difference in the size of the head circumference and the femur length of the fetuses in the yoga group compared to those in the control group ($p=0.002$ and $0.005$ RM-ANOVA, respectively). Even in case of fetal abdominal circumference that our overall result was not significant ($p=0.099$ RMANVA), further ANCOVA tests showed that there was significant improvements after 16 weeks of yoga interventions ($p=0.025$, ANCOVA). Perhaps the most important fetal measurement result of the present study was that of estimated fetal weight, which was significantly improved in the yoga group ($p=0.019$, RM-ANOVA).

While there are very few studies that have actively investigated the effects of mind-body therapies on the fetal measurements of Doppler or ultrasound scans, aspirin doses have been used as an intervention in at least one study.

Similar to the results in the control group of the present study, another trial investigated the effects of moderate exercise on uterine artery activities and found no significant changes.$^{316}$ This is important to note in these discussions because it emphasizes the possible role that the
meditative nature of our yoga practices to calm the mind of the mothers has played in the Doppler results of this study.

6.3 Mechanism

Scientific literature shows that yoga-based therapies seem to be promising interventions during pregnancy. Yet, none of the previous studies have been able to explain the underlying mechanisms of the physiologic and psychological effects of yoga during pregnancy. The collective results, including those of this study, suggest that the reported improvements likely occur through a number of pathways, which we can only speculate at this point.

Of the numerous processes that are involved in the physiology adaptation that ensure healthy progression of pregnancy, we propose three factors that could explain the potential observed benefits of yoga:

(c) Improved blood flow to the fetal and uterine arteries - assessed by the results of Doppler studies. At 12th week gestation a partial Doppler study (left and right uterine arteries only) while at 20th week and 28th week gestation, full Doppler study of the four main arteries (left uterine, right uterine, umbilical, and middle cerebral arteries) were performed.

(d) Reduction of maternal psychological stress - assessed by a self-administered psychological stress instrument, called the Perceived Stress Scale (PSS). The measurements were taken at the 12th week, the 20th week, and the 28th week gestation.

(e) Improved physiological adaptation (better hemodilution) - assessed by the measurement of serum uric acid and whole blood platelet count taken at the 12th week, the 20th week, and the 28th week gestation.

(f) Better flow of prāṇa and higher consciousness - a potential explanation of mechanism from the yogic vantage point.

6.3.1 UTEROPLACENTAL AND FETOPLACENTAL BLOOD FLOW

In the present study Yoga intervention proved effective in improving the blood flow to the uterine arteries, the umbilical artery, and the fetal middle cerebral artery. The blood flow to the right uterine artery in yoga group was better than the control group as observed by improved resistance index ($p=0.012$, RM-ANOVA). Both the systolic/diastolic and the
pulsatility index of the right uterine artery showed significant improvements at the end of the study \((p=0.001\) and \(0.010\) ANCOVA, respectively\) and so did the resistance index of the left uterine artery \((p=0.013\) ANCOVA\). The flow parameters of the umbilical artery showed remarkable improvements in the yoga group: the systolic/diastolic ratio was significantly improved after 8 weeks and 16 weeks of yoga interventions \((p=0.001\) and \(0.031\) T-test, respectively\), the pulsatility index was highly significant after 8 weeks and 16 weeks of yoga interventions \((p=0.001\) for both using Mann-Whitney test\), and the resistance index was significant after 8 weeks of yoga interventions \(p=0.011\) Mann-Whitney\). All three parameters of the middle cerebral artery were significant after 16 weeks of yoga interventions \(\text{systolic/diastolic ratio: } p=0.01, \text{pulsatility index: } p=0.013, \text{and resistance index: } p=0.048, \text{all calculated by Mann-Whitney}\)

Doppler velocimetry of the umbilical and uterine arteries points to the uteroplacental and fetoplacental units.\(^{317}\) It has been shown that the Doppler study of the uterine arteries can detect pathological increase in placental vascular resistance, which offers the potential to detect women at risk for diseases like preeclampsia and fetal growth restriction.\(^{318}\) The flow volume in the umbilical artery increases as the pregnancy advances, while the high vascular impedance detected in the first trimester gradually decreases.\(^{317}\) It is believed that the growth of placenta and with it, the increase in the number of vascular channels are the main reasons for this reduction in impedance.\(^{319}\) Low vascular impedance allows a continuous forward blood flow in the uterine artery throughout the cardiac cycle and when compromised, it can be an indicator of fetal complications in high-risk pregnancies.\(^{319}\) There is no substantial evidence that routine assessment of UA velocimetry in high-risk pregnancies, early in second trimester, helps the obstetrician to take preventive measures to decrease the perinatal mortality from IUGR without any increase in rate of unnecessary obstetric interventions.\(^{319}\)

Fetal MCA is easy to detect and has become an important part of the fetal Doppler assessments to measure cerebral blood flow that also helps in early detection of complications. A continuous forward flow in all cerebral arteries throughout the cardiac cycle is essential for healthy progression of pregnancy.\(^{320}\) Middle cerebral artery is now one of the highly sensitive measures to detect IUGR and its related complications.\(^{320}\)
6.3.2 MATERNAL STRESS

Stress was measured mainly by the Perceived Stress Scale (PSS) instrument. Although PSS was not a part of the present thesis, its results are mentioned here as evidence for the mechanisms. PSS was self-administered by the subjects in the two groups in the presence of a research staff. At baseline (12th week gestation), the PSS scores of the two groups were matched and had normal distributions. As the study progressed, the maternal stress load in the yoga group was 13% and 25% less than that of the control at the 20th and the 28th weeks of gestation, respectively. The Mean and standard deviation values for PSS at 12th, 20th and 28th weeks in the yoga group were 17.68 ± 5.74, 16.73 ± 4.94, 13.13 ± 4.80, and for the control group were 15.40 ± 4.27, 17.11 ± 6.65, 16.45 ± 6.69 in the control group respectively. The results of Repeated Measures ANOVA showed that there was a significant decrease ($F: 4.29, p = 0.016$) in the PSS scores of the women in the Yoga group as compared to those in the control group at the 28th week gestation. Figure 6.1 illustrates the progression of perceived stress between the two groups throughout the study. The control group had a lower average of perceived stress at the beginning of the treatment period. As the interventions were administered, the two groups had nearly the same mean after 8 weeks of treatments (perceived stress increased sharply in the control group while decreased in the yoga group). However, by the 28th week, the mean PSS in the yoga group had substantially dropped while it remained more or less flat in the control group.

An earlier study in normal pregnancy conducted at our university has investigated the efficacy of Yoga on PSS scores and HRV. That study showed a 31.57% reduction in the mean scores of the yoga group while the scores in the control group increased by 6.60%. The results were highly significant ($p=0.001$). HRV also showed improved adaptive autonomic responses as the pregnancy advanced ($p<0.001$).
There was a decrease in both systolic and diastolic Blood Pressure of the mother in both Yoga and control group with non-significant difference between the groups. While BP is a relevant topic to our study, the result of this parameter would have been very important if we were able to obtain a 24 hour average of the BP at each measurement in time. But we could get only one reading and that reading could have been affected by a number of environmental factors. Therefore, this result may not be an indication of the effectiveness of our interventions on the maternal blood pressure. This hypothesis is supported by the fact that hypertensive related complications of pregnancy were significantly reduced both in frequency and severity in the yoga group, as we will see later. There is now a mounting evidence in the literature that links maternal stress to reduced umbilical and uterine blood flow, increased pregnancy complications, and poor fetal development.

6.3.3 PHYSIOLOGICAL ADAPTATION

As we just discussed, the psychological stress results in vasoconstriction in pregnant women and causes poor blood flow to the fetal and uterine arteries, which in turn affects the hemoconcentration, mainly due to reduction in plasma volume. In chapter 3, we also discussed the link between platelet count and the plasma volume in the context of hemodilution, where the plasma volume increases more rapidly than the platelet count does. Therefore, it has been argued that the platelet count can be used as a marker for the normal progression of gestation—that is, the lower platelet count implies higher plasma volume that has caused the hemodilution. In the present study, we observed that none of the cases developed abnormal thrombocytopenia. Within groups, there was a progressive reduction (all within normal range) in platelet count (20th week: 7.5%, \( p= 0.014 \); 28th week: 11%, \( p= 0.006 \)) in the yoga group with non-significant drop in the control group (35% and 3.54%, respectively). There was no significant difference between groups at any point. The number of women who had reduction in platelet count (within normal range) at 20th week was significantly (\( p<0.004, \)

![Figure 6.2 Drop in Platelet Count Between Groups](image)

**Figure 6.2 Drop in Platelet Count Between Groups**
higher in the yoga group suggesting better plasma volume in that group. This can be better viewed in figure 6.2, which shows the degree of drop in platelet count between the two groups at the 20th week and the 28th week gestation. After 4-weeks of interventions the platelet count numbers in the yoga group dropped by 21.13 (10^4/dl) in contrast to the control group that saw only 3.39 (10^4/dl) drop. After 16 weeks of interventions, the number were 9.96 (10^4/dl) in the yoga versus 5.34 in the control group.

Another parameter that is often looked at as an indicator of physiological adaptation during pregnancy is the levels of uric acid. As we discussed in chapter 3 (section 3.2- Pathophysiology of Pregnancy Complications), in normal pregnancies, uric acid remains at a fairly constant level from the 8th week till the 24th week when it starts to rise continuously till term. However, in complicated pregnancies, the renal clearance of the uric acid is not at its optimum, leading to higher concentration of uric acid throughout pregnancy. This pattern can be clearly seen in the control group of this study (see figure 6.3), where the mean uric acid concentration at 12 weeks gestation is 2.8 (mean ± standard deviation: 2.8 ± 0.6), increased by the 20th week (mean ± standard deviation: 3.1 ± 0.6), and continues to rise until the end of the study at 28th week gestation (mean ± standard deviation: 3.2 ± 0.8). In contrast, the uric acid levels in the yoga group rose at substantially lower rate suggesting improvements in the renal uric acid clearance. However, the difference in the concentration levels between the two groups was not statistically significant. The non-significant results can have many potential explanations. One could be that our sample size was not large enough to detect statistically significant differences between the groups. Another explanation could be that our yoga practices were meditative in nature in order to be safe for the high-risk populations and more rigorous yoga exercises could have influenced the results differently. Finally, the serum concentration of uric acid is determined by several factors other than renal and gastrointestinal excretion during pregnancy.
pregnancy, that include dietary intake of purines, metabolic production of uric acid by the mother - all of which would be considered confounding factors to the present study.

6.3.4 BETTER FLOW OF PRĀṆĀ

We have seen in chapter two that yoga offers a holistic approach to healing and includes several practices that influence the various kośas differently and correct any imbalances in them. However, the collective objective is to settle the practitioner in a state of ānandamaya kośa, which is free from diseases. Unlike the other parameters, assessment of this progress can be a monumental task. In the paragraphs that follow, we try to explain the mechanism that such transformation could have potentially occurred through our yoga interventions at different kośa levels.

6.3.4.1 ANNAMAYA KOŚA LEVEL

Āsanas that involve stretching of specific parts of the trunk when maintained with ease and effortlessness help in providing deep rest to the organs. The participants were asked to focus their minds, with intense awareness, on the particular organs affected by the stretches and then relax in the posture, as recommended by the scriptures. Furthermore, the women were asked to visualize the uterus, the fetus, and the blood flow through them. This practice would not only provide a very deep rest to these organs. We used safe āsanas that would not produce any compression or over stretching of the uterine area but bring the awareness to the womb and allow the woman to relax the pelvic muscles, along with the entire internal pelvic organs. All sections of the yoga session would end in deep relaxation in the left lateral posture to further enforce the calmness of the mind. In short, these techniques aimed at offering deep relaxation and rest to the uterine region through local conscious wakeful awareness and this may have contributed to the health of the reproductive organs and promoted their proper functions.

6.3.4.2 PRĀṆAMAYA KOŚA LEVEL

Two of the most unique features of the yoga interventions administered in the present study were visualization and guided imagery. As can be seen in the appendix 5, titled ‘Complete List of Yoga Instructions’, the women were asked to visualize the uterus, the fetus, and the
blood flow through a series of guided instructions. The objective behind these visualizations and guided imagery were to move the prāṇa through the reproductive organs. It is a yogic principal that where the attention goes, the prāṇa will follow and where the prāṇa flows, the blood will follow. This basic principal has been the cornerstone of the interventions formulated for this study and could be a plausible explanation for many of the improvements observed in the results of the study, which included:

(a) Improved blood flow to the fetal and uterine arteries in the yoga group,

(b) Fewer complications in the yoga group, possibly due to better blood flow in the placental corridor, and

(c) Better fetal development in the yoga group, possibly also due to better blood flow through umbilical artery delivering necessary nutrients and oxygen to the fetuses.

6.3.4.3 MANOMAYA KOŞA LEVEL

We have repeatedly mentioned throughout this manuscript that the yoga interventions selected for the present study were meditative in nature. There were two reasons for this selection: (i) meditative practices were safer for the high-risk population of this study, and (ii) it was our hypothesis (and has been shown by many previous studies) that maternal psychological stress plays a vital role in the etiology of many of the pregnancy complications and meditative practices could potentially reduce that stress. The results of the PSS scores clearly show the effects of our practices on the maternal stress; the scores in the yoga groups drop steadily in the yoga group as the interventions are administered, while it increase or remains unchanged in the control group. This could have had a profound impact on the results that we have witnessed. Less activity in the manomaya kośa, as we have seen in chapter 3, translates into better prāṇa flow in prāṇamaya kośa, and in turn improved functionality of organs in the annamaya kośa. It also translates into better quality of life by uplifting the consciousness of the practitioner to ānandamaya kośa through vijnānamaya kośa. Figures 2.7 and 2.8 in chapter 2 show the impact of lifestyle stress as an aggressor and yogic practices as a pacifier on the mind from the Vedic point of view and reiterate these concepts. But what is the impact of this stress on the body physiologically?
Stress is the built-in response of a living organism, evolved to handle demanding situations; often referred to as ‘fight or flight’ -- that is, either to prepare to fight or run away to safety.\textsuperscript{48} In mammals, either choice triggers the sympathetic nervous system (SNS) into action, which will cause the pupils to dilate for better vision, move blood away from the intestine toward the big skeletal muscles that need fuel for action, and increases the heart rate as well as breathing rate to provide the necessary oxygen to the muscle cells. However, once the threat is over, the parasympathetic nervous system (PNS) kicks in to bring the body back to its normal homeostatic state.\textsuperscript{48}

The human body has evolved very well to handle the stress caused by such occasional demanding situations. The problem is that the stress caused by the modern lifestyle or an illness is usually continuous and does not allow the PNS come into action and do its part.\textsuperscript{48} As a result, the body forgets its normal homeostatic state and adapts a hyper sympathetic state, even in the absence of any danger. Such a hypersympathetic state usually compromises the health and the quality of life of the individual.\textsuperscript{82} When administered properly, yoga practices generally involve a set of stimulations followed by deep relaxations to reverse this condition and reactivate the parasympathetic functions in the body.\textsuperscript{82} Swami Sivananda, a physician and one of India’s greatest yogis, once said: “Hatha yoga is a course of psycho-physiological discipline for the attainment of complete mastery over the body, the nervous system and prāṇa.” This vision has been the backbone of the design of the present study.

6.3.5 MECHANISMS OF ACTION OF YOGA OBSERVED IN OTHER STUDIES

So far, we have hypothesized potential mechanisms of actions of yoga based on the results observed in this study. For the sake of completion, it would be beneficial to review the observations of other previous investigations. These include:

(i) Yoga by directly activating the vagus nerve may improve parasympathetic output leading to enhanced cardiac-vagal function, mood, energy state, and related neuroendocrine, metabolic and inflammatory responses.\textsuperscript{326}
(ii) Yoga may promote a feeling of well-being by reducing the activation and reactivity of the sympathoadrenal system through increased vagal activity and better autonomic reactivity after yoga as pregnancy advances.

(iii) Improved stability of hypothalamic pituitary adrenal (HPA) axis may also contribute as evidenced by decreased cortisol levels in normal adults and increased early morning cortisol in pregnancy after yoga. Dr Tiffany Field attributes this to the “stimulation of dermal and/or sub-dermal pressure receptors that are innervated by vagal afferent fibers, which ultimately project to the limbic system including hypothalamic structures involved in cortisol secretion.”

(iv) By reducing psychological stress through mind management, yoga could reduce oxidative stress, which in turn could potentially reduce pregnancy complications.

(v) It is also possible that yogic lifestyle has a positive impact on proper placentation (particularly if practiced early in pregnancy), though research data is needed to substantiate this. Improved blood volume and hemodilution with better blood supply to the placenta may be a major contribution of the restful relaxation techniques used in yoga.