CHAPTER 1

INTRODUCTION

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Chapter 1: Introduction

Pregnancy and childbirth constitute significant events in the life of a woman. Advances in science, technology, and management have offered many tools to obstetric practices. Systematic implementation of these tools in the antenatal health programs have saved many lives with reduced maternal and infant mortality. However, they have not been able to explain the root cause of pregnancy complications. As a result, the prevalence of many lifestyle and stress related disorders of pregnancy are on the rise.

Clearly, there is an urgent need for a holistic approach to the management of pregnancy complications. Not only does a pregnant woman during this phase of her life require a great deal of support from her family members, but she must also care for herself and follow a healthy regime to ensure the experience to be a rewarding one. The Vedic literature prescribes one such time-tested regiment. These guidelines contain various details related to ahara (nutrition), vihara (lifestyle), and vichara (thought process), which women have to follow at different stages of pregnancy. Diet also plays a major role. SVYASA University has conducted a couple of previous investigations on the effects of yoga in normal pregnancies that are reviewed in Chapter 3. This is the first randomized controlled trial that has investigated the effects of yoga in high-risk pregnancies.

The first three chapters of this manuscript are dedicated to providing general background information about pregnancy. The first chapter offers definitions of some terms frequently used in the rest of the manuscript. The second chapter describes the Vedic approach toward pregnancy and the third chapter reviews the scientific background on the subject. The remaining chapters provide information specific to this study and its results.

1.1 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. These could be simple inconveniences, such as sleep disturbance, some discomfort, back pain, edema, heightened labor pain, and anxiety due to the uncertainty of the outcome. However, the problems could be serious, like pregnancy induced hypertension, preeclampsia, eclampsia,
intrauterine growth restrictions,\textsuperscript{11} HELLP Syndrome,\textsuperscript{12} or gestational diabetes,\textsuperscript{13} which can be life-threatening. Stress has been shown to play a significant role in the etiology of many pregnancy complications; particularly in high-risk pregnancies.\textsuperscript{7}

High-risk pregnancy is defined to be a pregnancy affected by complications that may affect the mother, the fetus, or both and may occur at different times during the pregnancy.\textsuperscript{14} American Pregnancy Association lists about 39 such pregnancy complications on their website, which are presented in Table 1.1 (data from American Pregnancy Association, 2012, Pregnancy Complications, retrieved on 12-12-2012) The common pregnancy complications in the list include: Ectopic pregnancy, RH negative disease, group B strep, preterm delivery, gestational diabetes, and low birth weight. In our study, we only investigated the following conditions and the term ‘pregnancy complications’ in this context refers only to pregnancy-induced hypertension, preeclampsia, eclampsia, gestational diabetes, intrauterine growth restriction, small and large for gestational age babies, low birth weight babies, and preterm delivery.

Table 1.1: List of Major Pregnancy Complications

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1.2 Definitions of Complications of Pregnancy

1.2.1 HYPERTENSIVE DISORDERS OF PREGNANCY

Presence of hypertension during pregnancy can lead to many disorders, which are collectively referred to as hypertensive disorders of pregnancy.\textsuperscript{15} The National Heart, Lung, and Blood Institute (NHLBI) categorizes hypertensive disorders of pregnancy as follows: preeclampsia/eclampsia, pregnancy induced hypertension, the continued presence of chronic hypertension, and the superimposition of preeclampsia on chronic hypertension.\textsuperscript{15} In this study, we will only investigate pregnancy induced hypertension, preeclampsia, and eclampsia.

1.2.1.1 PREGNANCY INDUCED HYPERTENSION

Pregnancy induced hypertension (PIH) refers to the development of new arterial hypertension (BP systolic $\geq 140$ mm Hg; diastolic $\geq 90$mm Hg) after 20 weeks gestation without proteinuria represent clinical manifestation of PIH.

1.2.1.2 PREECLAMPSIA

Preeclampsia (PE) is a serious pregnancy disorder that can threaten the life of the mother and her infant.\textsuperscript{15-17} PE consists of PIH accompanied by new-onset proteinuria (defined as 24-hour urine protein $\geq 300$ mg) that typically develops after 20-weeks of gestation\textsuperscript{18} and remits after delivery.\textsuperscript{19} In the mother, PE can cause placental abruption, renal and/or hepatic failure, cerebral hemorrhages, pulmonary edema, and stroke.\textsuperscript{20} In the fetus, PE can result in intrauterine growth restriction, pre-term birth (about 15% of all pre-term births),\textsuperscript{21} and stillbirth.\textsuperscript{22} It is shown that PE increases the risk of cardiovascular diseases in both mother and the infant in later life; with maternal morbidity due to these complications increasing two folds.\textsuperscript{23}

1.2.1.3 ECLAMPSIA

Eclampsia is the advanced form of PE, which involves convulsion. Such convulsions, endangering the life of both the mother and the fetus, usually occur after mid-pregnancy or during delivery, but as many as one third of eclamptic convulsions occur during the first 48 hours of the immediate postpartum period.\textsuperscript{24}
1.2.2 GESTATIONAL DIABETES MELLITUS

Gestational Diabetes Mellitus (GDM) puts the woman and the fetus at higher risk of other complications during pregnancy, including: intrauterine growth restriction, and intrauterine fetal death.\textsuperscript{16} The Fourth International Workshop-Conference on Gestational Diabetes defined GDM as any degree of glucose intolerance with onset or first recognition during pregnancy.\textsuperscript{25} More specifically, a fasting plasma glucose level in two consecutive days of greater than 126 mg/dl (7.0 mmol/l) or a non-fasting plasma glucose of greater than 200 mg/dl (11.1 mmol/l) meets the threshold for the diagnosis of GDM.\textsuperscript{26}

1.2.3 INTRA-UTERINE GROWTH RESTRICTION

Intrauterine growth restriction (IUGR) refers to a condition that the fetal weight is below the 10\textsuperscript{th} percentile for gestational age as determined through an ultrasound.\textsuperscript{27} This can also be called small-for gestational age (SGA) or fetal growth restriction.\textsuperscript{27} There are numerous causes for IUGR, including placental dysfunction.\textsuperscript{28} IUGR is associated with sequelae during childhood that include both short stature and a higher incidence of learning and behavioral difficulties.\textsuperscript{29}

1.2.4 SMALL FOR GESTATIONAL AGE AND LARGE FOR GESTATIONAL AGE

Small for gestational age (SGA) is defined as infants with a birthweight lower than the 10\textsuperscript{th} percentile for their gestational age; whereas, those that are above the 90\textsuperscript{th} percentile are categorized as large for gestational age (LGA).\textsuperscript{30} The term SGA should not be used as a synonym for IUGR. The term IUGR refers to insufficient growth of the fetus in the presence of at least 2 assessments of intrauterine growth, which show clearly that the fetus is not growing appropriately.\textsuperscript{31} In the absence of information about fetal growth, the term SGA can be used, which refers to body size that is of low weight and/or length for a known gestational age.\textsuperscript{31}

1.2.5 LOWBIRTH WEIGHT

Low birthweight (LBW), as defined by the World Health Organization, is birth weight less than 2500 grams, irrespective of the duration of the gestational period.\textsuperscript{32, 33} LBW is prevalent in many countries and poses a significant public health problem contributing to a variety of
short- and long-term negative effects. While in the industrialized countries about half of LBW infants are born preterm (< 37 weeks' gestation), in the rest of the world, most of these LBW infants are born full-term. In particular, India has a very high rate of LBW infants. The current estimate is that nearly one-third of all Indian infants weigh less than 2.5 Kg at birth (information from Nutrition Foundation of India, 2005, Twenty-Five years report 1980-2005). For a summary of the definitions of the pregnancy complications studied in this trial, please see Table 4.1 in chapter 4.

1.3 Prevalence of Pregnancy Complications

Nearly 25% of all pregnancies end up with some complications other than c-sections. Hypertensive disorders of pregnancy, which affect an estimated 5 to 8% percent of pregnancies in the United States, contribute significantly to serious complications for both the fetus and the mother. Preeclampsia and eclampsia are recognized as a leading cause of maternal and perinatal morbidity and mortality throughout the world. World Health Organization (WHO) estimates that about 6 to 8% of the pregnancies in the US are affected by these disorders. The Preeclampsia Foundation approximates the financial cost of these complications at a staggering $7 billion dollars to the United States alone and the human cost at about 18% of US maternal deaths. Perhaps what is more troubling is that the incidents of preeclampsia have risen over 40% in the past few decades.

Approximately 4-8% of all infants born in developed countries and 6-30% in developing countries are classified as growth restricted. This figure is dramatically increased to 12-47% of all twin pregnancies, making multiple pregnancy a major and most common cause of IUGR. However, the figures vary depending on the population under examination (including its geographic location) and the standard growth curves used as reference. The immediate neonatal mortality of infants affected by IUGR is about 6 times more than the normal newborn. Perinatal asphyxia involving multiple organ systems is one of the most significant problems in growth-restricted infants. Most of these babies die within 24 hours of birth.
It is not just the incidence of hypertensive disorders of pregnancies that have been rising. The American Diabetes Association has reported that GDM affects 1%–14% of all pregnancies globally, and that its incidence has been steadily increasing.\(^4\) Women with GDM have increased risk of developing type 2 diabetes in the years following the pregnancy\(^4\) and their offsprings face increased risk of childhood obesity and early onset of type 2 diabetes mellitus\(^4\).

Preterm deliveries, which affected only 9.4% of live births in the United States in 1981, affected 12.5% of this population in 2004.\(^4\) In fact, the United States’ Institute of Medicine has reported that the incidence of preterm birth has increased markedly in the last two decades.\(^4\) Other data has confirmed these figures, showing that, in 2006, 12.8% of births were preterm, which represented a 21% increase compared to 1990.\(^4\) This increase is very alarming when you consider that excluding congenital malformations, about 75% of perinatal deaths and 50% of neurological abnormalities are directly attributed to preterm.\(^4\)

### 1.4 Need for Mind-Body Interventions

In the last section, we saw that the prevalence of pregnancy complications are on the rise. The reason for this increase is not clear yet. Some authors have hypothesized that the increase in obesity\(^4\) and decrease in physical activities\(^4\) of women are the major causes. However, the majority have implicated the increase in maternal stress due to modern lifestyle for this rise.\(^4\)\(^6\)\(^7\)

Psychological and social stress can cause an imbalance between the activities of the sympathetic and the parasympathetic nervous system in the mother.\(^7\) Stress, in itself, is a natural and necessary reaction to demanding situations, which engages the sympathetic nervous system to handle the situation.\(^7\) Once the source of stress has been removed, the parasympathetic nervous system gets activated to restore the body to its homeostasis.\(^7\)

However, today’s stressful lifestyle doesn’t include enough true relaxation for the body to restore its equilibrium.\(^7\) Therefore the sympathetic nervous system continues to be active--flooding the body with stress related hormones with adverse side-effects to the health of the individuals.\(^7\)\(^9\) When this condition becomes chronic, the body remains in the state of sympathetic hyperactivity even when the individual is resting and having no active stress.\(^9\) This can contribute to excessive vasoconstriction and elevated blood pressure.\(^7\)
1.5 Need for This Study

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, as we will see in chapter 3, the effects of exercise and other complementary therapies have been investigated. In particular, there are a few trials that have used yogic practices in their investigations, which are relevant to the present study. 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. Furthermore, yoga has been documented to improve pregnancy outcomes in part by reducing maternal stress.

Surprisingly, except for supplementation, very few mind-body therapies have been studied in high-risk pregnancies. Hence, we have undertaken this study to investigate the effects of yoga practices on the outcome of high-risk pregnancies. In light of the results of the previous trials of yoga in low-risk pregnancies, we hypothesized that regular practice of yoga can prevent pregnancy complications and improve pregnancy outcomes in high-risk pregnancies when compared to a usual-care control group.