Prenatal Yoga in Pregnancy

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Abstract

Prenatal yoga has emerged as an advisable, beneficial, and supportive addition to birth preparation. Many studies have linked participation in prenatal yoga with both maternal and infant benefits. Physical benefits for the mother include decreased labor time, decreased labor pain, and improved comfort during pregnancy. Significant emotional and mental effects have also been correlated, such as lowered rates of depression and anxiety, increased self-efficacy in labor, and easier transitions into the postpartum period. Finally, prenatal yoga has demonstrated benefits to the neonate, with a greater number of vaginal deliveries, which are less traumatic for the infant, an increase in gestational age at birth, and an increase in birth weight. These indicators point to a healthy infant who is physiologically prepared for birth and the transition to life outside the womb. Research and personal testimonies agree: prenatal yoga greatly improves the pregnancy, labor, delivery, and post-partum experiences for both the mother and the baby and should be encouraged as a component of prenatal care as health professionals seek to perform patient-centered care and education.

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History of Yoga

The practice of yoga has existed for over two thousand years but has found a new audience in the western world in the last century. While the ancient discipline differs in many ways from the current American practice, both have consistently demonstrated significant positive outcomes. By briefly evaluating the history of yoga, its metamorphosis leading to today, and the specific sector of prenatal yoga, a base of knowledge can be established to discuss the multifaceted benefits of practicing yoga during pregnancy.

Foundational Documents

The earliest known writings pertaining to yoga are dated between 500 and 200 BC Patanjali, a devout Hindu, penned the Yoga Sutras, which remain the foundation for eastern

practices of yoga and many principles have been preserved in twenty-first century western yoga (Malhotra, 2017). While the true genesis of yoga can be attributed to this document, it is based on many principles and writings of ancient Vedic priests, some who predated Patanjali by nearly two thousand years. From the Vedic holy texts sprung the roots of both Hinduism and Buddhism, historically eastern religions that incorporate the practice of yoga as a part of their spirituality (Castaneda, 2014).

Foundational Principles

The ancient concept of yoga does incorporate many spiritual philosophies and beliefs. Some of those incorporated into the earliest writings include the elimination of all mental fluctuation, achieving inner peace, and connecting with the inner spark of deity. There are two uses of the term 'yoga' in ancient texts. One connotes being able to separate the physical existence from the mental consciousness, while the other recognizes the oneness between the human soul and the essence of the universe (Malhotra, 2017).

Given those beliefs, it is understandable that many still consider yoga a spiritual practice, as ancient yoga was truly akin to a religion in and of itself. This has given many pause for thought, as the majority of Americans, especially Christians, do not align with many of these principles. However it is vital to realize that the physical and mental practice of yoga can be distinguished from the spiritual practice of yoga. This is specifically true with the rise of yoga in the western world.

Branches of Yoga

Yoga scholar, Ashok Malhotra, identifies four unique strands of yoga that have emerged in the western culture: Hollywood yoga, Himalayan yoga, Harvard yoga, and what he refers to as Cultic yoga (Malhotra, 2017). While they share their roots, each of these arms of yoga have

developed their own principles and philosophies of practice that distinguish them from one another. Differentiating between these variations will help to clarify the meaning of the term yoga as used in this thesis.

Hollywood yoga. Hollywood yoga is the closest kin to what is familiar in twenty-first century America. Devoid of many of the religious components of ancient yoga, Hollywood yoga places its focus on the physical and mental exercise. Participants in Hollywood yoga are seeking to strengthen and refine their bodies, pursue quality of life throughout the aging process, unwind from daily stressors, and stay both mentally and physically adept (Castaneda, 2014). The term Hatha yoga incorporates this audience and has become the most prominent branch of yoga in the western world (Malhotra, 2017).

Harvard yoga. Harvard yoga refers to the studies around the mental and physical effects of yoga that have been widely studied over the past 50 years. With a specific focus on personality effects, Harvard yoga seeks to understand how the practice of yoga influences the evolution of a person. Harvard yoga is in essence a scientific field more than a form of yoga practice and is the least relevant of the four branches (Malhotra, 2017).

Cultic yoga. Cultic yoga, as the name implies, truly has developed into a cult. It is founded and executed by leaders who claim enlightenment an offer to extend this enlightenment to members once a certain level of practice is reached. The goal of this form of yoga is personal achievement of power, not at all related to the physical exercise or mental alertness (Malhotra, 2017). While still relatively rare and on the fringe, this is a dangerous offshoot of yoga that is gaining popularity due to spirited leaders and has unfortunately claimed the name of yoga while promoting cultism.

Himalayan yoga. Himalayan yoga is the essence of the ancient art of yoga. Himalayan yoga is very closely associated to the original writings of Patanjali and the focus is on self-realization, ultimately defying what Patanjali would consider the limitations of self existance. Breathing and meditation exercises accompany the physical movements. There is still the ancient emphasis on gaining power over the mind and body as well as the accompanying spirituality (Malhotra, 2017).

Prenatal Yoga

Yoga has many different connotations in today's world. This has the potential to lead to confusion as to the conclusions of medical research on the topic. The term yoga will be used to refer to the physical movements, the breathing exercises, and the mental relaxation outlined in the definition of Hollywood yoga. This is the category of yoga that is overarching in the research studies on this topic.

Prenatal yoga, quite simply, refers to the practice of yoga while pregnant. Along with Hatha yoga, prenatal yoga has risen in both practice and popularity in the western world, precipitating the study of its effects on both mother and baby. As discussed earlier, prenatal yoga has been shown to decrease the discomforts of pregnancy, ease the process of labor and delivery, and assist in preparing the new infant for the transition of birth (Mayo Clinic Staff, 2019).

Physical Benefits of Prenatal Yoga

Women who participate in prenatal yoga have consistently reported numerous physical benefits to yoga. Prenatal yoga boosts the mother's immune system function, which benefits both her own body as well as the baby. Prenatal yoga decreased back pain common in pregnancy, nausea and vomiting, headaches, and shortness of breath. Yoga incorporates

elements that promote relaxing, stretching, strengthening, and deep, regular breathing designed to prepare the woman for effective breathing through labor. Yoga also relaxes the hips and opens up the pelvis in preparation for childbirth. These factors have been shown to promote deep, restful sleep, and increase the strength, flexibility, and endurance of the muscles utilized in childbirth (Mayo Clinic Staff, 2019).

Immune System Function

Immune system health during pregnancy is vital to the health of both expecting mother and baby. The immune system is responsible for fighting off infection, neutralizing bad bacteria, and maintaining homeostasis. Immunoglobulin A (IgA) greatly impacts overall immune function, as does cortisol, an endogenous hormone that is greatly impacted by pregnancy. Prenatal yoga can positively influence levels of both cortisol and IgA in the mother (Pao-Ju et al., 2017).

Cortisol function. A specific hormone that has a significant impact on the maturing fetus is maternal cortisol. Normal cortisol levels in the body are responsible for regulating serum glucose, balancing metabolism, and affecting the blood pressure and heart rate. At homeostasis, cortisol is released in a diurnal pattern, with levels peaking in the morning to assist in waking up and slowly dropping throughout the day. Exercise also promotes a boost of cortisol to increase the heart rate, blood pressure, and glucose stores to maintain proper oxygenation and energy for the cells. These short bursts of increased cortisol as seen in acute stress or exercise act as protective measures for the body, however when elevated cortisol levels persist, problems can arise (Cleveland Clinic Staff, 2017).

Cortisol stress response. Cortisol is often referred to as the stress hormone, as the amount of cortisol in the bloodstream fluctuates significantly with both external, mental, and

physiological stressors. As pregnancy places demands on the mother's body, cortisol levels tend to rise. This natural elevation occurring in pregnancy accommodates for the increased fluid volume and metabolic demands on the body. However, when coupled with mental stress and anxiety, cortisol levels skyrocket. In excess, the normally positive functions of cortisol are exaggerated and lead to hypertension, hyperglycemia, and increased adiposity. These factors contribute to the development of preeclampsia, gestational diabetes, and increased discomfort during pregnancy (Curtis, Weinrib, & Katz, 2012). Cortisol has also been shown to decrease blood flow to the placenta, thus inhibiting the normal growth of the fetus (Newham, Wittkowski, Hurley, Aplin, & Westwood, 2014).

Immunoglobulin A. IgA is the body's first line of defense against foreign invaders like bacteria and viruses. It is found in the mucus membranes, which specifically protect the genitourinary system, the respiratory system, and the gastrointestinal system (McKinley, O'Laughlin, & Bidle, 2016). It is responsible for recognizing and neutralizing foreign invaders on first contact with the body. This prevents them from entering into the circulatory system and promoting infection. Certain infections and toxins are teratogenic to the developing fetus, so IgA is of particular importance in pregnancy (Woof & Kerr, 2006).

Immunoglobulin A transmission to infant. IgA not only protects the infant in utero, but it also has significant effects postpartum. IgA is transmitted in breastmilk, specifically colostrum which is produced by the mother during the first few days following birth. This IgA contributes to both active and passive immunity in the infant, which can prevent severe illness affecting the GI tract as well as the respiratory system (Woof & Kerr, 2006).

Effects of prenatal yoga on cortisol and IgA. Pao-Ju et al. (2017) found that prenatal yoga significantly impacts the levels of both cortisol and IgA in maternal circulation. When

compared to the control group, mothers practicing prenatal yoga showed markedly decreased levels of cortisol after a yoga session. This lowered cortisol boosts immune function and decreases the risks of negative outcomes associated with high cortisol levels. The IgA levels were increased in both the immediate post-practice measurements, and long-term throughout the pregnancy. Not only does this increase immunity for the mother and infant in utero, but it also increases the amount of IgA available for transmission in the colostrum. These findings are monumental in promoting the overall health of the mother and baby throughout the pregnancy and post-partum periods. This is vital certainly in the physical aspect, but cortisol levels are critically impacted by mental factors such as stress and anxiety, which also have the potential to be managed with prenatal yoga (Gong, Ni, Shen, Wu, & Jiang, 2015).

Pregnancy Pains

Pregnant women undergo rapid, extreme changes to their bodies over a relatively short period of time. This leads to many of the aches and pains commonly associated with pregnancy, such as morning sickness, lower back pain, difficulty sleeping, and shortness of breath. The practice of yoga has been shown to be beneficial in all these areas and promote a happy and healthy pregnancy (Mayo Clinic Staff, 2019).

Morning sickness. Nausea and vomiting, generally called morning sickness, plague women specifically in their first trimester. Morning sickness is often attributed to increasing levels of human chorionic gonadotropin, a hormone associated with early stages of pregnancy. The effects of this morning sickness leaves mothers exhausted and worn down, as they are unable to participate in many of their normal activities and have difficulty keeping food down (Davidson et al., 2016). Yoga provides a lower intensity workout that helps to rejuvenate the

body, increase appetite, and promote relaxation and breathing. This allows for greater overall maternal comfort.

Back pain. Lower back pain is also common, as the growing abdomen causes and increased lumbar curve that puts pressure on the spine (Davidson et al., 2016). Yoga greatly increases the muscle strength in the core, which includes both the abdominal muscles, obliques, and the back. This muscle development helps balance out the increased strain on the back, and yoga also promotes stretching and relaxation which relieves pent up pressure and muscle tightness.

Shortness of breath. The expanding uterus begins to infringe on the thoracic cavity, specifically in the third trimester. This can compromise the ability of the lungs to fully expand and lead to shortness of breath in the expecting mother. This commonly occurs during periods of exercise (Davidson et al., 2016). Yoga teaches multiple types of breathing, however deep, full breaths as well as education on how to breathe through movement and exercise is most important to the pregnant client.

Sleep. Many pregnant women have difficulty sleeping. This may be due to disturbance of normal sleeping positions, as pregnancy is not compatible with sleeping directly on your back or stomach. Pregnancy insomnia can be attributed to a variety of other factors, such as back pain, heartburn, urinary frequency, and anxiety (American Pregnancy Association Staff, 2019a). Consistent yoga practice has been shown to help improve both sleep quality and quantity. Better effects are achieved if yoga is begun earlier in the pregnancy (Hollenbach, Broker, Herlehy, & Stuber, 2013).

Preparation for Labor

Another significant benefit of practicing prenatal yoga is the preparation of the muscles

involved in childbirth. This is accomplished through both stretching and strengthening exercises (Mayo Clinic Staff, 2019). Specifically targeted muscle groups include the perineum and the abdominals, as they are the most distinctly involved in the labor and delivery process (Davidson et al., 2016).

Abdominal muscles. The contraction of the abdominal muscles is under conscious control, unlike the uterus, and can assist in the expulsion of the infant (Davidson et al., 2016). Consequently, these muscles are extremely qualified for focus during the pregnancy period, as their strength can greatly affect labor (Mayo Clinic Staf, 2019). Yoga places a unique emphasis on core strength and stability. Many sequences and poses include plank position. Plank pose utilizes nearly all core muscles including the abdominals, obliques, and muscles in the back. Thus, consistent utilization of plank pose increases the efficacy of these muscles. Contraction of the abdominal muscles places external pressure on the uterus, which aids in contractions and promotes the continuing progression of the fetus through the birthing canal.

Pelvic floor. The pelvic floor consists of the pelvic girdle as well as the muscles between the spine, hips, and pubic bone that serve to support the genitourinary systems and organs. Both the joints and muscles of the pelvic floor are inherently involved in labor and delivery (Mayo Clinic Staff, 2019). The flexibility of these muscles is necessary to allow for the fluent descent of the infant and minimize or prevent tearing. Also, the strength of these muscles is vital to avoiding urinary incontinence in the post-partum period as well as promoting healing and returning to sexual intimacy.

Kegel exercises are encouraged during prenatal yoga classes to promote pelvic strength. Poses that open up the hips and gluteal muscles, such as child's pose and deep squat, develop lengthening and flexibility of the pelvic floor muscles (UT Southwestern Staff, 2016). Child's

pose is assumed from a kneeling position, with the buttocks resting on the heels and the upper body folded over the knees and the forehead on the ground. This pose stretches the pelvis, hamstrings, and lower back while promoting general relaxation. These exercises are monumentally helpful in preparing the pelvis for labor and delivery (UT Southwestern Staff, 2016).

Focused Breathing

Breath control and breathing exercises are a major component of the practice of yoga. There are three purposes in mind related to this facet of prenatal yoga. Mindful breathing can help relieve shortness of breath in pregnancy, assist in stress and anxiety management before, during, and after labor, and finally assist in nonpharmacological analgesia and maintain focus during labor (Chuntharapat, Petpichetchian, & Hatthakit, 2008). The wide utility of focused breathing explains its prominence in prenatal yoga.

Stress relief. Breathing is also a significant intervention for stress and anxiety, not even specific to pregnant women. Both stress and anxiety increase the heart rate and activate the sympathetic nervous system (SNS). This increases the heart rate, blood pressure, and cortisol levels as the "fight or flight" response is activated. Deep and controlled breathing taps into the parasympathetic nervous system (PNS), which is in essence the opposite of the SNS. Consequently, focused breaths slow the heart rate, counteracts the immediate fear and emotional response triggered by the SNS, and allows the client to regain a sense of control (VanMeter & Hubert, 2014). This intervention is useful in all stages of pregnancy and through the transition into postpartum.

Breathing through labor. Rhythmic and mindful breathing through the delivery process is incredibly beneficial to the laboring mother. Practicing breathing leading up to the birth

process fosters an awareness in the body, which then naturally tends toward healthy, helpful breathing patterns in labor. It is a natural response to hold one's breath or take very shallow breaths while in pain; however this is especially harmful to a pregnant mother as it reduces oxygen supply to the infant and the uterus, a muscle that will tire more easily in the absence of adequate oxygenation. Breathing patterns also assist in remaining relaxed and feeling in control during the labor process, which is significantly impactful for the mental state of the mother (Chuntharapat et al., 2008)

Benefits of Yoga with Labor

Chuntharapat, Petpichetchian, and Hatthakit conducted a study in 2008 that examined the physical benefits of yoga related to labor and delivery. The experimental group, which participated in six sessions of prenatal yoga, was found to have higher levels of maternal comfort during labor and two hours post-labor, and experienced less subject evaluated labor pain than the control group. The prenatal yoga group displayed shorter durations of the first stage of labor, as well as the total time of labor. The study findings suggest that thirty minutes of yoga practice at least three times per week for ten weeks is an effective complementary means for facilitating maternal comfort, decreasing pain during labor and two hours post-delivery, and shortening the length of labor. These factors are monumentally significant for pregnant mothers and have the potential to revolutionize their labor and birth experience.

Time of Labor

Prenatal yoga has the potential to greatly decrease the total time of labor (Chuntharapat, et al., 2008). This is a monumental outcome for both the mother and the infant. Prolonged labor is associated with a number of undesirable risk factors that can be significantly minimized with a shortened duration of the labor and delivery process. A study by Jahdi et al (2016) found that the

control group had a mean duration for the first stage of labor of over nine and a half hours. This was substantially different from the prenatal yoga group, that averaged six and a half hours for their first stage of labor. They also found that the second stage of labor, which consists of the pushing time, was 150% greater in the control group than the experimental group. These findings are certainly significant and beneficial to both the mother and the infant.

Implications for the mother. Nearly every mother would agree that the quicker the labor, the better. There are many factors that influence this statement, mental, emotional, and physical. Labor is exhausting for the body. Pain is intense, the consistency of contractions makes rest exceedingly difficult, and the muscles can easily become fatigued, which slows the labor process further. Prolonged labor also increases the risk of multiple unfavorable results for the mother. These include post-partum hemorrhage, need for forceps or vacuum assistance in the delivery, or vaginal lacerations (Davidson et al., 2016). Mentally and emotionally, a shorter labor leaves the mother with more energy to focus on bonding with her new baby, and these mothers are more likely to report a positive experience with labor and delivery.

Implications for the infant. Prolonged labor also has the potential for significant and long-term effects on the infant as well. The longer the infant remains in the birth canal, the greater the risk for oxygen deprivation to the brain or vital organs. Non-reassuring fetal status, especially in prolonged labor, is one of the leading causes of cesarean section (American College of Obstetricians & Gynecologists Staff, 2018). Prolonged labor is also associated with intracranial hemorrhage due to the extended exposure to pressure, and infection as the uterus has been open to the environment for an extended period of time (Davidson et al., 2016).

Pain Management

Maternal comfort has become paramount in labor and delivery. Nearly every ache and

pain is medicated in the American culture today (Bernard, Chelminski, Ives, & Ranapurwala, 2018). And while this may have some benefits, it has somewhat complicated the job of obstetric nurses. Every medication and intervention comes with side effects that have the potential to negatively impact the mother, the baby or both, even potentially with longer term implications. Offering natural interventions that are completely devoid of any adverse effects are of extreme value to the patients as healthcare workers pursue the best possible outcomes with the fewest possible complications (Curtis et al., 2012).

Pain is a hard concept to objectively measure. The numeric pain scale has been widely implemented in hospitals, and the patients are asked to rate their pain on a scale of zero to ten, zero being no pain and ten being the worst pain you can imagine. Pain is essential to address and is considered the fifth vital sign.

Jahdi et al. study completed in 2014 measured the pain ratings throughout the labor process using this numeric pain scale. The researchers found a considerable difference in pain ratings between the control group and the women who practiced prenatal yoga. The average pain rating for the experimental group four hours into active labor was less than four, in stark contrast to the control group who, at the same time in their labor process, rated their pain above an eight. While these results should be recognized to be somewhat affected by personal pain tolerance, this difference is monumental and noteworthy (Jahdi, et al. 2016).

Natural Birth Preparation

Childbirth Connection staff interviewed a nationally representative population of over 2400 women who gave birth between 2011-2012. These surveys have found that at least 25% of expectant mothers have a desire to achieve a natural labor and delivery free of medical intervention; however, only 2% do (Childbirth Connection Staff, 2014). Many find themselves

both physically and mentally unprepared for the task. Prenatal yoga empowers these women to take control of their health and take concrete steps to help achieve their goal of a natural childbirth (Campbell & Nolan, 2016).

Decreased Incidence of Cesarean Section

Mothers who choose medical interventions in labor such as an epidural or induction of labor are more likely to require a cesarean section (Jahdi et al, 2016). This is known as the cascade of interventions. While a common procedure, this is a major invasive surgery that may place both the mother and the infant at significantly higher risk than a vaginal delivery (Childbirth Connection Staff, 2014). Jahdi et al. found that the rate of cesarean section in women who practiced prenatal yoga was only thirteen percent as compared to fifty percent in the control group. This may be due to multiple factors such as better progression of labor or optimal fetal positioning, both of which are positively impacted in prenatal yoga (Jahdi et al., 2016). Other influences include maternal self-efficacy, strength, and flexibility. The decrease in cesarean sections among mothers who participate in prenatal yoga has significant impacts on the overall wellbeing of the mother and her infant.

Risk of cesarean section to infant. While cesarean sections are often performed for the ultimate safety of the infant, such as in cases of non-reassuring fetal status, inappropriate positioning, or prolonged labor, it is not the ideal birth method for the infant. Cesarean sections have multiple risks for the infant. During a vaginal birth, the contractions and pressure of the birth canal assist the infant in removing excess fluids from their lungs. However, in a cesarean section, this benefit is removed and often infants require more resuscitation after birth. Cesarean born infants also have a fifty percent increased risk of lower APGAR scores than vaginally born infants (American Pregnancy Association Staff, 2015). This may be due to the anesthesia being

passed through maternal circulation to the baby, or due to the decreased stimulation (Davidson et al., 2016). A vaginal delivery provides significant stimulation to the infant, which increases their preparedness for birth (American Pregnancy Association Staff, 2015).

Risk of cesarean section for mother. Vaginal births are superior for the infant, but also for the mother. Vaginal deliveries are associated with a shorter recovery time and a lower risk of infection or surgical complications (Davidson et al., 2016). Due to the anesthesia, surgical environment, and need for infant stimulation, maternal child bonding after birth is often delayed until the mother is moved to recovery (American Pregnancy Association Staff, 2015). Cesarean sections also carry an increased risk of complications with future pregnancies, such as uterine rupture or mandatory cesarean deliveries (Davidson et al., 2016).

Psychological Benefits of Prenatal Yoga

Physical benefits to yoga are clearly significant, but the psychological effects perhaps have even a greater influence on the overall pregnancy journey. Prenatal yoga has been utilized as a successful treatment for women suffering from depression and anxiety in pregnancy. As women's anxiety and the rate of medical intervention in labor and birth continue to increase, it is important to identify how antenatal education can increase women's confidence and their ability to manage the intense sensations of labor. Four main themes of prenatal yoga intentionally focus on preparing women for labor: creating a sisterhood and community, modelling labor, building confidence and self-efficacy and enhancing learning. Instructors see yoga in pregnancy as a multi-faceted, non-prescriptive intervention that enhances women's physical, emotional and social readiness for labor and birth, and supports women to make their own decisions through the transition to parenthood (Campbell & Nolan, 2016). Understanding the magnitude of a diagnosis

of depression and anxiety enhances appreciation for the positive effects of prenatal yoga on mental health.

Depression Overview

Prenatal depression differs from depression only in relation to the time of onset. Depression is one of the most common psychiatric diagnoses in the United States and occurs in between 14% and 23% of pregnant women (American Pregnancy Association Staff, 2019b). It holds the potential to be crippling emotionally, mentally, and socially. The staggering consequences of depression mandate increasing social recognition and support as well as both medical and cognitive interventions to promote recovery and maintain optimal quality of life. Continued follow-up treatment and awareness is vital to prevent the all too common occurrence of relapse (Potter & Moller, 2016).

The Diagnostic and Statistical Manual of Mental Disorders (DSM) has established specific parameters the patient must present with in order to be diagnosed with major depression. The two cornerstone criteria are persistent depressed mood and anhedonia. Persistent depressed mood is defined as feelings of hopelessness, sadness, tearfulness, or emptiness present for the majority of the day on a very regular basis. Anhedonia is the loss of ability to find pleasure; this change is most marked in activities which are normally enjoyed by the patient. Again, this symptom must be present nearly all day and nearly every day (Potter & Moller, 2016).

One of these two cardinal signs must be present for the diagnosis; however, they are also often accompanied by suicidal ideation, feelings of shame and hopelessness, fatigue, changes in sleep and eating habits, or decreased libido. The clinical presentation must cause visible impairment for the patient. Patients with depression often present with decreased motivation, which can make desire to seek treatment and then compliance difficult. At least five of the DSM

criteria must be met to confirm the diagnosis of depression (Potter & Moller, 2016). These symptoms can be overwhelming to bear in any season of life, however they can be specifically detrimental during pregnancy due to the stress of a growing family and the potential negative effects on the infant.

Hormones in depression. Three major hormone factors play a role in the development of depression. Dopamine, a catecholamine, mainly functions in the reward-seeking pathways of the brain and thus influences both pleasure and motivation. It can also play a role in creativity, insight and decision-making. In essence, dopamine contributes to a positive feeling of overall wellbeing. Norepinephrine is an excitatory neurotransmitter that is primarily responsible for the body's response to stress. With influence over nearly all regions of the brain, its influence is monumental. It interprets environmental stimuli and increases awareness, increases attention and memory, and regulates sleep and sexual arousal. As part of the sympathetic nervous system (SNS) response, it also increases energy and alertness. Serotonin has a particular influence on depression symptoms, as serotonin is a major mood-regulating neurotransmitter that impacts sleep, sex-drive, appetite, fear, and perception of pain (Potter & Moller, 2016). It appears that patients with depression have accelerated rates of breakdown in these hormones, which may contribute to chronically low levels (Pan et al, 2018).

Physical Effects of Depression

Depression manifests itself in numerous physical symptoms that disrupt a healthy lifestyle and pregnancy.

Nutrition. Maternal nutrition needs increase substantially in pregnancy, as the mother requires specific intake of vitamins and minerals as well as 300 to 500 more calories than her baseline during her second and third trimesters (Davidson et al., 2016). Depression often causes

appetite disturbances, either increased cravings or decreased intake. Both effects are detrimental to the developing fetus, as they result in poor nutrition, decreased energy, and a sedentary lifestyle.

Sleep and fatigue. Sleep imbalances and general fatigue are closely related to hormone levels as well as a lack of motivation and poor nutrition. Factors and symptoms in depression have a tendency to compound on themselves. Poor quality of sleep and overall malaise lead to decreased compliance with prenatal care and exercise, which has negative consequences for both the mother and the infant (Davidson et al., 2016)

Mental Effects of Depression

The mental effects of depression are more commonly associated with the diagnosis and impair functioning and mental health.

Motivation. In the daily life of people with depression, many psychosocial functions that come naturally to most are often exceedingly difficult. Tasks such as getting out of bed in the morning, meeting deadlines, and fulfilling commitments are often neglected due to the lack of motivation, termed avolition. Social engagements are often extraordinarily draining and bring no pleasure due to anhedonia. The combination of these two factors as well as generalized fatigue often contribute to the patient isolating themselves and sometimes spending excess time in bed (Knight & Baune, 2017). Both isolation and a sedentary lifestyle can be detrimental in pregnancy.

Relationships. Decrease in motivation often causes issues in work, friendships, and families. This tends to increase tension and the ensuing conflicts tend to further exacerbate the depression. It can be very difficult to break out of this downward spiral (Knight & Baune, 2017). The depression and consequent stress are detrimental to the overall health of her pregnancy, but

also to her relationships within her support system, usually comprised of her significant other, parents, and close friends. Division in these relationships carries difficulties both in the pregnancy period and in the post-partum period where the need for the support system is monumentally increased.

Self-actualization. Depression also severely stunts self-actualization. Abraham Maslow in his hierarchy of needs pinned down self-actualization, the fulfillment of one's potential and realization of one's gifts, as the pinnacle of the human journey (Potter & Moller, 2016). However basic needs such as food, sleep, safety, and self-esteem must be met prior to self-actualization. Patients with depression are often lacking in nearly all of these categories, sometimes due to outside influences, but often compounded by a negative view of self (Knight & Baune, 2017). Depression minimizes self-actualization and self-efficacy, which are major factors affecting labor and delivery.

Influence of Yoga on Depression

The practice of prenatal yoga significantly affects depression in pregnancy. Studies have found that prenatal yoga lowers rates of depression in the expecting mother, which is a critical finding in itself. Women participating in prenatal yoga also reported significantly better relationships, specifically with their spouse or significant other, throughout the pregnancy. This is a major consequence of depression and thus an equally important benefit of prenatal yoga (Field et al., 2012).

In lowering rates of depression and consequently the accompanying symptoms, prenatal yoga promotes a healthy lifestyle for the mother during her pregnancy. Lowering fatigue allows her to participate in both social activities and physical exercise, which are vital to her wellbeing.

Adequate sleep and nutrition allow for the healthy development of the baby and promote better energy in the mother (Davidson et al., 2016).

Necessity of community. Lack of motivation and a decreased drive toward healthy relationships propitiate isolation in the pregnant client. This negatively impacts current relationships, but also keeps the mothers from forming new and encouraging relationships throughout the pregnancy. Prenatal yoga provides an environment of like-minded women who are pursuing the best health for themselves and their infants. As these women are experiencing similar seasons of life and changes in their bodies, they are equipped in a unique way to provide support and encouragement to one another. This is a unique and beneficial aspect to prenatal yoga that interventions like massage therapy or even other exercise programs do not appear to consistently mimic (Campbell & Nolan, 2016).

Promotion of self-efficacy. Self-efficacy is defined by the *Cambridge Dictionary* as "a person's belief that they can be successful when carrying out a particular task" (para 1). Maternal self-efficacy is specifically related to perceptions about the labor and delivery process as well as motherhood. Higher self-efficacy is also correlated to decreased pain and anxiety in labor and decreased unnecessary medical interventions. Prenatal education when combined with the physical practice of yoga, as seen in most prenatal yoga classes, has the potential to increase women's self-efficacy by promoting confidence in the body's abilities and personal ownership of the birthing process (Campbell & Nolan, 2016).

Anxiety

Anxiety often accompanies depression, specifically in the post-partum experience as the mother acclimates to new roles and responsibilities (Ali, 2018). The body's response to anxiety very closely resembles the body's response to stress. The physical effects of the body's response

to anxiety have significant impacts on the baby, but anxiety can also be mentally paralyzing to the expecting mother, who is facing a new season of life having to prepare for those changes. Prenatal yoga as an intervention has been shown to decrease maternal feelings of anxiety, specifically regarding pregnancy and childbirth concerns, along with the physical markers such as cortisol. It also showed great efficacy in both achieving short-term benefits and maintaining the efficacy (Newham et al., 2014). Breathing exercises are a traditional form of treatment for anxiety, which helps to explain the impact of that aspect of prenatal yoga (Potter & Moller, 2016).

Impact of Yoga on Anxiety

Anxiety is specifically addressed in prenatal yoga, as the class focuses on preparing the mother mentally for what to expect in labor in order to ease the fear and sense of being unready. These education points include repeated practice of a variety of pain management strategies, use of affirming language and the telling of positive labor stories, all underpinned by yoga practice to lower somatic response to stress. Further, deep, rhythmic breathing designed to increase physical readiness also assists with combatting anxiety. Increased confidence and competence enable women to remain calmer, to mobilize pain management skills and take greater control of their labor.

Mental Preparation for Labor

The education provided in the prenatal period through prenatal yoga focuses on labor and delivery preparation by equipping the mother with knowledge, answering common questions, and fostering community among pregnant mothers. This education is provided in the hopes that more mental and physical energy can be focused on how to successfully transition to the post-partum season. It encourages a focus centered on excitement and anticipation rather than fear

and anxiety. Prenatal yoga instructors are knowledgeable about information to help equip pregnant women for the mental strength and emotional endurance needed for labor and delivery (Newham et al., 2014). The mental preparedness for labor greatly impacts the overall experience of the transition to parenthood and helps mitigate postpartum depression and anxiety.

Benefits of Prenatal Yoga for the Infant

Prenatal yoga also has significant positive impacts on the infant. It has been shown to improve birth weight, decrease preterm labor and consequent preterm birth, and decrease the incidence of intrauterine growth retardation, which has a significant negative impact on the fetus and can cause birth defects (Davidson et al., 2016). These benefits to prenatal yoga are not associated with any increased complications or adverse effects either to the mother or the infant (Curtis et al., 2012). Infants at full term are physically prepared to enter the world and are at a significantly decreased risk for neonatal complications (Davidson et al., 2016).

Prematurity

Prematurity is one of the most common causes of infant death. The premature infant does not have the desired maturity of many body systems, specifically the respiratory system, and are far more likely than full-term infants to suffer from long term mental and physical ill effects (Mayo Clinic Staff, 2017). They are also far less equipped to regulate their temperature, as infants burn brown fat to produce body heat, but that brown fat is not stored until the end of the third trimester (Symonds et al., 2018). Another concern is the infant's risk for hypoglycemia. Similar to brown fat, glycogen stores in the liver are inadequate to properly support cell metabolism until the last few weeks of pregnancy. These are just a few examples of the complications commonly experienced by preterm infants. These concerns are often cause for

admission to the neonatal intensive care unit, which is both an incredible cost and stressor to the parents (Davidson et al., 2016).

Impact of prenatal yoga on prematurity. Overall maternal wellbeing is a major factor in the mother carrying her infant to term. Maternal factors such as stress, pre-eclampsia, and non-reassuring fetal status are common causes of prematurity (American College of Obstetricians and Gynecologists Staff, 2018). Non-reassuring fetal status is characterized by recurrent variable or late decelerations, fetal tachycardia or bradycardia, or a poor biophysical profile (American College of Obstetricians and Gynecologists Staff, 2015). Prenatal yoga counteracts nearly all of these factors and allows for a healthy, full-term pregnancy, which is vitally important to the health and well-being of the new (Bolanthakodi et al., 2018). Premature delivery can cause additional stress to the parents, as they are not prepared for the arrival of the infant. Thus, carrying to term also has significant benefits for the mother as well (Field et al., 2013).

Birthweight

Adequate infant birthweight is an indicator of proper fetal nutrition and oxygenation during gestation as well as a term delivery. Proper birthweight is a significant factor affecting the infant's transition into extrauterine life (Davidson et al., 2016).

Small for gestational age. Low birthweight infants are termed small for gestational age (SGA). These babies can be further separated into asymmetrical and symmetrical SGA. Asymmetrical indicates that the head and consequently brain are measuring between the tenth and ninetieth percentiles, which is considered normal, and the total body weight is below the tenth percentile. This is a positive sign for the infant as the brain has been spared. Symmetrical SGA babies are often much more likely to suffer long-term complications. These infants are prone to many of the same difficulties as preterm infants (Davidson et al., 2016).

Intrauterine growth retardation (IUGR) is a subcategory related to SGA. Babies diagnosed as SGA may be physically healthy, even while small, however IUGR infants are often affected in more significant physical or mental capacities. Intrauterine growth retardation may be associated with maternal infection or substance abuse, and contributes to fetal malformations which may be significant (Davidson et al., 2016).

Causes of low birthweight. Low birthweight occurs in approximately 8% of infants and is often related to the maternal health status. The most frequent causes of low birthweight infants are premature birth and IUGR. Other causes include chronic health conditions such as diabetes. Maternal infection and medication use can also contribute to low birthweight (March of Dimes Staff, 2018).

Low birthweight is often a consequence of hypertension and stress in pregnancy. These factors are often related, and both of them decrease the blood flow to the placenta. The placenta is the only source of nutrition to the developing fetus. Increased blood pressure whether primary or secondary to stress, causes vasoconstriction in the blood vessels that supply the placenta. Long term hypertension will also begin to damage and ultimately breakdown the blood flow to the placenta. As a result, the fetus receives significantly decreased nutrients, glucose, and oxygen. This leads to the decreased size as well as malformations often seen in IUGR (Davidson et al., 2016).

Impact of prenatal yoga on birthweight. Prenatal yoga has a significant impact on infant birthweight. First, it decreases some of the major risk factors such as prematurity, IUGR, stress, and hypertension. Overall maternal circulation is improved, which benefits the baby. Maternal oxygenation is also maximized through the breathing exercises, which increases oxygen supply for the infant Yamamoto-Morimoto, Horibe, Takao, & Anami, 2019). These

outcomes of prenatal yoga certainly affect the infant in utero, but it can also prevent the long-term complications that could handicap an infant for the rest of their life (Field, Diego, Delgado, & Medina, 2013).

Guidelines and Modifications for Prenatal Yoga

The practice of prenatal yoga has not been implicated in any studies to have any negative effects on either the mother or the baby (Bolanthakodi et al., 2018). It is important to note that there are a few recommendations from the American College of Obstetricians and Gynecologists as well as the Mayo Clinic and prenatal yoga instructors that help maintain the safety of the woman and her child (Committee on Obstetric Practice Staff, 2019; Mayo Clinic Staff; 2019). Most guidelines are directed at mothers who have not consistently practiced yoga previously, as most yogis have conditioned their bodies to that exercise and movement and can continue their practice fairly normally.

Inversions

Total inversions are not recommended for mothers who are new to yoga. A total inversion in yoga is defined as a pose or posture with both the pelvis and feet above the heart. Inversions most frequently include headstands, handstands, and shoulder stands. Inversions increase the stress on the circulatory system by increasing the blood pressure and decreasing the heart rate. This is compounded by the fact that pregnant women's circulatory systems are functioning with nearly 150% of the average circulatory volume, which further increases the strain placed on the heart (Davidson et al., 2014).

Poses

Also related to the cardiovascular system, poses in which the mother is flat on her back ought to be avoided in pregnancy, specifically in the second and third trimesters. The growing

uterus can compress the inferior vena cava, the major vessel that returns blood from the lower extremities to the heart. This may cause the mother's heart rate to increase and can also impede circulation to the infant (Mayo Clinic Staff, 2019). Modifications for these poses generally include a folded towel or bolster pillow under one or both hips to relieve the pressure on the inferior vena cava.

Hot Yoga

Hot yoga should also be avoided in pregnancy. This is practiced in a room that is heated to over 100 degrees Fahrenheit, which can cause maternal hyperthermia (Mayo Clinic Staff, 2019). A significant and specific consequence of maternal hyperthermia is neural tube defects (NTD) in the baby. Research has shown that the risk of NTDs is doubled in cases of maternal hyperthermia, which is a compelling reason to forego hot yoga in pregnancy (Chan, Natekar, & Koren, 2014).

Rotation

Compressing or twisting the uterine area should be kept to a minimum. Many yoga poses have rotated forms, which help to increase flexibility. However, increasing the pressure on the uterine area can stress the ligaments that support the uterus and decrease blood flow to the baby (Mayo Clinic Staff, 2019). These poses can be modified by limiting the rotation to the shoulders and upper back, or remaining in the traditional pose without adding the twist.

Relaxin

Of particular importance to expecting mothers is the major influx of the hormone relaxin during pregnancy. Relaxin helps to prepare the pelvis for childbirth by relaxing the joints, and its action affects all the joints in the body. This contributes to the clumsy feeling during pregnancy as well as increased flexibility. Relaxin does, however, increase the risk of

overstretching injuries (Davidson et al., 2016). Pregnant women should be advised not to sink into poses, but to embrace stabilizing muscle contraction that resembles opposition. This modification allows for greater support in the pose and less risk of injury during the practice.

Conclusion

Prenatal yoga has monumental benefits. In both the physical and psychological realms, yoga impacts the course of pregnancy for the mother (Campbell & Nolan, 2019). Yoga reduces the morning sickness as well as many of the common complaints associated with pregnancy (Mayo Clinic Staff, 2019). It also prepares the mothers joints, ligaments, and muscles for the experience of labor and delivery (Chuntharapat et al., 2008). This results in decreased pain and time of labor as well as a decreased risk for cesarean section (Jahdi et al, 2016). Prenatal yoga also has been shown to be an effective treatment for both depression and anxiety in pregnancy. This natural intervention decreases both maternal and fetal harm from these conditions (Campbell & Nolan, 2016). In addition to the maternal benefits, the infant is significantly more likely to be born at full term and a healthy weight, as prenatal yoga reduces premature labor, IUGR, pre-eclampsia, and hypertension (Field et al., 2013). Research regarding the positive impact of prenatal yoga is continuing to grow and the practice is becoming more widely promoted. Factors hindering further implementation include the limited knowledge of providers regarding prenatal yoga, perceived cost of attending classes, and maternal non-compliance. However, research and personal testimonies agree: prenatal yoga greatly improves the pregnancy, labor, delivery, and post-partum experiences for both the mother and the baby and should be encouraged as a component of prenatal care as health professionals seek to perform patient-centered care and education (Campbell & Nolan, 2019).

References

Ali, E. (2018). Women's experiences with postpartum anxiety disorders: A narrative literature review. *International Journal of Women's Health*, *10*, 237–249. doi:10.2147/IJWH.S158621

American College of Obstetricians and Gynecologists Staff. (2018). Fetal heart rate monitoring during labor. Retrieved from https://www.acog.org/Patients/FAQs/Fetal-Heart-Rate-Monitoring-During-Labor?IsMobileSet=false#happens

American College of Obstetricians and Gynecologists Staff. (2015). ACOG committee opinion No. 326: Inappropriate use of the terms fetal distress and birth asphyxia. *Obstet Gynecol 106(*6),1469–1470. doi: 10.1097/00006250-200512000-00056.

American Pregnancy Association Staff. (2015). Risks of a cesarean procedure. Retrieved from https://americanpregnancy.org/labor-and-birth/cesarean-risks/

American Pregnancy Association Staff. (2019a). Insomnia during pregnancy: Snooze or lose. Retrieved from https://americanpregnancy.org/pregnancy-health/insomnia-during-pregnancy/

American Pregnancy Association Staff. (2019b). Depression during pregnancy: Signs, symptoms, and treatments. Retrieved from https://americanpregnancy.org/pregnancy-health/depression-during-pregnancy/

Bernard, S. A., Chelminski, P. R., Ives, T. J., & Ranapurwala, S. I. (2018). Management of pain in the united states-A brief history and implications for the opioid epidemic. *Health services insights*, *11*. 1178632918819440. doi:10.1177/1178632918819440

Bolanthakodi, C., Raghunandan, C., Saili, A., Mondal, S., Saxena, P. (2018) Prenatal yoga: Effects on alleviation of labor pain and birth outcomes. *The Journal of Alternative and Complementary Medicine 24*(12), 1181-1188.

Cambridge University Press Staff. (n.d.). Meaning of self-efficacy in English. Retrieved from https://dictionary.cambridge.org/us/dictionary/english/self-efficacy

Campbell, V., & Nolan, M., (2010). 'It definitely made a difference': A grounded theory study of yoga for pregnancy and women's self-efficacy for labour. *Midwifery* (68), 74-83. doi: 10.1016/j.midw.2018.10.005.

Campbell, V. R., & Nolan M. (2016). A qualitative study exploring how the aims, language and actions of yoga for pregnancy teachers may impact upon women's self-efficacy for labour and birth. *Women and Birth*, *29*(1), 3–11. doi:10.1016/j.wombi.2015.04.007.

Castaneda, C., (2014). America the yogiful: Insights into American yoga culture today. *Rollins Scholarship Online.* Retrieved from https://scholarship.rollins.edu/cgi/viewcontent.cgi?article=1056&context=mls

Chan, J., Natekar, A., & Koren, G. (2014). Hot yoga and pregnancy: Fitness and hyperthermia. *Canadian Family Physician Medecin De Famille Canadien, 60*(1), 41–42. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=mnh&AN=24452558&site=ehost-live&scope=site

Childbirth Connection Staff. 2014. Data briefs: Listening to mothers. Retrieved from http://transform.childbirthconnection.org/wp-content/uploads/2013/05/DataBriefs-all.pdf

Chuntharapat, S., Petpichetchian, W., Hatthakit, U. (2008) Yoga during pregnancy: Effects on maternal comfort, labor pain and birth outcomes. *Complementary Therapies in Clinical Practice*, *14*(2), 105–115. doi:10.1016/j.ctcp.2007.12.007.

Cleveland Clinic Staff. (2017). What happens when your immune system gets stressed out? Retrieved from https://health.clevelandclinic.org/what-happens-when-your-immune-system-gets-stressed-out/

Committee on Obstetric Practice Staff. (2019) Physical activity and exercise during pregnancy and the postpartum period. Retrieved from https://www.acog.org/Clinical-Guidance-and-Publications/Committee-Opinions/Committee-on-Obstetric-Practice/Physical-Activity-and-Exercise-During-Pregnancy-and-the-Postpartum-Period?IsMobileSet=false

Curtis, K., Weinrib, A., & Katz, J. (2012). Systematic review of yoga for pregnant women: Current status and future directions. *Evidence-based Complementary and Alternative Medicine: eCAM*, *2012*, 715942. doi:10.1155/2012/715942

Davidson, M., London, M., & Ladewig, P. (2016). *Olds maternal-newborn nursing and women's health across the lifespan. 10th ed.* Boston, MA: Pearson.

Field, T., Diego, M., Delgado, J., Medina, L. (2013) Yoga and social support reduce prenatal depression, anxiety and cortisol. *Journal of Bodywork & Movement Therapies*, *17*(4), 397–403., doi:10.1016/j.jbmt.2013.03.010.

Field, T., Diego, M., Hernandez-Reif, M., Medina, L., Delgado, J., & Hernandez, A. (2012). Massage, yoga reduce prenatal depression, prematurity. *Massage Magazine*, (198), 79.

Gong, H., Ni, C., Shen, X., Wu, T., & Jiang, C. (2015). Yoga for prenatal depression: A systematic review and meta-analysis. *BMC Psychiatry*, *15*(1). 14. doi:10.1186/s12888-015-0393-1

Hollenbach, D., Broker, R., Herlehy, S., & Stuber, K. (2013). Non-pharmacological interventions for sleep quality and insomnia during pregnancy: A systematic review. *The Journal of the Canadian Chiropractic Association*, *57*(3), 260–270.

Jahdi, F., Sheikhan, F., Haghani, H., Sharifi, B., Ghaseminejad, A., Khodarahmian, M., & Rouhana, N. (2016) Yoga during pregnancy: The effects on labor pain and delivery outcomes (a randomized controlled trial). *Complementary Therapies in Clinical Practice*, *27*, 1–4. doi:10.1016/j.ctcp.2016.12.002.

Knight, M. J., & Baune, B. T. (2017). Psychosocial dysfunction in major depressive disorder-rationale, design, and characteristics of the cognitive and emotional recovery training program for depression (CERT-D). *Frontiers in Psychiatry*, *8*, 280. doi:10.3389/fpsyt.2017.00280

Malhotra, A. (2017). *An introduction to yoga philosophy: An annotated translation of the yoga sutras*. London: Taylor and Francis.

March of Dimes Staff. (2018). Low birthweight. Retrieved from https://www.marchofdimes.org/complications/low-birthweight.aspx

Mayo Clinic Staff (2019). Prenatal yoga: What you need to know. Retrieved from https://www.mayoclinic.org/healthy-living/pregnancy-week-by-week/in-depth/prenatal-yoga/

Mayo Clinic Staff (2017). Premature birth. Retrieved from https://www.mayoclinic.org/diseases-conditions/premature-birth/symptoms-causes/syc-20376730

McKinley, M. P., OLoughlin, V. D., & Bidle, T. S. (2016). *Anatomy & physiology: An integrative approach*. New York: McGraw-Hill Higher Education.

Newham, J. J., Wittkowski, A., Hurley, J., Aplin, J. D., & Westwood, M. (2014). Effects of antenatal yoga on maternal anxiety and depression: A randomized controlled trial. *Depression and Anxiety*, *31*(8), 631–640. https://doi.org/10.1002/da.22268

Pao-Ju, C., Yang, L., Cheng-Chen, C., Chia-Chi, L., Chang, Y., & Liaw, J. (2017). Effects of prenatal yoga on women's stress and immune function across pregnancy: A randomized controlled trial. *Complementary Therapies in Medicine, 31*, 109-117. doi:http://dx.doi.org/10.1016/j.ctim.2017.03.003

Potter, M. L., & Moller, M. D. (2016). *Psychiatric mental health nursing: From suffering to hope*. Hoboken, NJ: Pearson Education.

Symonds, M., Aldiss, P., Dellschaft, N., Law, J., Fainberg, H., Pope, M., Sacks, H., & Budge, H. (2018). Brown adipose tissue development and function and its impact on reproduction. *Journal of Endocrinology, 238*(1), R53-R62. Retrieved Nov 5, 2019, from https://joe.bioscientifica.com/view/journals/joe/238/1/JOE-18-0084.xml

UT Southwestern Staff. (2016). 5 exercises and techniques to train for childbirth. Retrieved from https://utswmed.org/medblog/prepare-body-labor-delivery/

VanMeter, K. C. & Hubert, R. J. (2014). *Gould's pathophysiology for the health professions.* St. Louis, MO: Elsevier Mosby Press.

Woof, J., & Kerr, M. A. (2006). The function of immunoglobulin A in immunity. *The Journal of Pathology 208*(2), 270-282. 10.1002/path.1877

Yamamoto-Morimoto, K., Horibe, S., Takao, R., & Anami, K. (2019). Positive effects of yoga on physical and respiratory functions in healthy inactive middle-aged people. *International Journal of Yoga*, *12*(1), 62–67. doi:10.4103/ijoy.IJOY_10_18