Healthy Lifestyles during Pregnancy is Associated with Better Maternal and Fetal Health

Abstract

Evidence indicates that healthy lifestyles can significantly improve maternal and fetal outcomes during pregnancy. Several major physiological changes take place during a normal pregnancy, all aimed at keeping the mother and the growing fetus healthy. Five major lifestyles: tobacco smoking, alcohol consumption, obesity, sedentary lifestyle, and inadequate nourishment can deleteriously alter these processes. Several myths, addictions, societal stigmas, and other factors often lie behind continuance of unhealthy lifestyles. Besides directly impacting the course of a normal pregnancy, fetal development, delivery and lactation with breastfeeding, these unhealthy lifestyles also impact several chronic diseases that invariably have a negative effect on pregnancy. This manuscript briefly reviews the effects of these lifestyles.

Keywords: pregnancy, smoking, exercise, alcohol, diet, obesity, maternal health, fetal health

Introduction

Pregnancy is associated with several physiological changes, including an increase in the production of estrogens, progesterone, prolactin, and the placental human chorionic gonadotropin[1-3]. The gestational bodyweight increases, mainly due to the additional weight of the fetus, the placenta, enlarging uterus, amniotic fluid, mammary glands, and adipose tissue[4]. Several cardiac and hematological changes also occur. Plasma volume and cardiac output may increase by about 40% - resulting in peripheral vasodilatation and a decrease in systemic vascular resistance. There is a reduction in hemoglobin concentration, hematocrit, red blood cell and platelet count[5]. Oxygen demand increases by 20 to 30%. There is an increase in respiratory rate and an increase in ventilation. Several other systems are also affected, primarily to adapt to the growing needs of pregnancy[6]. These changes continue to evolve as the pregnancy progresses and start resolving with the birth of the baby and expulsion of the placenta[6]. Lactation and breastfeeding provide the offspring with hydration and nutrients for the first 4–6 months of life[7]. Pregnancy is a complex physiological process. Lifestyles play a significant role during the entire perinatal period. This is briefly discussed in this manuscript.

Discussion

The five major lifestyles that have a significant impact on human health are: smoking, obesity, exercise, alcohol intake and diet. They play a major role in the pathogenesis of most major chronic diseases. Li et al. estimated that avoidance of these five unhealthy lifestyles can significantly increase longevity[8]. In their estimate, adherence to healthy lifestyles at age 50, provide women 14.0 years, and men 12.2 years of additional life. These five lifestyles also have a major impact on the health of both the mother and the fetus before conception, during pregnancy and after childbirth.

Smoking/Tobacco Use

Most pregnant smokers are aware that smoking in pregnancy is harmful, although many lack a detailed knowledge of the associated risks[9]. However, despite this general awareness, approximately 12% of pregnant women in the United Kingdom and United States smoke throughout pregnancy[10]. Tobacco is the most common substance abused during pregnancy[11]. Its use is associated increased maternal, fetal, and infant morbidity and mortality[12]. Serious outcomes from tobacco use include ectopic pregnancy, increased risk of miscarriage, placenta previa, premature rupture of membranes[13,], preterm birth[14,15], antepartum and intrapartum stillbirth[16], low birthweight[17,18], decreased head circumference, perinatal death[19] and sudden unexpected infant death[20,21]. Smoking women also tend not to breastfeed, wean offspring earlier, and produce less milk than non-smokers[22]. Waterpipe smoking may also increase the risk of delivering a low birthweight infant as well as other pregnancy complications[23]. Snuff or chewing tobacco is also associated with an increased risk of stillbirth, low birthweight, prematurity, and infant death[24]. Secondhand smoke (SHS) exposure to infants causes increased risk of SIDS and lower respiratory illness[25]. Almost every developing organ system in the fetus, including the lungs, brain, heart, and ears, appears to be affected by prenatal exposure to tobacco[26,27]. The damage is usually long-term, and results in future lower respiratory tract infections, asthma, otitis media, dental caries, hearing loss, and the metabolic syndrome[28]. Exposure to secondhand smoke is also dangerous for pregnant women – studies have shown that they have a 20% greater chance of giving birth to a low birthweight baby than women who are not exposed to secondhand smoke (SHS) during pregnancy[29]. Nicotine and cotinine are known to accumulate in concentrations two- to three-fold higher in breast milk than in plasma, posing additional risk in breastfeeding infants[30]. Prenatal third hand smoke is also dangerous to the lungs in utero of the unborn child[31]. After birth, the newly born child may continue to be exposed to environmental dust with third hand smoke particles in a home where smoking is or was present[32]. Studies show that most women who smoked during pregnancy also continue to do so after the birth of the child[33]. Among children exposed to tobacco smoke either prenatally or postnatally, increased rates of behavioral problems are seen very early in life[34]. Newborns exposed in utero have heightened startle responses, tremors, hypertonicity, have more severe reactions to bowel movements and diapering, and tend to be fussier and cry more[34]. By 18 months, children exposed to SHS in utero manifest increased externalizing behaviors, including defiance, not responding to punishment, inattentiveness, and hyperactivity[35]. During early school years, children exposed prenatally to tobacco smoke also demonstrate increased rates of behavior problems. These include hyperactivity, oppositional defiant disorder, delinquency, and both internalizing and externalizing behaviors[36]. An association with ADHD has also been noted[37]. During pre-school years, children prenatally or postnatally exposed (also with SHS) show more behavioral problems than unexposed children[38,39]. These include demanding attention, changes in mood, emotional instability, arguing, aggression, and destructive behavior[39,40]. These behaviors are often persistent into adolescence[41,42.] E-cigarettes, unlike cigarettes[43], exposes non-pregnant adults to lower levels of carcinogens and toxins[44]. Exposure to second-hand e-cigarette vapor may pose less risk than exposure to second-hand cigarette smoke[45]. However, although the data on any harm to the pregnant woman or her baby from exposure to vaping is limited[46-48], precautions should be taken to avoid such an exposure. And finally, children of women who

smoke cigarettes are more likely to take up smoking themselves[49]. There is obviously no safe level of exposure to tobacco smoke during pregnancy.

Obesity

Obesity (BMI>30) is increasing in pregnant women. It has recently become one of the most important health issues in pregnancy[50]. Current Centers for Disease Control and Prevention (USA) data suggest excessive weight gain is reported in roughly 59% of overweight women and 56% of obese women[51]. Excessive weight gain and obesity impacts pregnancy even during the preconception period. Obesity in females is associated with subfertility and with a longer time to achieve pregnancy[52,53]. Observational studies indicate that bariatric surgery improves fertility in women with obesity[54]. Following conception, the complication rates in abnormally overweight pregnant women go up dramataicaly[55]. They are more likely to experience miscarriage[56] – one meta-analysis showed that in women with a BMI>25, the increased risks had an odds ratio (OR) of 1.67[57]. Preeclampsia and gestational hypertension, usually occurring in the second half of pregnancy or soon after childbirth in obese women, can lead to dangerous cardiovascular complications[58]. A Swedish cohort study of 805,275 pregnancies found that 2.8% of women with a BMI of 29.1–35.0 had preeclampsia compared to 1.4% of women with a BMI of 19.8–26.0 (adjusted OR 2.62)[59]. Duckitt et al. found that there was a 50% increase in the risk of preeclampsia in pregnant women who had an increased BMI at the outset and this risk doubled if the BMI was >35[60]. Gestational diabetes is also dangerous. It leads to more cesarean sections, offspring born with high body weight, and a higher risk of T2DM in both the mother and the child in the future. One study found that almost 42% of mothers developed T2DM over a 10 year follow up following gestational diabetes[61]. Several studies have documented the high risk of gestational DM in overweight/obese pregnant women. A retrospective UK study of 287,213 pregnancies between 1989 and 1997 showed that after adjusting for confounding factors, women with a BMI ≥30 were more likely to develop gestational diabetes than women with a BMI of 20.0–24.9 (odds ratio 3.6)[62]. A subsequent Australian study of 14,230 pregnancies found that the risk of developing gestational diabetes was 2.95 times higher in obese women (BMI 30.01–40.00) compared with normal-weight (BMI 20.01–25.00) women[58]. Obesity also increases the risk of death from VTE. There are several factors contributing to an increased risk of VTE in obese pregnant patients. These women often have reduced mobility, suffer from co-morbid conditions, increased frequency of operative delivery, and possibly higher levels of coagulation factors VIII and IX[63]. In a United Kingdom study, pregnant women with a BMI ≥30 was had an adjusted OR of 2.65 for antenatal pulmonary thromboembolism[64]. The offspring is exposed to an increased risk of being still born or preterm[65,66]. Ultrasound examination of the fetus may be difficult in obese pregnant women. In a systematic review and meta-analyses, Aune et al. determined that the relative risk for each five unit increase in maternal BMI in overweight and obese women was 1.21 for fetal death, 1.24 for stillbirth, 1.16 for perinatal death, 1.15 for neonatal death, and 1.18 for infant death[67]. During labor, they experience problems with difficulty with anesthesia, and cesarean delivery. The BMI inversely proportional to the length of labor in in nulliparous women[68]. Cesarian delivery is 1.46 (unadjusted OR) in overweight and 2.05 (unadjusted OR) is more common in obese women, compared with normal weight women[69]. Anesthesia is more problematic, with obese women – epidural failure is more common[70] and

endotracheal intubation may be difficult if general anesthesia is used[71]. Cesarian section is more likely to be complicated by surgical site infections in the overweight (odds ratio 1.6), obese class I (2.4), and obese classes II and III (3.7)[72]. Macrosomia (birth weight of ≥ 4,000 grams regardless of gestational age) is more common and may complicate childbirth (especially birth trauma e.g., shoulder dystocia, fracture of clavicle, damage to the brachial plexus[59,73]. The risk of congenital abnormalities in the offspring is also increased in overweight/obese pregnant women[74]. A systematic review and meta-analysis found the increased risk as follows: spina bifida (Odds Ratio or OR: 2.24), neural tube defects (OR: 1.87), limb reduction anomalies (OR: 1.34), cardiovascular anomalies (OR: 1.30), and cleft lip and palate (OR: 1.20) – in obese when compared with non-obese women[75]. The risk increases with increasing levels of obesity[76]. Children born with excess bodyweight increase their risk of later life obesity[77]. After delivery, obese women also demonstrate decreased rates of initiating breastfeeding and breastfeed for shorter durations compared to normal weight women[78]. Obese women face several hurdles, such as delayed lactation, embarrassment with body size, larger breasts and nipples, and comorbid medical conditions, that may interfere with breast feeding. It also results in postpartum weight retention and obesity[79,80]. They are also prone to long-term obesity and future co-morbidities such as diabetes and cardiovascular disease[65,77]. According to the USA Institute of Medicine optimal gestational weight gain (GWG) in pregnancy of 11 to 20 lbs. (5 to 9 kg) for women who are obese (BMI >30.0 kg/m2) and 15 to 25 lbs. (6.8 to 11.3 kg) for women who are in the overweight (BMI of 25.0-29.9 kg/m2) category. They recommend a weight gain of 25 to 42 lbs. (about 11 to 19 kilograms) for obese women carrying twins or multiples. For underweight (BMI <18.5 kg/m2) women a weight gain of 28-40 lbs. (12.5-18 kg) and for normal weight women (BMI of 18.5-24.9 kg/m2), a weight gain of 25-35 lbs. (11.5-16 kg) is appropriate[81]. The optimal weight gain recommended may differ for Asian women.

Alcohol

It is estimated that an estimated 10% of women globally, consume alcohol during pregnancy[82]. Data suggests that in Europe about a quarter of women drink alcohol during pregnancy. However, this use is much higher in some countries such as Russia (36.5%), the United Kingdom (41.3%), Denmark (45.8%), Belarus (46.6%), and Ireland (60.4%)[82]. Alcohol use and binge drinking among women of childbearing age has been increasing in most countries globally[83]. Denny et al found that (in a report published in 2019), almost one in nine (11.5%) of pregnant women drink alcohol during pregnancy and 3.9% report binge drinking in the past 30 days[84]. Prenatal alcohol exposure (PAE) can affect multiple aspects of infant health and development[85]. The harm from alcohol starts preconception, as it adversely affects the quality and quantity of nutrient intake[86]. Since almost one half of all pregnancies in the United States are unintended, and often unrecognized early on, alcohol intake may harm a fetus during embryologic development (3–8 wk. of pregnancy)[87]. The teratogenic effects of alcohol are most significant during this stage88. Alcohol use in women who are sexually active and in the reproductive-aged, should therefore be, (current recommendation from the American College of Obstetricians and Gynecologists, Center for Disease Control (CDC), Surgeon General, and medical societies from other countries including the Society of Obstetricians and Gynecologists of Canada) completely avoided[89-91]. Alcohol exposure during the second and third trimester is associated with neuronal

loss[92-94]. Overall, alcohol use during pregnancy may lead to several detrimental effects which include miscarriage, preterm labor, intrauterine growth restriction, and stillbirth[95,96]. Alcohol consumption also may lead to the fetal alcohol spectrum disorder (FASD). This includes growth retardation, craniofacial dysmorphisms, central nervous system dysfunction, or neurobehavioral disabilities in the child[97-99]. Although alcohol use specifically is harmful to the fetus, pregnant and parenting women who use alcohol often shy away from necessary health care[100]. The related fear of a punitive response may result in avoidance of the much-needed health and social services. To summarize, there is no safe threshold for alcohol consumption during pregnancy[101] and it should be totally avoided during pregnancy and breastfeeding[102]. Alcohol consumption and its harmful effects should be discussed with all pregnant women as early in the pregnancy as possible and at every prenatal visit[103]. WHO also recommends detoxification if the pregnant woman is addicted to alcohol[104]. Withdrawal symptoms (visual, auditory, and tactile disturbances, tremors, sweating, agitation, anxiety), if severe may require inpatient monitoring during detoxification[105].

Physical Activity

Exercise tends to decrease in many women with pregnancy[106,107]. It is estimated that almost 60% of women are inactive in pregnancy[108], only 15%–38% of pregnant women follow physical activity guidelines[109], and only 8% meet the recommendations in the 3rd trimester[110]. Moreover, the decrease in levels of physical activity during pregnancy tends to persist up for to six months after delivery[111]. Several barriers contribute towards this increase in sedentary behavior, especially worries that physical activity might contribute to the mother suffering a miscarriage. Other justifications include the nausea experienced during pregnancy, together with increased body weight and size[112]. Physical activity and physical exercise during pregnancy is not only safe but helps improve maternal and fetal health and prevents several pregnancy-related complications11[3,114]. It helps prevent weight gain[115]. Exercise before and during pregnancy helps reduce the risk of maternal diabetes[116] and if present, makes it easier to control[117]. It may also help prevent preeclampsia[118]. Regular exercise may shorten the duration of labor and reduce the risk of Cesarean section and operative-assisted vaginal delivery[119]. Exercise also helps reduce peri-natal depression[120]. PA does not lead to adverse effects on birthweight and does not increase the risk of stillbirth. Fetal benefits include reduced preterm birth and decreased fat mass[121]. There is no detrimental effect on lactation or infant growth[122]. Even non-traditional exercise like yoga help reduce several pregnancies related complications[123,124]. Exercise also helps relieve stress, lowers blood pressure and cholesterol, decreases depression, and enhances self-confidence[125,126]. In general, exercise reduces the morbidity and mortality associated with cardiovascular disease, hypertension, and type 2 diabetes mellitus and several other chronic diseases[127]. Several professional associations, including the American College of Obstetrics and Gynecology (ACOG) recommend that pregnant women should perform at least 30 minutes of moderate exercise, five days per week[128,129]. Aerobic exercise can be safely initiated in the first trimester, and continued until delivery[130,131]. Resistance exercises, properly designed, may also help complement aerobic exercises[132,133]. Besides improving cardiorespiratory fitness, they also help decrease both weight gain, decrease lower limb edema, and mitigate depression[134,135]. Exercises may be modified as the pregnancy progresses. Postpartum exercises also help urinary urge

incontinence decrease lumbopelvic pain, and help strengthen the recti abdominus muscles[136,137]. In general, exercises that harm should be avoided. These include exercise above 5250 feet, those increasing the risk of contact, falling, or abdominal trauma, and scuba diving[138]. Hot yoga and hot Pilates may also cause harm. Women may not be able to exercise if they have severe preeclampsia, severe respiratory/heart/endocrine/hematological or neurological diseases. They may also be unable to exercise if they suffer from placenta previa, second or third trimester bleeding, vasa previa, intrauterine growth restriction, and preterm labor[139,140]. These patients can minimize the risk of VTE by ambulating regularly rather than exercising[141]. Pregnant women should stop exercising and seek immediate medical attention if there are unexplained symptoms – such as dizziness, shortness of breath, chest pain or calf pain. Many symptoms related to pregnancy are also indications for seeking medical advice and include painful contractions, vaginal bleeding, a leak of the amniotic fluid or rupture of membranes[142,143].

Nutrition

Adherence to the nutritional recommendations is low in pregnant women[144,145]. Most women start avoiding alcohol and caffeine when they find out that they are pregnant[146]. However, diet modification during pregnancy should go beyond that[147]. Non-pregnancy requirement for protein is generally 0.8g/kg/day. However, in the pregnant women, this goes up to 1.1g/kg/day[148]. Pregnant women should consume 45-64% of daily calories from carbohydrates and 20-35% of daily calories from fats[147]. The micronutrient intake also goes up – both during pregnancy and during lactation. Three micronutrients are specifically important – folic acid, iron and B12[149]. The requirements for folic acid increase 10-20-fold, for iron two- to three-fold and for B12, two-fold[149]. Folic acid is necessary to support cell growth and nucleotide synthesis for fetal and placental development. Several studies have shown that folic acid supplementation helps reduce neural tube defects in the offspring[150]. It is recommended that folate consumption should increase from 400 μg/d to 600 μg/d during pregnancy and should be around 500 μg/d during lactation[150]. Another micro-nutrient – iron, needs to nearly double in intake during pregnancy – the requirements go up from 18 mg/d to 27 mg/d. Iron deficiency anemia (ferritin <15 μg/L,) can cause harm and needs to be aggressively treated. Although other micronutrient requirements also go up, these can usually be provided by intake of a daily prenatal multivitamin before conception and during pregnancy. Additional 500 additional kcal/day intake is needed by breast feeding women beyond what is recommended for non-pregnant women to ensure an appropriate amount of weight gain by the newborn[151]. Requirements of many micronutrients also continue to be high during this postnatal lactating phase. These can be usually remedied by taking a prenatal vitamin daily. Vegetarian diets during pregnancy have been found to have no protective associations with adverse maternal outcomes. The fluid requirements during pregnancy also increase by about 300 ml per day during the last few months of pregnancy[152].

A proper diet during pregnancy and the peri-pregnancy period is crucial in preventing deleterious pregnancy outcomes[153-167]. These include maternal ailments such as unwanted obesity, preeclampsia, gestational hypertension, and postpartum depression[153-154]. The impact on the fetus especially from an inadequate intake of folate and other B vitamins by the pregnant mother may cause preterm birth, neural defects, cleft palate, and congenital heart disease[155-160].

The neonatal may experience eczema, cough and wheezing during the first year of life[161,162]. The growing infant may develop obesity, hypertension and adverse cardiovascular outcomes[163]. Inadequate intake of vitamin B12 may also result in long term damage to the child's nervous system[158,159,164]. A vitamin D and/or iodine deficient diet may affect bone mineralization in the offspring[165-167]. Adequate and balanced intake of macronutrients and a multivitamin supplement before, during and often after pregnancy is therefore extremely crucial for good maternal and fetal health[168].

Conclusion

Lifestyles are extremely important in modifying the results of pregnancy. Obesity has a harmful relationship with pregnancy, and this is often unrecognized, overlooked, or ignored. Obesity impacts pregnancy even before conception as it reduces fertility. During pregnancy, excess body weight significantly increases the risk of maternal and fetal complications. The repercussion persists into future life of both the mother and the child. The quality of diet also makes a significant impact on maternal and fetal health. The increased protein requirement and the critical role played by folic acid and iron in the health of the growing fetus is well recognized. The Institute of Medicine dietary guidelines are helpful. The deleterious role of smoking and alcohol for both the pregnant mother and the offspring is well recognized. Even a single cigarette or alcoholic drink are unsafe in pregnancy. And finally, the myth of exercise not being safe during pregnancy has now long been proven false. Most healthy nulliparas are advised about 30 minutes of moderate intensity exercise about 5 days a week, leading to better maternal and offspring health. The adoption of healthy lifestyles should begin before pregnancy and continue through the postpartum period.

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