



IMPACT OF MOTHER'S DIET AND LIFESTYLE DURING PREGNANCY ON MATERNAL HEALTH AND FETAL OUTCOMES

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ABSTRACT

A pregnant woman should realize that her behaviour directly affects the fetus inside her. Blood cells are primarily responsible for transporting nutrients, oxygen and potential teratogens from the mother's placenta to the fetus, via the umbilical cord. There are many such maternal factors like diet, physical activities, stress, sleep, disorders like diabetes, hypertension etc. which affects the fetus directly or indirectly. There are many harmful substances the mother can ingest or become exposed to that can have negative and harmful effects on the fetus, as well certain vitamins and minerals that can promote prenatal development. In some cases it may be very fatal. Hence, a lot of care should be taken during the pregnancy as it is the most critical period.

Keywords: Varicose veins, Intra-Uterine Growth Retardation, Neural Tube Defects, unilateral retinoblastoma, fetal goitre, gestational diabetes mellitus.

INTRODUCTION

There are millions of behaviours and activities that we participate in every day. Usually, these activities have an effect only on the person who does the action. But a pregnant woman must realize her behaviour directly affects the fetus inside her as well. Blood cells are primarily responsible for transporting nutrients, oxygen and potential teratogens from the mother's

placenta to the fetus, via the umbilical cord. There are many harmful substances the mother can ingest or become exposed to that can have negative and harmful effects on the fetus, as well certain vitamins and minerals that can promote prenatal development. Pregnancy and the foetal environment can have a profound influence on many chronic diseases, such as diabetes obesity, breast cancer



and cardiovascular diseases in both the mother and her offspring. Much of the influence of the intrauterine milieu is transmitted to the next generation through epigenetic mechanisms. However, the specific pathways affected through these mechanisms by lifestyle during pregnancy are largely unknown and deserve further study. There are some common discomforts during pregnancy least affecting fetal outcomes. But when there are symptoms like blood or fluid coming from your vagina, sudden or extreme swelling of your face or fingers, headaches that are severe or won't go away, nausea and vomiting that won't go away, dizziness, dim or blurry vision, pain or cramps in your lower abdomen, chills or fever, change in your baby's movements, less urine or burning when you urinate, any illness or infection etc. then it can be very serious and there is need to call the doctor immediately (www.doctorsada.com/pregnancycare.html). Hence, in this review the several maternal and fetal

outcomes that arise due to maternal diet or any kind of activities are discussed so that it may help to make us alert for such situations.

1) Effect of maternal diet

Nutrition plays a major role in maternal and child health. Poor maternal nutritional status has been related to adverse birth outcomes; however, the association between maternal nutrition and birth outcome is complex and is influenced by many biologic, socioeconomic, and demographic factors, which vary widely in different populations. (Abu-Saad and Fraser, 2010). Excessive maternal weight gain contributes more to postpartum weight retention and less to fetal growth in normal and overweight women. So there are more chances of obesity in mother as well as child. Higher weight gain tends to occur in pregnant teenagers who are still in growing stage. Maternal growth in multiparous teenagers is also associated with lower birth weight babies. Whereas low weight gain



especially in second and third trimesters of pregnancy leads to Intra-Uterine Growth Retardation and low birth weight infants. Deficiency in folic acid can lead to Neural Tube Defects and iron's deficiency can lead to anaemia. High dose of iron supplements or normal digestive changes can lead to constipation and dry and hard stools. Negative environmental factors including suboptimal maternal nutrition may play a major role. The relationship between low birth weight and disease is an imbalance between fetal demand and maternal supply. The imbalance results in metabolic and endocrine changes, which assist the fetus in the short term by slowing growth and increasing available fuel, but lead to long-term greater risk of metabolic syndrome and cardiovascular diseases per ADA, 2002.

Nutrition is a primary non-genetic factor affecting brain development. The effects of under-nutrition (and malnutrition) on the developing brain are long-lasting,

leading to permanent deficits in learning and behaviour. A predominant cause of hindered fetal brain development is maternal malnutrition, including placental insufficiency. Prenatal protein deficiency can impact brain development at critical junctures. Nutritional deprivation seems associated with varying degrees of intellectual disturbance such as cognitive impairments and attention deficit disorders. When cancer in offspring was studied, Musselman *et al.*, 2011 found that higher adherence to a diet that is high in fruits and vegetables was associated with a lower likelihood of childhood germ cell tumours. A case-control study provided preliminary evidence that a diet higher in fruit and lower in fried foods and cured meats during pregnancy may decrease the risk of unilateral retinoblastoma in offspring.

Nausea or vomiting or "morning sickness" is one of the most common complaints among women. But it is reported that morning sickness can protect the



fetus by decreasing maternal intake of strong flavoured foods. Mild nausea can be treated by taking small and frequent meals. But in case of *Hyperemesis gravidarum* in severe case persisting beyond 14 weeks of gestation is a high risk condition and requires hospitalization, antiemetic medications, rehydrations, correction of electrolyte and nutritional support. If untreated may lead to lack of nutrients in fetuses per ADA, 2002.

Pregnant women are at higher risk of food borne illness. Among the most common causes during pregnancy there are several food-borne or water-borne pathogens including *Salmonella*, *Helicobacter*, *Shigella*, *E. Coli* etc. Hepatitis A is also a food or water borne pathogen of concern. Listeriosis, caused by *Listeria monocytogenes*, can result in premature delivery, stillbirth or infection in the newborn. The Food and Dietetic Association has also advised pregnant women to avoid consuming large fish like shark,

swordfish, king mackerel etc. to avoid methylmercury poisoning as per ADA, 2002.

So a proper diet should be maintained so that we can protect both the mother and the fetus from deadly diseases and disorders.

2) Effect of maternal lifestyle

a) Physical activities- Maintaining light to moderate physical activity during an uncomplicated pregnancy provides various benefits for the woman's health. This process helps reduce and prevent lower back pain, fosters lower liquid retention, reduces cardiovascular stress, increases the oxygenation capacity, decreases blood pressure, reduces the risk of gestational diabetes, prevents thromboses and varicose veins, and helps control gestational weight gain. The advantages also include emotional aspects, since physical activity helps make the pregnant woman more self-confident and satisfied with her appearance, in addition to raising her self-esteem, thus reducing the risks of postpartum



depression (Schlussel, 2008). Exercise is protective against the most common complication of pregnancy, gestational diabetes mellitus (GDM) and also preeclampsia. There tends to be a lower rate of caesarean delivery among exercising women. Exercise can be used to combat excessive weight gain with the help of your doctor who may prescribe a safe exercise regime to adopt during pregnancy. Increased cardiovascular and muscular fitness and strength can be achieved. We can get improved posture due to increased abdominal and upper body strength. There is improved circulation which reduces the incidence of varicose veins and deep vein thrombosis. Constipation, bloating and swelling are reduced. A greater chance of experiencing easier deliveries can be found with less medical interventions. Babies born to exercising mothers are comparatively healthier than inactive mothers. So, it is very important for the mother to be

active and exercise regularly to remain fit and keep the baby healthy.

b) Sleep-Sleep needs are often pushed to the bottom of women's daily priority list. During pregnancy and the postpartum period, women are at particular risk for sleep restriction because of the physical changes of pregnancy and the need to provide frequent infant care. Pregnancy and the postpartum period are also times when women are at a heightened risk of depression. Maternal depression adversely impacts maternal-child relationships, parenting practices, family functioning, and children's development and general well-being. Several authors have hypothesized that sleep deprivation may increase the risk of adverse maternal and fetal outcomes (Chang, 2010). Limited evidence also suggests an association between sleep problems and maternal depression. Sleep in women is affected by physiologic changes in neuro-endocrine hormones, body



temperature, mood, and emotional state during puberty, the menstrual cycle, pregnancy and menopause. Lee *et al.*, 2000 discovered that women averaging less than 6 hours of sleep per night during the last month of pregnancy had a significantly longer mean duration of labor (29 hours vs. ≥ 20 hours) and a higher rate of caesarean births than women getting more than 6 hours of sleep. Beebe and Lee, 2007 observed that less time of total sleep on the night before hospitalization was associated with elevated perception of pain and discomfort during labour. Okunet *al.*, 2007 showed that self-reported short sleep duration and poor sleep efficiency in both mid and late pregnancy in 19 healthy women were associated with higher levels of IL-6, a pro-inflammatory serum cytokine that contribute to the etiology of spontaneous preterm birth. Hence, getting enough sleep is very much important during pregnancy to protect the mother from

depression & child from preterm birth.

c) Stress-The prenatal period is a critical time for neurodevelopment and is a period of vulnerability during which a range of exposures have been found to exert long-term changes on brain development and behavior with implications for physical and psychiatric health (Michael *et al.*, 2009). Brown *et al.*, 2000 have shown that fetal development during this period is associated with a two-fold increased risk for schizophrenia, schizoid/schizotypal personality disorder, as well as comparable risk for major affective disorders in adulthood. Maternal stress, secondary to famine, could have neurotoxic effects on brain regions relevant to mental illness. Clinical studies link pregnant women's exposure to a range of traumatic, as well as chronic and common life stressors (i.e., bereavement, daily hassles, and earthquake), to significant alterations in children's neurodevelopment, including increased risk for mixed handedness, autism, affective



disorders, and reduced cognitive ability (Talge *et al.*, 2007). Reports show that elevated levels of antenatal depression and anxiety are associated with poor emotional adjustment in young children (O’Conner *et al.*, 2003). Fetuses of mothers who reported greater stress showed significantly lower Fetal Heart Rate (FHR) variability than the low stress group, which may contribute to diminished parasympathetic control of the fetal heart. (DiPietro *et al.*, 1996). Lower levels of high frequency heart rate variability are associated with less adaptive transitions in responding to emotion-eliciting cues (Sloan *et al.*, 2001). Maternal mood may also affect autonomic and central nervous system development. Fetuses of mothers with high anxiety have also been found to spend more time in “quiet sleep” and to be less active in “active sleep”. But, fetuses of mothers without high anxiety, have a linear relationship emerging between maternal anxiety and percent quiet

sleep over a 4 hour monitoring period (Groome *et al.*, 1995).

Hence, maternal stress should be avoided to protect the fetus from different nervous ailments and maintain a healthy heart.

d) Hypothyroidism-Clinical thyroid dysfunction has been associated with pregnancy complications such as hypertension, preterm birth, low birth weight, placental abruption, and fetal death. Thyroid hormones play a critical role in fetal brain development. The fetus depends entirely on maternal thyroid hormones for the first 12 weeks of pregnancy, until the baby’s thyroid begins to produce thyroid hormones on its own. Babies born to mothers with undiagnosed or inadequately treated hypothyroidism are at risk for lower IQ scores and learning disabilities (Trentini, 2013). Hypothyroidism in pregnant women can adversely affect their children’s subsequent performance on neuropsychological tests. Decreases in performance can



occur even when the pregnant woman's hypothyroidism is mild and probably asymptomatic." Abnormal thyroid gland function may be restricted to the fetus, the expectant mother, or both. Fetal hypothyroidism can be permanent or transient. Combined maternal and fetal hypothyroidism is almost always due to iodine deficiency, but thyroid-binding inhibitory immunoglobulin (TBII) has been implicated on occasion. It is now believed that even mild maternal hypothyroidism (from mild iodine deficiency, thyroid autoimmunity, or thyroid under-replacement) may affect fetal brain development (Smallridge and Ladenson, 2001). Rovet reported the long-term outcome in a group of affected children older than 13 yr of age and found their mean IQ was 8.5 points lower than controls. These adolescents had deficits in memory and in visuospatial and motor abilities, the presence of which correlated with the severity of the Congenital Hypothyroidism. Transplacental passage of thyrotropin receptor blocking

antibody occurs in some women with thyroid autoimmunity. Antithyroid drugs also cross the placenta and may result in fetal goiter and TSH elevations on cord blood.

Hence, hypothyroidism should be avoided because even mild hypothyroidism can lead to poor brain development in fetus and in severe case can lead to death.

e) Smoking, drinking and other habits-Alcohol is the most commonly consumed teratogen, and can cause fetal alcohol syndrome (FAS) when drunk by a pregnant mother. Many infants with this syndrome have stunted growth and facial features that include a thin upper lip, smoothed philtrum, and a decreased eye width. They often have decreased brain function due to damaged neurons which causes cognitive and behavioral problems. A milder syndrome called fetal alcohol effect (FAE) is characterized by behavioral problems and developmental delays (CDC, 2013).



Smoking is known to cause cancer, heart disease and other health problems in adults and can have deadly effects on the fetus. Mother's smoking during pregnancy is associated to premature births, infant deaths and other birth defects (CDC, 2013). Smoking can also cause damage to the placenta, which is how infants receive nutrients and oxygen. Smoking deprives the eggs, embryo, and fetus of oxygen. This can lead to accelerated ovarian aging, a higher risk of miscarriage and low birth weight babies. Once born, there is a higher likelihood of the child having developmental issues like mental and behavioral problems.

As per ADA, 2002, in case of *pica*, i.e. consumption of non-food substances over a longer period of time during pregnancy and in excess may be harmful. These women may be exposed to lead or their environmental toxicants. It can also lead to reduced serum ferritin and haemoglobin level in the mother and smaller head

circumference in infant. It may also lead to heavy metal toxicity.

Any Category X Drugs (include birth control and fertility drugs, an oral medication used for treatment of severe acne, some anti-cancer and anti-seizure drugs) should not be taken. According to the FDA (2013), these drugs have demonstrated fetal abnormalities and/or there is positive evidence of human fetal risk. Category D Drugs (include several antibiotics, neurologic, psychiatric drugs, along with certain forms of chemotherapy) also should not be taken.

Caffeine can also affect the growing baby. Heavy doses are strongly discouraged since caffeine is a stimulant, it increases our heart rate and metabolism both of which directly affect the baby. The Academy of Nutrition and Dietetics recommends keeping your intake of caffeine below 300 milligrams per day.

3) Some other health problems and their outcomes

a) Hypertension (High Blood Pressure)-Chronic poorly-controlled high blood pressure



before and during pregnancy puts a pregnant woman and her baby at risk for problems. It is associated with an increased risk for maternal complications such as preeclampsia, placental abruption (when the placenta separates from the wall of the uterus), and gestational diabetes. These women also face a higher risk for poor birth outcomes such as preterm delivery, having an infant small for his/her gestational age and infant death.

b) Gestational Diabetes Mellitus

(GDM)-GDM is diagnosed during pregnancy and can lead to pregnancy complications. Poorly controlled diabetes increases the risk of preeclampsia, early delivery, caesarean birth, having a big baby, which can complicate delivery, having a baby born with low blood sugar, breathing problems, and jaundice. Although GDM usually resolves after pregnancy, women who had GDM have a higher risk of developing diabetes in the future.

From this review we can conclude that a pregnant woman

should strictly take care of her health whatever the case may be because even the slightest mistake can lead to adverse health effects in her child. Poor nutrition in mother can lead to PEM, NTDs, deficit in learning and behaviour, placental insufficiency, retinoblastoma, still births etc. Physical activity during pregnancy is very much beneficial and can combat number of pregnancy induced diseases like Gestational diabetes and helps to remain fit. Reduced maternal sleep can lead to caesarean births, pain and discomfort during labour, preterm birth etc. Maternal stress can lead to mixed handedness, autism, affective disorders, and reduced cognitive ability, poor emotional adjustment, lower Fetal Heart Rate etc. Hypothyroidism during pregnancy can lead to lower IQ scores, learning disabilities, fetal hypothyroidism, deficit in memory, fetal goitre etc. Consumption of alcohol, caffeine, drugs and smoking in excess can lead to adverse effects on infants like FAS, still birth, premature



birth etc. Other health conditions like hypertension, gestational diabetes, infections etc. in mother can be dangerous to fetus if untreated.

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