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ESTABLISHING LINK BETWEEN VITAMIN D LEVEL AND GESTATIONAL DIABETES DURING PREGNANCY: A SYSTEMIC REVIEW

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ABSTRACT

A woman's life changes drastically during pregnancy because she becomes accountable for her developing child's wellbeing in addition to her own. After the baby is delivered and the mother starts nursing, this process is repeated. Researchers are still learning all there is to know about the impact of vitamin D levels at this time. New research challenging long-held beliefs about the importance of vitamin D in health indicates that vitamin D affects immune function and surveillance, which extends beyond calcium and bone metabolism to affect the health of the mother and her foetus. This role goes beyond what conventional thinking has hitherto allowed. The mother's breast milk continues to be the child's main supply of vitamin D after delivery, while this process continues. As a result, deficiencies in foetuses and infants are predicted by maternal insufficiency throughout pregnancy and lactation; the importance of this is just now being recognised and will be underlined in this review. Throughout pregnancy, maternal insufficiency is predictive to fetal and neonatal deficit.

Keywords: Vitamin D, Gestational Diabetes, Pregnancy

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INTRODUCTION

Pregnancy is a turning point in a woman's life because she is responsible not only for her own well-being but also for the well-being of her developing child. This procedure continues after the infant is born and the mother begins breastfeeding. Only recently have researchers begun to fully comprehend the influence of vitamin D status during this time period. Emerging evidence addressing the significance of vitamin D in health challenges long-held doctrine and suggests that vitamin D, by virtue of the influence it has on immune function and surveillance, plays a role in the health status of both the mother and her fetus beyond the realm of calcium and bone metabolism. This function exceeds the traditional scope of traditional dogma. This process continues after birth, with the mother's breast milk continuing to be the child's primary source of vitamin D. Consequently, maternal insufficiency during both pregnancy and breastfeeding is predictive of fetal and infant deficits; the significance of this is just beginning to be understood, and it will be emphasized in this review. Maternal deficiency predicts fetul and neonatal deficiency throughout pregnancy (Wagner, C. L., 2012). Gestational diabetes mellitus (GDM) is a common pregnancy complication characterized by hyperglycaemia with onset or first recognition during pregnancy. Risk factors include family history of diabetes, previous GDM, genetic predisposition for GDM/type 2 diabetes, insulin resistance conditions such as overweight, obesity and ethnicity. Women with GDM are at high risk for fetal macrosomia, small for gestational age, neonatal hypoglycaemia, operative delivery and caesarean delivery. The aim of this narrative review is to summarize the most recent findings of diagnosis and treatment of GDM in order to underline the importance to promote adequate prevention of this disease, especially through lifestyle interventions such as diet and physical activity (Zito, et al, 2019).

The period of gestation which starts with the conception through development of the fetus and lasts till birth. Gestation period of a normal woman is 9 months or 40 weeks or 280 days. It is the very crucial period in a woman’s’ life due to many physical, psychological and emotional changes. Multiple pregnancies have more than one off spring or fetus such as twins or triplets (Bishnoi, 2020).

During pregnancy, a woman's body, physiology, and responsibilities undergo significant changes. This is a period of rapid change. At this point in a woman's existence, she is responsible not only for her own well-being and health but also for that of the fetus developing within her. During this period, she is responsible for their health and safety. The 'wrong diet' and 'wrong lifestyle,' such as diets lacking folate or iron and lifestyles involving alcohol and cigarettes, are

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linked to higher rates of congenital anomalies, adverse pregnancy outcomes, and direct sequelae in the progeny exposed to such 'wrong' conditions. This is despite the fact that the 'right diet' and the 'right lifestyle' cannot guarantee a healthy infant at birth one hundred percent of the time. Some aspects are more visible because we observe the immediate effect or manifestation of the absence of a nutrient or the excess of an environmental contaminant, such as cigarette smoke (with decreased fetal growth) or the stigmata of fetal alcohol exposure (manifesting as fetal alcohol syndrome). Other aspects are less apparent because we do not observe the direct effect or manifestation of a nutrient deficiency or an environmental toxin excess. In other cases, however, the effects of nutrient deficiency may be more subtle and manifest over an extended period of time (such as a lack of vitamin B12). Furthermore, advances in molecular and cellular techniques over the past decade are likely to have altered what was previously known about a particular nutrient and its influence on maternal health during pregnancy and lactation. These developments have contributed to a more comprehensive understanding of the effects of nutrient deprivation on gene expression and associated cell function. Such is the case with vitamin D, which has risen from scientific obscurity as a forgotten vitamin only associated with bone and calcium metabolism to become one of the most acclaimed and controversial vitamins and micronutrients in modern medical and public literature (Wagner, C. L., 2012).

Hence During pregnancy, a woman's body, physiology, and responsibilities undergo significant changes. This is a period of rapid change. At this point in a woman's existence, she is responsible not only for her own well-being and health but also for that of the fetus developing within her. During this period, she is responsible for their health and safety. The 'wrong diet' and 'wrong lifestyle,' such as diets lacking folate or iron and lifestyles involving alcohol and cigarettes, are linked to higher rates of congenital anomalies, adverse pregnancy outcomes, and direct sequelae in the progeny exposed to such 'wrong' conditions. This is despite the fact that the 'right diet' and the 'right lifestyle' cannot guarantee a healthy infant at birth one hundred percent of the time. Some aspects are more visible because we observe the immediate effect or manifestation of the absence of a nutrient or the excess of an environmental contaminant, such as cigarette smoke (with decreased fetal growth) or the stigmata of fetal alcohol exposure (manifesting as fetal alcohol syndrome). Other aspects are less apparent because we do not observe the direct effect or manifestation of a nutrient deficiency or an environmental toxin excess. In other cases, however, the effects of nutrient deficiency may be more subtle and manifest over an extended period of time (such as a lack of vitamin B12). Furthermore, advances in molecular and cellular techniques over the past decade are likely to have altered what was previously known about a

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particular nutrient and its influence on maternal health during pregnancy and lactation. These developments have contributed to a more comprehensive understanding of the effects of nutrient deprivation on gene expression and associated cell function. Such is the case with vitamin D, which has risen from scientific obscurity as a forgotten vitamin only associated with bone and calcium metabolism to become one of the most acclaimed and controversial vitamins and micronutrients in modern medical and public literature (Wagner, C. L., 2012).

VITAMIN D NEEDS IN FOR WOMEN

Vitamin D (VD) has emerged as one of the nutrients and prohormones that have generated the most controversy in the twenty-first century, despite the fact that it was not discovered until much later. The fact that it plays a role in calcium metabolism and bone health is not debatable; however, its effect on other diseases and, more generally, health over the long term is. Due to the ease with which supplementation can affect VD's status, it seems to be an appealing research topic for GDM-focused perinatal researchers (Lanzone, S., 2015).

A comprehensive review of 10 observational studies found that 25-hydroxyvitamin D deficiency was linked to a higher risk of GDM in several subpopulations. However, there is still no clear evidence to show a link between serum vitamin D levels and GDM outcomes in the general population. This is despite the fact that the effect was linked to an increased risk of GDM. There are still a number of issues that have not been resolved satisfactorily. One of these looks at how other factors might change the link between 25-hydroxyvitamin D levels in the blood and the risk of GDM (Ronksley, P., 2013).

Vitamin D deficiency is common and there exists a huge gap between recommended dietary vitamin D intakes and the poor vitamin D supply in the general population. While vitamin D is important for musculoskeletal health, there are accumulating data suggesting that vitamin D may also be important for fertility, pregnancy outcomes and lactation. Significant changes in vitamin D metabolism during pregnancy such as increased production of the “active vitamin D hormone” calcitriol support the important role of vitamin D in this setting. Observational studies show that vitamin D deficiency is a risk marker for reduced fertility and various adverse pregnancy outcomes and is associated with a low vitamin D content of breast milk (Pilz, et al, 2018).

Vitamin D has an important role in glucose homeostasis and helps the secretion and the action of insulin. Vitamin D deficiency may have detrimental effects throughout the different stages of a woman’s life, especially during menopause [58–61]. However, several studies about use of

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vitamin D supplementation provide insufficient evidence to support clear 434 recommendations for women at risk or affected 435 by GDM, although some observational 436 studies report an association between vitamin D deficiency and the incidence of GDM (Poel, et al, 2012).

Vitamin D during pregnancy

Several distinct organs and bodily systems benefit from vitamin D's presence in the body. The primary functions of vitamin D are to facilitate calcium absorption from dietary sources into the bloodstream and to prevent calcium reabsorption by the kidneys. Vitamin D is a vitamin that is fat-soluble. This helps to direct calcium towards osteoclasts and osteoblasts, thereby strengthening the bones, and also reduces the risk of hypocalcemic tetany, which is associated with excessive calcium consumption (Yolanda Smith, et al, 2010).

A deficiency in vitamin D during pregnancy has been associated with a number of adverse pregnancy outcomes, including gestational diabetes mellitus (GDM), urinary tract infections (UTIs), preeclampsia, and cesarean deliveries. In addition, children born to mothers with low vitamin D levels have an increased risk of being underweight for their gestational age, having a low birth weight, and developing cardiovascular disease, respiratory illness, and type 2 diabetes mellitus (Ede G. et al., 2019).

Deficiency

The effects of a vitamin D deficiency typically manifest over an extended period of time, most notably causing the bones to become fragile. Vitamin D deficiency can cause rickets in children and osteomalacia and osteoporosis in adults. Rickets is more prevalent in developing nations.

The main cause of vitamin D deficiency is a lack of sun exposure, but it can also result from inadequate dietary vitamin D intake. Specifically, populations that lack adequate sun exposure are at risk for deficiency. These populations include the elderly, those who labor indoors all day, those who cover their skin while outside, and those who reside in areas with little sunlight.

It is fairly common for pregnant women and breastfeeding mothers to be deficient in vitamin D, which can also impact the infant. Since it is not safe for a newborn's skin to be exposed to direct sunlight, the preponderance of vitamin D that an infant requires must come from breast milk. Despite the fact that this is dependent on the vitamin D levels of the mother, this nearly always results in deficiency (Yolanda Smith, et al., 2010).

The Effect of Sunlight

When a person's epidermis is exposed to ultraviolet (UV) rays from the sun, a chemical reaction called 7-dehydrocholesterol occurs, which stimulates the body's production of vitamin D3. The optimal UV radiation has a wavelength of 295-297 nanometers, which is more prevalent in

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tropical regions and during spring and summer in four-season areas. Vitamin D deficiency is more prevalent in areas that do not receive a significant amount of UV radiation at the wavelength required by vitamin D, such as the arctic circles and other similar areas. People with darker skin tones are more susceptible to vitamin D deficiency because they require more solar exposure to initiate vitamin D production and are thus more likely to be affected by the deficiency.

Even though exposure to sunlight increases the body's vitamin D production, recommendations to spend more time in the sun should be taken with the utmost caution due to the risk of developing skin cancer. Sunscreen protects the epidermis from the sun's potentially damaging ultraviolet radiation while reducing the body's ability to manufacture vitamin D. In an optimal situation, sun exposure should be limited to brief bursts of 10–15 minutes, with the face and arms receiving direct sunlight. However, it is necessary to safeguard the skin for extended periods of time, and proper sun safety procedures should always be followed (Yolanda Smith, et al., 2010).

Dietary Sources

Some dietary sources, such as fish and eggs, as well as some food products with added vitamin D, are excellent places to look for vitamin D; however, it can be difficult to obtain adequate vitamin D levels from natural food sources.

When a person is at risk for vitamin D deficiency or has insufficient levels of the vitamin, vitamin D supplements are advised. During the winter months, when there is less exposure to the sun's ultraviolet rays, it is necessary for certain groups to take vitamin D supplements to meet their requirements (Yolanda Smith, et la., 2010).

GESTATIONAL DIABETES DURING PREGNANCY

It is thought that insulin resistance and insulin secretion are not balanced, which leads to maternal hyperglycemia and makes gestational diabetes mellitus (GDM) the main reason why mothers and their babies have problems during childbirth (Khanpaye A et al., 2019). Diabetes mellitus during pregnancy (GDM) is the medical term for this condition. The prevalence of gestational diabetes mellitus (GDM), a disorder characterized by variable severity of glucose intolerance with onset or first recognition in pregnancy, has increased over the years, reaching 10–15% globally (Visconti F. et al., 2019). GDM has been reported as one of the obstetric complications on the rise.

Physiologically speaking, pregnancy is diabetogenic because steroid hormone levels rise and

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peripheral tissues develop insulin resistance. Inflammatory cytokines released by fat cells and the placenta can also make insulin resistance and pathogens that cause GDM worse (Lindqvist S, 2017).

RELATIONSHIP BETWEEN VITAMIN D AND GESTATIONAL DIABETES DURING PREGNANCY

Gestational diabetes mellitus (GDM) is recognized as a significant risk factor for unfavorable pregnancy outcomes. Vitamin D deficiency is prevalent among diabetic women. This investigation aimed to determine the effect of vitamin D supplementation on the pregnancy outcomes of pregnant women with gestational diabetes mellitus (GDM) who were not taking oral hypoglycemic medications. This study included 45 expectant women diagnosed with gestational diabetes mellitus (GDM) between 24 and 28 weeks of pregnancy in a randomized, controlled clinical trial. The participants were randomly assigned to consume cholecalciferol (vitamin D tablets) or a placebo. The participants in the vitamin D group (n = 22) were administered 50000 IU of vitamin D3 twice during the course of the study: once at the outset of the intervention and again on day 21. The placebo group (n = 23) received two identical placebos at the same intervals. Blood samples were taken at the outset of the study to determine the level of glucose in the blood after fasting. Blood samples were collected at 60, 120, and 180 minutes of a 3-hour oral glucose tolerance test (OGTT) to determine plasma glucose levels. The newborn's weight, height, head circumference, Apgar score, and hyperbilirubinemia status were evaluated. Compared to placebo, administration of vitamin D supplements improved pregnancy outcomes. In particular, there were no cases of polyhydramnios in the vitamin D group, while 17.4% of participants in the placebo group experienced this condition ($p = 0.04$). Furthermore, the incidence of hyperbilirubinemia in newborns was substantially lower in the group receiving vitamin D compared to the group receiving a placebo (27.3% vs. 60.9%, $p = 0.02$). Vitamin D supplements administered to expectant women with gestational diabetes mellitus (GDM) for 6 weeks resulted in a reduction in maternal polyhydramnios and baby hyperbilirubinemia compared to a placebo. (RFID-TA, 2021, Web).

Gestational diabetes mellitus, often known as GDM, is defined as an intolerance to glucose that occurs during pregnancy. It affects approximately 7% (1–14%) of all pregnancies. For a very long time, a lack of vitamin D has been recognized as a contributing factor in the development of glucose intolerance. Low levels of vitamin D have been linked to maternal hyperglycemia, insulin resistance, and an increased risk of developing diabetes, according to the findings of

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several scientific investigations. However, the precise relationship between vitamin D levels and the risk of developing diabetes is still not completely understood. Several studies have suggested that low levels of vitamin D in the mother's blood may be a factor that contributes to the increased risk of medical issues during pregnancy for both the mother and the baby. In addition, low serum vitamin D levels have been documented in pregnant women who have GDM. This condition is typically linked to preeclampsia, GDM, infertility, and an increased likelihood of having a cesarean delivery. Vitamin D also has the ability to influence the immune system, as well as cytokines and antibacterial peptides, and the use of this vitamin is widely regarded as an essential component of prenatal care. Women who are pregnant and have HIV, for example, are at an elevated risk of transmitting the human immunodeficiency virus (HIV) to their unborn child and of experiencing devastating mortality. Low levels of vitamin D have also been linked to bacterial vaginosis that occurs during the first trimester of pregnancy. In a variety of populations, low levels of this vitamin were detected in pregnant women, based on the findings of epidemiological research (Bahrani Fard, B., 2020).

CONCLUSION

There is a pervasive deficiency of vitamin D in pregnant women throughout the world as a result of changes in lifestyle, access to sunlight, the use of sunscreen, and the inadequate vitamin D content in a variety of diets. This deficiency is most widespread in developing nations. Conservative parameter estimates indicate that women with darker skin pigmentation, those with limited or no access to sunlight, and those who do not take vitamin D supplements are more likely to have a vitamin D deficiency. Diabetes during pregnancy has been linked to a variety of unfavorable outcomes for both the mother and her offspring, both during pregnancy and throughout their lifetimes. According to the results of this study, giving pregnant women GDM vitamin D supplements decreased the incidence of polyhydramnios but had no effect on the frequency of cesarean sections, the need to initiate insulin therapy after intervention, or the rate of premature births. According to the results of our study, the consumption of vitamin D supplements by healthy expectant women had no effect on the likelihood of having a premature birth. In addition, the consumption of 15–20 ng/d of vitamin D did not reduce the incidence of preeclampsia in healthy nulliparous women, as compared to the consumption of less than 5 ng/d of vitamin D.

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