Vitamin D status during pregnancy, risk factors and outcomes: a review

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Abstract— Consuming less than required amount of vitamin D during pregnancy have been associated with numerous health consequences in the children. Maternal and infant cord 25(OH)D levels are greatly interrelated. Vitamind D synthesis, metabolism, risk factors, and vitamin D pregnancy outcomes are discussed. The existing findings for these harmful outcomes on health are reviewed here. Majority of the indication has ascended from observable epidemiological findings, however randomized measured tests are currently ongoing. The proof up to now aids that women ought to be supervised and remedied for vitamin D deficit throughout pregnancy for the welfare of the pregnant women as well as the neonate.

Index Terms— Vitamin D; risk factors, pregnancy, pregnancy health

1 INTRODUCTION

Vitamin D is a vitamin which is fat-soluble that is made when the skin is unprotected to sunlight. It is available in limited types of foods. Vitamin D supports calcium metabolism. It aids the body to take up calcium from food and supplements for supporting the reservation of healthy bone cells. Vitamin D originates from a limited types of foods and is created when the skin is uncovered to sunlight. Additionally, Vitamin D assists muscle health, participates in a function in the immune system, aids cell growth, and reduces inflammation, which could indicate illnesses like cancer and rheumatoid arthritis, controls blood pressure and aids cardiovascular health. Vitamin D intake is not the finest gauge of the vitamin's standing in the body, as various aspects can influence its uptake.

Vitamin D is an essential nutritional factor responsible for the absorption of calcium and phosphate, regulation of bone metabolism, and maintenance of muscle function [1]. Recently, insufficient stages of vitamin D have become a public health concern, especially in pregnant females, because of its effects on obstetric outcomes and fetal development. Up to 70% of nulliparous women having single pregnancies were found to be vitamin D deficient (deficiency characterized as a serum level < 30 ng/ml) [2]. Vitamin D deficit in pregnant female has been connected with adverse pregnancy outcomes for the mother throughout pregnancy as well as the developing offspring. In addition to immediate pregnancy concerns, the effect of depleted vitamin D levels in pregnant females during pregnancy may have health effects in mothers and their children throughout the birthing process and the beginning stages of life for the neonate.

Vitamin D deficit is a problem commonly seen in young, reproductive female in the United States [2]. There are many factors and determinants that are involved when it comes to the quantity of vitamin D is absorbed and synthesized by the body. Vitamin D can be absorbed from nutrients in the foods we eat, absorbed from the ultraviolet light from the sun, or supplemented synthetically through pills and multivitamins. Therefore, features like old age, female, greater latitude, winter timing, shadier skin coloration, a reduced amount of sunlight exposure, and dietary habits all contribute to lower 25[OH]D levels [3]. These influences on vitamin D 25[OH]D levels contribute to the elevated danger for vitamin D deficit amongst pregnant women. In a reflective cohort report that included 310 pregnant, nulliparous women in their first trimester of a singleton pregnancy, seventy percent of the participants were found to be deficient in vitamin D [2]. However, in another study involving 2382 mothers, 31.8% and 19.6% were vitamin D insufficient and deficient, respectively [4]. In this same study, it was found that an sufficient amount of circulating maternal vitamin D (25[OH]D3 ≥ 30 ng/ml) in pregnancy decreased the risk of needing an emergency caesarean operation by obstructed labor. From this understanding, it is turn out to be ever more obvious that vitamin D shortage has a vital influence in pregnancy and birth consequences.

2 VITAMIN D SYNTHESIS

A particular hormone that is produced in the body is Vitamin D (25[OH]D3). Vitamin D levels can be assessed through obtaining whole blood and using enzyme immunoassay to determine circulating serum level. Vitamin D condition is affected by sun exposure, dietary intake, and supplementation. Vitamin D is produced in the skin when bared to ultraviolet light from the sun [5]. Other factors, such as age, clothing type, skin coloration, and sunscreen usage also affect the amount of the vitamin D that is synthesized [6]. Overall sun exposure in relation to location and total minutes of sun exposure an area receives has an influence on overall vitamin D level. This can also vary contingent upon the season during which vitamin D amounts are being measured. When sun display is limited, one must use other means make up for the deficiency either through supplementation or dietary intake, primarily fatty fish like Herring or Mackerel which are not advised to be eaten in large amounts during pregnancy [5].

One of the key functions of vitamin D is to provide extracellular calcium ion levels in the body by controlling the amount of calcium that is absorbed from the small intestine [3]. If vitamin

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D is low, thus making calcium levels low, the parathyroid hormone (PTH) regulates and mobilizes the calcium from stores, specifically the bones, to increase the amount of calcium in blood [5]. A substantial quantity of distributing vitamin D and calcium, would then suppress the parathyroid hormone (PTH). Even though there are compensation mechanisms throughout the body, adequate amounts of vitamin D are necessary for the proper absorption and regulation of calcium.

3 VITAMIN D METABOLISM

Vitamin D proceeds via two conversions in the body. The first occurs in the liver, where vitamin D_3, also known as cholecalciferol, is hydroxylated into 25-hydroxyvitamin D (25(OH)D) by the enzyme 25-hydroxylase CYP2R1 [5] (Lips, 2006). This vitamin D serum level (25[OH]D) is the form of vitamin D found and measured in the circulating blood. The second conversion in the kidneys converts 25-hydroxyvitamin D (25(OH)D) into 1,25-dihydroxyvitamin D (1,25(OH)2D) via the enzyme CYP27B1, which is the active metabolite responsible for stimulating the calcium amalgamation in the gut [5]. The circulating form of vitamin D, 25[OH]D is used as the clinical measure of vitamin D status and has been connected to health consequences [3]. There are health consequences for acute vitamin D shortage including rickets or osteomalacia [5]. Furthermore, even slight vitamin D shortage may cause bone resorption, osteoporosis, and fractures, especially in high risk groups. High-risk factions comprise of young children, pregnant women, the elderly, and immigrants [7]. There is consensus that vitamin D is vital for the overall healthy growth and development of teeth, muscles and bones. There is emerging evidence for the relation of vitamin D throughout pregnancy in the inhibition of unfavorable birth outcomes.

4 RISK FACTORS FOR VITAMIN D DEFECIT

Below are some of the factors that affect if an individual is in danger of shortage of vitamin D:

(1) *People with various physical conditions:* The pigment melanin decreases the skins ability to make vitamin D when it is in touch with ultraviolet rays emitted from the sun. Therefore, these individuals need more direct sunlight to get the amount they need from the sun, or would need to grab a vitamin D supplement. Individuals having shadier skin have biologically sun shield because melanin takes up ultraviolet radiation, therefore 3 to 5 times longer sun display is needed for them to synthesize the equal extent of vitamin D than individuals with light skin. Several research indicates that older persons with shadier skin are at higher danger of vitamin D shortage.

Those who are obese: Study indicates that being overweight relates to lesser vitamin D levels. This can be as additional body fat someway influences vitamin D uptake. Obesity can also be associated to Vitamin D defecit, because being a fat-soluble vitamin, vitamin D is hidden by body fat. Vitamin D is removed from the blood by fatty cells changing its discharge into the passage. When a person has excessive body fat, vitamin D gets trapped in its fat tissues instead of going into circulation for use. Obesity is indicated as a body mass index (BMI) > 30. People with a BMI of ≥ 30 often have lower blood stages of vitamin D.

Age: People's capability to intake vitamin D may decrease with increase in age. Both physical age and skin age can reduce the capability of the skin to manufacture Vitamin D owing to lesser accessibility of 7-dehydrocholesterol.

Skin damage: Skin damage like burns can reduce Vitamin D production.

(2) *Folks with disease and restricted diet:* People with liver or kidney ailment incline to have lesser vitamin D levels. Vitamin D is converted to its functioning self in the kidneys, so in case the kidneys are not working properly, one could be taking in enough and absorbing enough, but its body cannot use it in the way it is needed due to the poor kidney function. For some people, their kidneys cannot transform vitamin D to its functioning stage, therefore rising their danger of vitamin D shortage.

Individuals with various digestive disorders: These situations regulate or sometimes forbid the body's capacity to take up vitamin D from the food that is eaten. Certain medical problems including Crohn's disease, cystic fibrosis, inflammatory bowel disease, and celtic disease can affect ones intestine's capability to take up vitamin D from the food we eat.

Self-imposed or medically restricted diets: By removing certain food groups, the chance of vitamin D shortage can increase. The other reason is the decreased consumption of Vitamin D because small types of foods like blue fish, egg yolks contain high quantities of it. The consumption of the vitamin can be improved by using fortified products like dairies, though the quantity of Vitamin D they give may not be enough for an adequate state of Vitamin D. Consuming foods high in vitamin D, or foods that have been enriched with the vitamin, reduces the dangers of vitamin D deficiency.

Dairy allergies: dairy allergy is a risk that can range from skin rashes to life-threatening vitamin D and calcium in our food supply. Adults and children who have dairy allergies can take advantage by taking a calcium and vitamin D supplement, also taking non-dairy drinks enhanced or fortified with calcium and vitamin D.

Lactose intolerance: If one is lactose intolerant, one can safely drink lactose-free milk and eat yogurt and cheese in small doses.

Fad and vegan diets: Many popular fad diets eliminate food groups that contain vitamin D.

Not consuming the endorsed amounts of vitamin over time: If someone strictly follows vegan diet- because most from the natural origins are animal products, comprising fish, fish oils, egg yolks, fortified milk, and beef liver.

(3) *Exclusively breastfed infants, pregnant and lactating women:* Human milk is depleted in vitamin D. Babies who are breastfeed might require a vitamin D addition especially if they stay indoors mostly every day. Breast milk contains 5 IU or less of vitamin D, so exclusively breast-fed infants need minimum 400 IU of supplemental vitamin D. Supplemental vitamin D can be found as liquid at majority of grocery stores and pharmacies.

Pregnant and lactating women: pregnant and lactating women are at a lot of risk of generally due to the metabolic stress of forming and feeding an infant. Some studies suggest

low vitamin D status in pregnancy can contribute to early deliveries and pre-eclamsia. Holick advises from 1500 to 2000 IU vitamin D for pregnancy, while the recommended daily allowance (RDA) is fixed at 600 IU. The majority of prenatal supplements ranges from 400 to 1000 IU.

(4) *Geographic location and environment:* There is limited access to the sun's ultraviolet-B rays at higher latitude resulting in less vitamin D production. Individuals having less time outdoors can direct to reduction in sunlight leading to have lesser vitamin D accumulation.

Residing in a densely contaminated zone: Vitamin D production can be decreased as pollution can take up some of the sunlight.

Applying a lot of sunscreen: Vitamin D intake can be reduced by applying too much sunscreen for blocking ultraviolet rays from sun. Use of sunscreen having a protection factor 30 can decrease the fabrication of vitamin D in the skin (greater than 95%).

Ambient temperature: Warmer skin can absorb the sun's rays better for producing vitamin D compared to cooler skin.

The time of the day and season of year: These two features can influence to the ability for the skin to produce Vitamin D.

Those with limited sunlight: As the body produces vitamin D when our skin is uncovered to sunlight, we may be at danger of shortage if we stay home often, reside in northern part of earth, wear long robes or head coverings (religious purposes), or have a profession that precludes sun contact. The further away we are from the equator, more we are at danger for vitamin D shortage for nearness to the sun. During winter the rays from sun are not at the proper wavelength for vitamin D fabrication in the skin no matter how sunny it may be on a given day.

Overcast and atmospheric contamination: These two factors can represent like a sunscreen thus reducing vitamin D production [8].

5 TESTS, SYMPTOMS AND TREATMENTS

Vitamin D deficiency tests: The best precise method to calculate the amount of vitamin D is stored in body is by the 25-hydroxy vitamin D blood test. From 20 nanograms/milliliter to 50 ng/ml is depicted as healthful. Below 12 ng/ml signifies vitamin D deficiency.

Symptoms: A vitamin D storage can trigger fatigue and mood fluctuations. Many individuals having vitamin D shortage may not have any indications or multiple years may pass before any signs are visible. Vitamin D shortage signs can be imprecise and can vary with time, also having similarity with various other illnesses. Therefore it is not wise to self-diagnose a vitamin D shortage illness. Several signs of vitamin D are: (a) osteoporosis, recurrent bone fractures, or thinning or fragile bones, (b) muscle paleness, (c) mood fluctuations (individuals having lesser vitamin D feel depression or nervousness), (d) chronic pain, (e) higher or rising blood pressure, (f) exhaustion, even with enough sleep, (g) decreased endurance, and (h) unexplained infertility .

Treatment: Ideal vitamin D absorption fluctuates with various factors (e.g. metabolic health, activity sage, age). Doctors should be referred with concerning vitamin D intake. During the beginning of treatment, it is wise to keep records of all signs of illnesses. There are three approaches for elevating vitamin D levels: (a) **Taking a vitamin D supplement**: These are easily found at shops over the counter. A doctor can also advise a supplement or multivitamin. Usually for majority of adults, the advised amount is 600 IU. For adults over 70 years old, it is 800 IU. For children who are less than 12 months of age, this is 400 IU. (b) **Consume foods abundant in vitamin D**: Fatty fish (e.g. mackerel, salmon and tuna) and fish-liver oils have good amount of vitamin D. Beef liver, cheese, and egg yolks contain small amounts of vitamin D. Milk as well as multiple cereals are safeguarded with vitamin D. (c) **Intensify natural sunlight exposure**: The dangers of sun exposure may be more comparable to the dangers of vitamin D shortage for personals susceptible to sunburn having family background of skin cancer, or have extremely light skin.

6 PREVENTING VITAMIN D DEFICIENCY

Consuming foods abundant in vitamin D and devoting 15-20 minutes every day under the sun are excellent ways to avoid vitamin D shortage. Besides these, a vitamin D addition can also benefit. Some other lifestyle strategies that may support healthy vitamin D levels include: (a) Sustain a healthful weight, (b) Supervising and remedying medical situations, (c) Taking vitamin D extras and (d) Consulting a doctor for any major health fluctuations.

7 VITAMIN D IN PREGNANCY

Pregnant women are among the risk groups for having vitamin D deficiency [6]. In a study by Flood-Nichols, seventy percent of the participants (n=235) were found to be vitamin D deficient [2]. Deficiency was indicated as a serum concentration <30 ng/ml. A low vitamin D type has been increasingly associated with diverse difficult pregnancy consequences and fetal development (e.g. decreased birth weight, length and gestational age at birth) [1]. It is suggested that as much as 4000IU/day of vitamin D in pregnant women and 6400 IU/day for lactating women is an effective amount to improve the health of the mother, fetus, and in the future, the breastfeeding infant [9]. Some of the variables that might explain these discrepancies include: different measurement tools of vitamin D levels, diverse patient populations, varying sample sizes, and interventions offered. Because of this conflicting evidence, it apparent that further research requires to be performed on the exact role vitamin D plays in regards to birth mode.

8 VITAMIN D DEFICIENCY IN PREGNANCY OUTCOMES

8.1 Vitamin D and maternal weight

There has been evidence that indicate as maternal weight increases, vitamin D 25[OH]D serum levels decrease. Savvidou et al. reported that as BMI increased, maternal serum 25(OH)D

decreased [10]. In another study, there was no found association between body mass index of the mother and vitamin D serum level [2]. Some of these discrepancies could have been due to the fact that BMI is not a flawless indicator if an individual is overweight or obese because muscle mass of each individual person is not taken into consideration.

8.2 Vitamin D deficiency with preterm birth, stillbirth and spontaneous abortion

The evidence vitamin D shortage on preterm birth (PTB), stillbirth and spontaneous abortion were reviewed in this study. It showed here that vitamin D insufficiency was linked to PTB, but not with spontaneous abortion and stillbirth. More research in varied geological locations are advised to further examine the advantages of vitamin D supplementation in pregnancy on fetal health and the avoidance of unfavorable pregnancy and birth outcomes. Future research should also explain the precise 25(OH)D level that can be believed enough for better maternal and perinatal health [11].

8.3 Vitamin D supplements in pregnancy

All Vitamin D addition in pregnancy may decrease the hazard of unfavorable gestational consequences. Seven trials comprising 868 women indicate that pregnant women complemented with vitamin D had considerably greater 25(OH)D amounts than controls. Two trials obtained a lesser hazard of preeclampsia and additional two trials obtained no alteration in the hazard of gestational diabetes linked to addition of vitamin D. Furthermore, three trials uncovered that adding vitamin D with calcium decreased the hazard of pre-eclampsia. Hence, pregnant women who were given vitamin D indicated to considerably greater amounts of 25(OH)D at delivery than to control group [12].

A search was performed to revise an earlier meta-analysis on the consequences of oral vitamin D supplementation. Data obtained from seven trials comprising of 868 women indicate that pregnant women who were given vitamin D had substantially greater amount of 25(OH)D than controls. Two trials obtained a lesser hazard of preeclampsia and additional two trials uncovered no variation in the hazard of gestational diabetes linking vitamin D addition. Also, three trials obtained that adding vitamin D with calcium decreased the threat of preeclampsia. Therefore, pregnant women who were given vitamin D directed to substantially greater amounts of 25(OH)D at term than placebo, although findings were unpredictable [12].

In this controlled trial, women with a single pregnancy at 12-16 weeks' gestation were given 400, 2000 or 4000 IU vitamin D_3/day till delivery. No unpleasant situation arisen due to vitamin D complementation or distributing 25(OH)D levels. Vitamin D addition of 4,000 IU/day for pregnant women was secure and highly efficient in attaining adequacy for all women and their newborn child irrespective of race, whereas the present approximately average prerequisite was relatively useless at attaining sufficient circulating 25(OH)D, particularly in African-American women [13].

Data from seven trials with 868 female dependably demonstrate that females who took vitamin D supplements daily had greater 25-hydroxyvitamin D than females taking no intervention/placebo. Also, data from two trials with 219 female indicate that females who took vitamin D supplements might have a lesser chance of preeclampsia than those taking no intervention/placebo. Data from two trials with 219 female indicates a similar chance of gestational diabetes amongst those taking vitamin D extras or no intervention/ placebo. Data from three trials with 477 female indicates that vitamin D supplementation in pregnancy decreases the probability of preterm birth than no intervention/placebo. Data from three trials with 493 women also indicates that females who receive vitamin D additions in pregnancy less frequently had a baby with a birth weight less than 2500 g than those taking no intervention/placebo. There were no distinct alterations in caesarean section, stillbirths or neonatal deaths. Several proof showed that vitamin D complementation enlarges infant length and head circumference at birth [14].

This research was planned and instigated to investigate the consequence of vitamin D through the first and second trimesters during pregnancy in decreasing the hazard of gestational diabetes mellitus (GDM) in females who are at greater risk [history of GDM, birth macrosomia, family history, and BMI]. In another study 90 pregnant females who had minimum one risk factor for GDM were randomized into involvement (46 females) and control (44 females) clusters. Females in the trial section obtained 5000 IU of vitamin D per day and the control section obtained placebo till the 26th week of pregnancy. The results indicated that the instruction of vitamin D intake in the first and second trimesters during pregnancy was successful in lowering GDM and managing GTT and GCT [15].

Two vitamin D pregnancy supplementation studies which were undertaken in South Carolina suggest elevated quantities of supplemental vitamin D were linked with enhanced health results of both mother and newborn, comprising possibility of preterm birth (<37 weeks gestation). Although a recent report indicated a concentration of 20 ng/mL would be aimed, further current work implies best translation of 25(OH)D–1,25(OH)2D takes place at 40 ng/mL in pregnant female. By race and ethnicity, there was a 79% lesser chance of preterm birth amongst Hispanic female with 25(OH)D concentrations >40 ng/mL contrasted to those with 25(OH)D concentrations <20 ng/mL and a 45% lesser possibility amongst black female. There were less number of white female with low 25(OH)D concentrations for valuation. Women with serum concentrations >40 ng/mL in the mixed group had a 46% lesser degree of preterm birth generally with a 66% lower degree amongst Hispanic females and a 58% lesser amongst black females [16].

8.4 Vitamin D deficiency in numerous countries

To investigate vitamin D shortage and hazards amongst pregnant Chinese women, a cross-sectional study was performed from years 2010 to 2013 on 1985 healthy pregnant females. The median serum 25-hydroxyvitamin D was found to be 15.5 ng/ml, with 74.9% of women having vitamin D shortage (25-hydroxyvitamin D <20 ng/ml). Vitamin D deficit was widespread amongst pregnant Chinese women. Living in lo-

cations with lesser UVB amount elevated the dangers of vitamin D deficit, particularly for women having late gestation, for younger pregnant women and for women of Hui ethnicity. Thus, vitamin D complementation and practical sun contact should be urged, particularly in the winter [17].

Pregnant females in Asia, the Middle East, Africa and Latin America are at danger of vitamin D deficit and occurrence through these locations are amongst the topmost universally. The correlations of maternal vitamin D deficit in pregnancy with undesirable health consequences was examined through review. Incidence of vitamin D deficit varied from 51.3% to 100%. Ten studies showed minimum one substantial relationship connecting vitamin D deficit and negative maternal and/or neonatal health consequences comprising preeclampsia, gestational diabetes mellitus, postpartum depression, emergency cesarean section delivery, low birth weight babies, small for gestational age and stunting. Nevertheless most of these reports indicated no relationship with various health results. This study highlights the need to improve maternal vitamin D status in developing countries in an attempt to assist best maternal and child health consequences throughout these areas [18].

A cross-sectional analysis showing vitamin D levels of 1088 adult pregnant female were assessed in the United Arab Emirates (UAE). Data on vitamin D consumption was accessible in a sub-sample of 266 women presenting average serum 25(OH)D of 26.2 nmol/L, alongside 69% of women not being vitamin D sufficient (<30 nmol/L). Due to the elevated frequency of vitamin insufficiency in UAE, there is a need for involvements concentrating on complementation, protection and diet variation for averting health consequences during a crucial duration of growth [19].

One thousand pregnant women were enlisted through early labor from the King Khaled University Hospital, Riyadh, Saudi Arabia. Medical data of all contributors were obtained from their files while delivery, birth outcomes were recorded. Gestational diabetes mellitus (GDM) was the frequent problem sensed (11.1 %) while the rate of miscarriage was higher (24.5 %). There was no association between GDM and low 25(OH)D, but there was a substantial negative correlation concerning serum 25(OH)D concentrations and fasting blood glucose among females older than 35 years. Hypovitaminosis D, a common health issue amongst pregnant women in Riyadh, has a higher occurrence of miscarriage in women with low 25(OH)D [20].

8.5 Vitamin D deficiency and various illnesses

Total 110 patients were studied for vitamin D levels and related obstetrical difficulties and risk factors over a period of six months. Results showed 53 pregnant women had low vitamin D levels. Majority of patients were 21-30 years of age. Low birth weight babies (80%) were born to women with vitamin D deficiency. This study could not find a contributing relation linking low vitamin D level and unfavorable maternal and fetal results (e.g. preeclampsia, cesarean delivery, oligo and diabetes). A relationship was obtained vitamin D deficit and low birth weight babies [21].

Research in women with preeclampsia have indicated small amount of urinary excretion of calcium, low ionized calcium stage, higher amounts of PTH and low levels of 25(OH)D [22]. An association between maternal vitamin D defficiency (< 50 nmol/L) and increased risk of gestational diabetes [23], as well as the fact that vitamin D deficit is a neutral risk factor for bacterial vaginosis [24] have been found during pregnancy. Another study found that providing 4,000IU/day supplementation in pregnancy was linked with decreased hazard of mutual diseases (e.g. maternal infections, cesarean section and preterm delivery). [22],[23],[24],[25] A research indicated that cesarean delivery is 4 times more widespread in females with Vitamin D (<37.5nmol/L) in comparison to women with normal amounts of Vitamin D [26].

8.6 Vitamin D and birth mode

This study involved 52 nulliparous women over the age of 18 with singleton pregnancies. In summary, no substantial associations between vitamin D serum levels and gestational age at birth or infant birth weight. We did however find a strong correlation between early maternal pregnancy weight and vitamin D serum levels in the first trimester. The correlation was a strong, negative correlation. There was no connection between vitamin D serum levels in any of the 3 trimesters of pregnancy and birth mode. However, there was a compelling relationship linking early maternal pregnancy weight and greater odds of cesarean delivery. Knowing the effects of vitamin D during pregnancy and birth consequences can aid to promote healthy pregnancies, labor experiences, and birth outcomes for both the mother and infant involved. After analyzing the results from this study, it is apparent that nutritional counseling to promote optimal weight not only during pregnancy, but also before pregnancy may promote ideal pregnancy outcomes in regards to birth mode.

Recent findings suggest conflicting evidence between maternal vitamin D in pregnancy and difficult birth mode including operative birth and cesarean section. Pérez-López et al. reported no association between elevated distributing 25(OH)D levels and cesarean section [1]. Another recent study, measuring first trimester serum 25(OH)D levels in 995 women, found no substantial variation in serum level of those women who delivered vaginally and by those who delivered by either elective or emergency caesarean section [10]. Another study found that females with sufficient circulating vitamin D serum levels (≥30 ng/ml), had lower risk for caesarean section due to obstructed labor (non-elective or non-emergency) [4].

9 RECOMMENDATIONS

Endorsed regular quantities of vitamin D: While Holick endorses changeable quantities of vitamin D, founded on life stage and gender, the National Institutes of Health (NIH) suggests the subsequent regular vitamin D intake: (i) Infants (birth to 12 months): 400 IU (ii) Children (1 to 13 years) : 600 IU (iii) Teenagers (14 to 18 years): 600 IU (iv) Adults (19 to 70 years): 600 IU (v) Seniors (71 years and older): 800 IU (vi) Pregnant and breast-feeding women: 600 IU. In most countries, the monitoring of serum levels of 25(OH)D during pregnancy is not performed; however, it is suggested that women with one or more risk factors for vitamin D defecit be supervised of preg-

nancy during initial and middle stages [29]. Subsequently, the danger of vitamin D deficit during pregnancy would be decreased, also the negative consequences on the mother and the fetus. Still the suitable dose of vitamin D for supplementing pregnant women to inhibit vitamin D deficit stays as a mystery.

A meta-analysis research performed on grown-ups about vitamin D supplements with 2,000 IU/day and bone health exhibited that for every 1IU of vitamin D_3 consumed, there is a consequent upsurge of 0.016nmol/L in serum levels of 25(OH)D [29]. In spite of the partial indication on the consequences of vitamin D additions in pregnancy and its results for the mother's health and perinatal and early childhood outcomes, vitamin D supplementation (800-1,000 IU/day) was complimented by a defensive outcome in newborns with low birth weight [27], [28]. The Canadian Academy of Pediatrics (CAP) endorses supplementing with 2,000 IU/day during pregnancy and lactation [30]. In conclusion, vitamin D serum levels in pregnancy are a key problem, and the hindrance of vitamin D defecit in pregnant women and their newborns is fundamental and crucial.

10 Conclusion

It is vital to understand the important role vitamin D plays during pregnancy and also have proper knowledge about the risk factors. Pregnant women can use the recommended levels of vitamin D for the welfare of the maternal and neonatal health. Having good understanding of the pregnancy outcomes due to vitamin D deficiency can contribute to a better pregnancy experience and healthy output of the newborn.

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