Executive Summary

• Vitamin D levels can be determined by detecting 25(OH)D levels in the blood, but there is no consensus as to what levels determine deficiency & insufficiency.
• Deficiency is principally caused by inadequate sun exposure, with inadequate dietary intake being a common secondary cause. Major risk factors are shown below.
• Prevalence of deficiency among pregnant women in the US is anywhere between 5-89%, but it is consistently more prevalent among Black populations.
• Several maternal and child outcomes have been associated with low vitamin D levels during pregnancy.
• There is insufficient evidence to recommend routine screening or routine supplementation with vitamin D beyond what is found in prenatal vitamins.
• Those at high risk can be screened, and if found to be insufficient, most experts agree 1000-2000IU daily is safe.

Major Risk Factors for Vitamin D Deficiency[8,10]

<table>
<thead>
<tr>
<th>Limited Sun Exposure</th>
<th>Malabsorptive Syndromes</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern latitudes, regular use of sunscreen, extensive clothing</td>
<td>Cystic fibrosis, inflammatory bowel disease, short gut syndrome</td>
<td>Obesity, dark skin, aging, alcoholism, smoking</td>
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What is Vitamin D Deficiency?

A blood test that assesses levels of 25(OH)D can help determine if a person has a deficiency in Vitamin D, but there is some controversy about where to draw the line. According to the Institute of Medicine, a person is deficient if levels are below 12ng/ml and insufficient with levels between 12-20ng/ml. Sufficiency is defined as >20ng/ml and potential adverse effects can occur >50. The Endocrine Society, however, defines deficiency as <20, insufficiency as 21-29, and sufficiency as >30ng/ml with no maximum. [10]

What causes Vitamin D Deficiency?

While the main cause is inadequate sun exposure, inadequate dietary intake is an important secondary cause. Vitamin D is found naturally in fish and some plants, but is most commonly found in fortified foods such as milk, orange juice, yogurt, and cereal. [8] The Recommended Dietary Allowance is 600IU, and it is estimated that 43% of women in the US and Canada have intake levels that fall below recommended levels [10,2].

Who is affected?

Since different cutoff points are used for determining deficiency and since there is great variation by populations, the prevalence for deficiency has been estimated in the US to be between 5-89%, a wide range. [10] An NHANES study of pregnant and lactating women in the US 2001-2006 estimated that 72% had levels at or above 50ng/ml and only 7% had levels less than 30ng/ml. [7]

Aren’t prenatal vitamins enough?

No. Prenatal vitamins typically only contain 400IU of vitamin D, below the recommended amount, and deficiencies are reported despite widespread prenatal vitamin use. In one study in which 90% of pregnant women consumed prenatal vitamins, 29% of black women were deficient and 54% were insufficient; 5% of white women in the same study were found to be deficient while 42% were insufficient. [8]
The controversy around interventions and recommendations

There is no clear consensus for an acceptable target level of 25(OH)D in the blood during pregnancy. In addition, there is little evidence for what dose of vitamin D would be optimal for supplementation during pregnancy, if any. But considering the multiple poor maternal and child outcomes that have been associated with low maternal vitamin D levels during pregnancy, some have suggested that supplementation has the potential to produce significant benefits. [1]

One study found that supplementation with halibut liver oil (900IU vitamin D) starting at 20 weeks gestation reduced the odds of preeclampsia by 32%. Another study found that supplementation with 1200IU/day of vitamin D plus 375mg Ca started at 20-24 weeks reduced blood pressure but not preeclampsia. [8]

A large clinical trial compared supplementation with 400, 2,000, or 4,000 IU of vitamin D during pregnancy, but showed no benefit except an increase in 25OHD levels.

In another study women got 10,000IU of vitamin D daily. The infant’s blood levels of vitamin D were significantly higher in the supplemented group, and five infants in the control group had hypocalcemia while none in intervention group did. [7]

Two other randomized controlled trials compared supplementation with 2000 and 4000IU of vitamin D during pregnancy and no effect was found with intention to treat analysis; however, when outcomes were assessed by resultant serum vitamin D levels, there were reduced rates of hypertensive disorders, infections, and preterm births in the group with higher serum vitamin D. [10]

A Cochrane review in 2012 determined that there were too few studies of too low quality to determine the usefulness and safety of routine vitamin D supplementation during pregnancy, and they determined that more studies are needed.[4] Some authors suggest that studies are needed to assess markers for inflammation before, during, and after supplementation, and to determine specific recommendations by race and gestational age. [10]

Women who have been treated with doses as high as 200,000IU of vitamin D daily did not find any adverse effects in their infants, and no teratogenic effects have been noted according to one review. However, adverse effects have been shown in animal studies where high dose vitamin D is administered. [10]

The American College of Obstetricians and Gynecologists recommends against routine screening, but endorses screening for women at increased risk. If deficiency is identified, they contend that 1000-2000IU daily is most likely safe. [11]

Vitamin D & Breastfeeding

American Academy of Pediatrics recommends 400 IU of Vitamin D supplementation daily for exclusively breastfed infants [8]
Maternal and Child Outcomes Related to Vitamin D Deficiency During Pregnancy

Pre-eclampsia

Pre-eclampsia is a condition of pregnancy that consists of a compilation of high blood pressure and protein spillage into the urine. It affects 3-10% of pregnancies worldwide and can lead to fluid in the lungs, clotting problems, kidney failure, and subsequent heart disease. While studies have varying results, associations between preeclampsia and gestational vitamin D levels <20ng/ml have been confirmed in the U.S. [1,9]

Gestational Diabetes

A meta-analysis that pooled results from 10 studies on gestational diabetes and first trimester vitamin D status found that women with gestational diabetes had significantly lower 25(OH)D levels than women without the condition, and women with vitamin D insufficiency were found to have a pooled odds ratio of 1.49, or 49% greater odds of having gestational diabetes. [1]

Small For Gestational Age (SGA)

A Cochrane review found that women were less likely to deliver a baby below 2500g (Low Birth Weight) if they received vitamin D supplements during pregnancy. [4] Another meta-analysis showed a pooled OR of 1.85 demonstrating increased odds of small for gestational age infants among women who were considered vitamin D insufficient during the first trimester. [1,3]

Miscellaneous Child Outcomes

While many child outcomes have been linked to low maternal vitamin D during pregnancy, one review found convincing evidence for increased risk of maternal to child transmission of HIV as well as increased risk of rhinitis symptoms and eczema. Some studies also suggest reduced risk of development of Type I Diabetes in children whose mothers had adequate vitamin D, but a review specifically focusing on this outcome concluded that there was not enough evidence to confirm the association. [3,5] Interestingly, limited research suggests a potential link between low levels of vitamin D and the development of Autism Spectrum Disorders. [6]
Bibliography


