

How Maternal Vitamin D Status Impacts Preterm Birth Risk

Analysis by [Dr. Joseph Mercola](#)

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STORY AT-A-GLANCE

- › First trimester vitamin D levels significantly affect baby length and preterm birth risk, with every 10 nmol/L increase in maternal vitamin D corresponding to measurable increases in fetal length
- › Pregnant women with severe vitamin D deficiency (below 10 ng/mL) face nearly eight times higher risk of preterm birth and more than four times greater risk of developmental delays in their children
- › Vitamin D triggers production of natural antimicrobial substances that help protect against infections that could lead to preterm birth
- › Vitamin D plays a role in placental blood vessel development and helps control inflammation during pregnancy, directly impacting fetal brain development and overall pregnancy health
- › Strategic sun exposure is the optimal way to boost vitamin D, but care must be taken with timing and duration, especially for those consuming seed oils, which increase UV sensitivity

Research revealed 62% of pregnant women tested in the first trimester were deficient in vitamin D.¹ This concerning statistic underscores a major public health issue, especially considering that inadequate maternal vitamin D status is strongly associated with adverse pregnancy outcomes for both the expecting mother and her developing infant.

Indeed, the consequences of insufficient vitamin D during pregnancy are significant, ranging from conditions like preeclampsia and gestational diabetes to an increased risk of preterm birth. In fact, vitamin D is necessary for proper immune cell function and plays an important role during implantation and placental formation – foundational steps of a healthy pregnancy.

Further, vitamin D actively promotes the production of key growth factors for the early vascularization of the placenta, the very network that nourishes the growing fetus. It's also essential for the skeletal development of the baby and achieving a healthy birth weight. If you're expecting or planning a pregnancy, understanding the importance of vitamin D, and how to optimize your levels using safe sun exposure, will help give your baby a healthy start to life.

First Trimester Vitamin D Level Linked to Infant Length and Preterm Birth

A 2025 study published in *The American Journal of Clinical Nutrition* explored the relationship between a mother's vitamin D levels during pregnancy and the growth of her baby. Researchers specifically wanted to understand if and how vitamin D status in the first and second trimesters of pregnancy affect fetal growth patterns and various birth outcomes.

To do this, they followed a group of pregnant women, carefully measuring their vitamin D levels at different points during their pregnancies and then tracking the growth and health of their newborns. The key finding was that a mother's vitamin D status during the first trimester of pregnancy has a positive association with the length of her baby. Every 10 nmol/L increase in maternal vitamin D at that time coincided with a 0.05 rise in fetal length z-score – a modest but meaningful gain.

Further, low vitamin D status in the first trimester, specifically levels below 16 ng/mL (40 nmol/L), was associated with a higher risk for preterm birth. Preterm birth means a baby is born too early, before 37 weeks of gestation, which often leads to numerous health challenges for the newborn.

Second trimester vitamin D status did not appear to have a significant impact on fetal growth patterns or pregnancy outcomes in this study, highlighting how important vitamin D status is during the very early stages.

Why might first trimester vitamin D be so influential for a baby's length? The researchers propose that vitamin D plays a role in supporting the development of blood vessels in the placenta, particularly in early pregnancy.

By helping the formation of placental blood vessels in the first trimester, vitamin D could be setting the stage for healthy fetal growth, especially linear growth, which is so rapid during this time. This early boost in placental vascular development could be the reason why first trimester **vitamin D levels** seem to have this specific impact on a baby's length at birth.

Vitamin D Deficiency in Early Pregnancy Linked to Preterm Birth and Developmental Delays

A 2023 study published in *Heliyon* also explored the risks associated with vitamin D deficiency during pregnancy, especially when the deficiency is severe.² Researchers examined data from a cohort of 1,079 pregnant women, analyzing vitamin D levels measured in their first trimester and then tracking various health outcomes for both mother and child.

A significant portion of the women studied, about 26.7%, had a concerning low vitamin D level in their first trimester – less than 10 ng/mL (25 nmol/L).³ Women with these very low vitamin D levels had a notably higher chance of experiencing preterm birth. In fact, the adjusted odds ratio indicated a 7.78 times higher risk of preterm birth in this severely deficient group.

This means, according to this study, severe vitamin D deficiency in early pregnancy is strongly associated with an increased likelihood of delivering a baby too early.

Beyond preterm birth, this study also uncovered a link between severe vitamin D deficiency and developmental delays in children. The adjusted odds ratio here was 4.28, indicating that children in this group were more than four times as likely to experience delays in reaching developmental milestones compared to children born to mothers with vitamin D levels at or above 10 ng/mL.

Vitamin D's role in immune regulation and anti-inflammatory processes may be a key factor in these findings. Vitamin D is known to help regulate the immune system, reducing proinflammatory agents in the body. In pregnancy, maintaining a balanced inflammatory environment is incredibly important, particularly in the uterus.

Severe vitamin D deficiency disrupts this balance, contributing to chronic intrauterine inflammation that's been linked to late preterm birth – the type of preterm birth most strongly associated with vitamin D deficiency in this study.

Inflammation, especially in early pregnancy, also negatively impacts fetal brain development, which could contribute to the developmental delays observed in children. Therefore, ensuring sufficient vitamin D appears to be important for both reducing the risk of preterm birth and supporting healthy neurodevelopment in offspring.

Meta-Analysis Confirms Vitamin D Deficiency Elevates Preterm Birth Risk

The link between vitamin D and preterm birth has been known for some time. A 2016 meta-analysis published in the journal *Nutrients* systematically examined a significant body of work, pooling data from 10 observational studies that collectively involved over 10,098 pregnant women.⁴

What this large-scale analysis revealed is quite compelling: pregnant women who are vitamin D deficient face a significantly increased risk of preterm birth. The researchers defined vitamin D deficiency as levels below 20 ng/mL (50 nmol/L), a commonly used threshold for deficiency in conventional medicine, but one that's far below the 60 to 80 ng/mL of [vitamin D needed for optimal health](#).

The meta-analysis revealed that pregnant women with vitamin D deficiency are about 29% more likely to experience preterm birth compared to those with sufficient vitamin D. This is a noteworthy increase in risk, especially considering the serious health implications associated with preterm birth for newborns.

The consistency of this finding across multiple studies strengthens the evidence base, indicating that this is not just a chance occurrence, but a real and significant association.

Vitamin D is known to orchestrate both your acquired and innate immune responses, especially during the important interface between you and your developing baby – the fetal-maternal interface. Think of vitamin D as a conductor of the immune symphony in your placenta, ensuring all the immune players are working in harmony to protect the pregnancy.

Moreover, vitamin D is known to boost your body's ability to fight off bacteria by triggering the production of antimicrobial substances, like cathelicidin. These substances act as natural antibiotics, helping to ward off infections that could otherwise lead to preterm birth.

Preterm Birth Risk Declines as Vitamin D Levels Increase to a Threshold

A paper in the journal *Obstetrics & Gynecology* also provides insights into the connection between a mother's vitamin D levels and the risk of preterm birth.⁵

The researchers analyzed data from over 12,861 eligible women who had prenatal aneuploidy screening to detect chromosomal abnormalities in the fetus. From this large group, they selected a random sub-cohort of 2,327 women, and included all cases of preterm birth that occurred within the larger eligible group, resulting in 1,126 preterm birth cases for detailed analysis.

When they examined the overall incidence of preterm birth across different vitamin D levels, a clear pattern emerged: the incidence of preterm birth was notably different across the vitamin D categories.

They observed preterm birth rates of 11.3%, 8.6% and 7.3% among mothers with vitamin D levels of less than 20 ng/mL, between 20 ng/mL and 30 ng/mL (74.9 nmol/L) and more than 30 ng/mL, respectively. This trend was statistically significant, indicating a real association between higher vitamin D levels and lower rates of preterm birth.

After adjusting for various factors that could influence preterm birth risk, such as maternal race and ethnicity, pre-pregnancy body mass index (BMI), smoking status and other confounders, the risk of preterm birth significantly decreased as vitamin D levels increased. This decrease continued up to a certain point, approximately 36 ng/mL (90 nmol/L), after which the protective effect seemed to plateau.

Compared to mothers with the highest vitamin D levels, mothers with vitamin D levels below 20 ng/mL had a 1.8-fold greater risk of preterm birth. Even mothers with vitamin D levels in the range of 20 ng/mL to 30 ng/mL faced a 1.4-fold higher risk compared to those with the highest levels.

This pattern held true not only for overall preterm birth risk, but also when the researchers looked at subtypes of preterm birth, including both spontaneous preterm births (those that occur on their own) and medically indicated preterm births (those induced for medical reasons), as well as births occurring even earlier, before 34 weeks of gestation.

How to Optimize Your Vitamin D Levels During Pregnancy

Given the strong evidence highlighting the importance of [vitamin D for a healthy pregnancy](#) and to reduce your risk of preterm birth, it's important to take proactive steps to ensure you're getting enough. While vitamin D supplements are an option, the most effective and natural way to boost your vitamin D levels is good old sunlight.

Interestingly, many benefits we attribute to vitamin D itself likely come from the healthy sun exposure that leads to higher vitamin D levels.

Think of your vitamin D status as a marker, showing you're getting the right amount of sun exposure. However, I must caution you about sun exposure during peak hours if you consume dietary seed oils. These oils, unfortunately rampant in processed and fast food, are packed with **linoleic acid** (LA). When LA accumulated in your skin interacts with the sun's ultraviolet (UV) rays, it triggers inflammation and DNA damage.

If you're regularly eating these oils, like most Americans, you need to be extra mindful about how you approach sun exposure. Don't worry, though, you can still enjoy the sun safely; it just requires a bit of strategy. Here are some steps toward that end and to help optimize your vitamin D levels during pregnancy:

- 1. Reduce seed oil intake** — Start by eliminating processed foods made with soybean, corn, canola or any other “vegetable” oils. Think of snack foods, fast food, most restaurant meals and many store-bought dressings. Stick to healthier fats like tallow, grass fed butter and ghee.
- 2. Embrace sunlight strategically** — It's best to avoid direct sunlight during peak hours (10 a.m. to 4 p.m.) until you've cut back on seed oils for six months. This gives your body time to clear some of the accumulated LA. Since body fat stores LA, individuals with higher body fat percentages should also use additional caution, as those stored oils prolong the risk period even after dietary changes.
- 3. Use the sunburn test** — To gauge safe sun exposure, perform a simple “sunburn test.” Pay very close attention to your skin as you're in the sun. You're aiming to stay just below the point where your skin starts to turn even slightly pink. Any redness at all is a signal to get out of the direct sun, so avoid getting a sunburn — that's a sign of damage, not benefit.

Everyone's skin is different, and factors like your skin tone and your body composition influence how much sun is right for you. If you have darker skin, you'll

need to spend a more time in the sun to produce the same amount of vitamin D as someone with lighter skin.

- 4. Consider extra protection if needed** – If you find yourself needing to be in the sun during peak hours, especially in the first six months after reducing seed oils, there are some excellent protective strategies available. **Astaxanthin** supplements are useful for boosting your skin's natural resistance to UV rays from the inside out.

Applying a topical niacinamide cream before sun exposure is another smart move, as it protects your skin cells from UV-induced DNA damage. Even a baby **aspirin** taken before sun exposure helps prevent LA from turning into harmful oxidized metabolites when they interact with sunlight.

- 5. Supplement wisely when sunlight isn't enough** – Depending on where you live or the season, getting regular sun exposure can be challenging. In those cases, **vitamin D3 supplementation** is often necessary, especially during pregnancy. Your goal is to reach and maintain optimal vitamin D levels, ideally between 60 to 80 ng/mL (150 to 200 nmol/L).

The best way to know if you're in this range is to get your vitamin D levels tested. I recommend doing this twice a year. Based on your test results, adjust your sun exposure or your supplement dose. Regular monitoring is key to keeping your vitamin D level in that sweet spot and supporting a healthy pregnancy.

Frequently Asked Questions About Vitamin D and Pregnancy

Q: Why is vitamin D so important during pregnancy?

A: Vitamin D isn't just about bone health; it plays a central role in many processes involved in a healthy pregnancy. It's essential for your immune system to function properly, which is important for implantation and placenta formation early in pregnancy.

Vitamin D also helps produce growth factors that build the placenta's blood vessels, ensuring your baby gets the nutrients needed to grow. Plus, it directly supports your baby's bone development and healthy birth weight.

Q: How does vitamin D deficiency affect my baby's growth?

A: Research shows that your vitamin D levels in the first trimester are particularly important for your baby's length at birth.⁶ If you have sufficient vitamin D early in your pregnancy, your baby is more likely to be longer. Interestingly, first trimester vitamin D mainly seems to affect length, not weight or head size.

Q: What is the link between vitamin D deficiency and preterm birth?

A: Multiple studies and a large meta-analysis confirm that vitamin D deficiency increases the risk of preterm birth.⁷ Severe vitamin D deficiency, in particular, is linked to a significantly higher risk of delivering your baby too early. Vitamin D helps regulate your immune system and reduce inflammation, which protect against infections and conditions that lead to preterm birth.

Q: What vitamin D level should I aim for during pregnancy?

A: Aim for optimal vitamin D levels between 60 and 80 ng/mL. It's a good idea to get your vitamin D levels tested, ideally twice a year, to understand your status and make adjustments as needed.

Q: How can I best optimize my vitamin D level?

A: Sunlight is the most natural and effective way to boost your vitamin D level. Try to get regular sun exposure daily. However, be mindful of your intake of dietary seed

oils, common in processed foods, as they make your skin more susceptible to sun damage. Consider reducing these oils in your diet for six months before spending time in the sun during peak hours.

If needed, use protective measures like astaxanthin, topical niacinamide or baby aspirin if you're in the sun from 10 a.m. to 4 p.m. before your body has cleared stored seed oils. When sunlight isn't enough, vitamin D supplements are helpful, especially during pregnancy.

Sources and References

- ^{1, 2, 3} [Heliyon September 2023, Volume 9, Issue 9, e19367](#)
- ^{4, 7} [Nutrients. 2016 May 20;8\(5\):301](#)
- ⁵ [Obstet Gynecol. 2015 Feb;125\(2\):439-447](#)
- ⁶ [The American Journal of Clinical Nutrition February 2025, Volume 121, Issue 2, Pages 376-384](#)