**////Title: Changes in Maternal Vitamin D Levels Throughout Pregnancy and Across the Seasons**

**////Stand-first**:

Maternal nutrition plays a major role in reducing pregnancy complications and improving infant and child health. Vitamin D is important during pregnancy as it helps the baby’s heart, bones, teeth and nervous system develop properly. Low levels of vitamin D in pregnancy have been linked to a number of problems and conditions. Dr Pal Bela Szecsi and his team at Copenhagen University Hospital in Denmark have been investigating vitamin D concentrations throughout normal pregnancy and in relation to possible complications.

**////Body text:**

Vitamin D is taken into the human body in two main forms: vitamin D3, which makes up 95% of vitamin D in humans and is primarily produced in the skin by UVB radiation from sunlight; and indigested vitamin D2, which constitutes the remaining 5%, and is only available from foods such as fish, eggs and red meats, although some foods such as cereals and spreads may be fortified to contain more vitamin D.

During pregnancy, the need for vitamin D is increased, with low levels being associated with maternal complications such as preeclampsia and gestational diabetes, as well as infant conditions such as impaired neurological development, low birth weight, asthma, and recurrent wheezing. Due to this association, a vitamin D rich diet or supplementation is recommended for pregnant women. Current recommendations in Denmark suggest that pregnant women should have blood vitamin D levels of at least 75 nanomoles per litre.

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Dr Pal Bela Szecsi at Copenhagen University Hospital, Denmark, worked with colleagues to conduct one of the world’s first studies investigating vitamin D concentrations during pregnancy in healthy women. They looked at changes in vitamin D levels throughout pregnancy as well as across the different seasons and investigated if vitamin D levels were linked with pregnancy complications such as gestational diabetes, preterm birth and caesarean section.

This study is particularly interesting as it took place in Denmark, a country with predominantly fair-skinned Caucasians, which, due to its far northerly location, receives limited sunlight in the winter months, and where few food products are currently fortified with vitamin D.

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The team collected 3,304 blood samples from 694 healthy women across the duration of their pregnancies and for two days after giving birth. They then tested the concentrations of both forms of vitamin D in these samples using liquid chromatography tandem mass spectrometry, the gold standard laboratory test. Statistical analyses were used to see if vitamin D concentration in maternal blood was associated with factors such as season, gestational age (how far along the pregnancy was), possible vitamin D-linked complications, and the mother’s age, body mass index (BMI), number of previous births and social class.

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The results of this study are intriguing. Dr Szecsi and his team found that nearly all the women in this study had vitamin D levels below the recommended level all year round, with the average overall vitamin D concentration being 54.6 nanomoles per litre which is well below the suggested value of 75 nanomoles per litre. The team also discovered that women with possible vitamin D-linked complications during pregnancy and those who had a caesarean section actually had slightly higher vitamin D levels than those with no complications and those with vaginal births.

The researchers found that blood taken in summer and autumn contained significantly higher levels of vitamin D than blood taken in winter and spring, with only 9% of samples in winter and spring containing more than the suggested value. This difference is likely to have come from changes in the amount of vitamin D3 produced by sun radiation to the skin, as levels of vitamin D2 were stable across the seasons.

The researchers also discovered that overall vitamin D concentration varied significantly with gestational age, with the highest vitamin D levels seen in weeks 21 to 34 of the pregnancy, and the lowest in the two days following delivery. The team found that as a woman’s BMI went up, her vitamin D levels went down, and interestingly the more children a mother had given birth to, the lower her vitamin D levels were. Maternal age, social class, smoking status and the mode of conception were not found to be associated with vitamin D levels.

The team’s results are supported by previous studies by other groups which also found low levels of vitamin D in pregnant women in northern Europe. The findings of Dr Szecsi’s study contradict the assumption that vitamin D levels should be above 75 nanomoles per litre to decrease the risk of pregnancy complications.

Another large, high-quality study found that taking vitamin D supplements during pregnancy did increase vitamin D levels in the blood but did not reduce maternal complications or improve growth. Together with Dr Szecsi’s study, these results could imply that there is a vitamin D threshold; as long as the mother and unborn child have enough vitamin D then increasing the concentration will not improve their health or reduce the risk of pregnancy complications.

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Improving the health and wellbeing of mothers and children is an important public health goal, with nutrition during pregnancy playing a significant role. This study provides important information about the levels of vitamin D needed for a healthy pregnancy in Caucasian women, and now, studies in other geographical areas with other populations are needed to provide a more rounded overview. Dr Szecsi and his colleagues state that the impact of vitamin D in pregnancy on the long-term health of children needs further research, as does the importance of vitamin D levels before conception on foetal development.

Dr Szecsi’s study is one of the first of its kind to look at variation in vitamin D levels across the duration of pregnancy in relation to the seasons. In doing so, it provides valuable information about the impact of variation in vitamin D levels in regard to pregnancy complications in this Danish population. Critically, the findings that low levels of vitamin D in pregnancy are not associated with pregnancy complications, suggest that the Danish guidelines for vitamin D in pregnancy require updating.

This SciPod is a summary of the paper ‘Variation in plasma 25-hydroxyvitamin D2 and D3 in normal pregnancy with gestational age, sampling season, and complications: A longitudinal cohort study’ from PLOS One. DOI: <https://doi.org/10.1371/journal.pone.0231657>

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