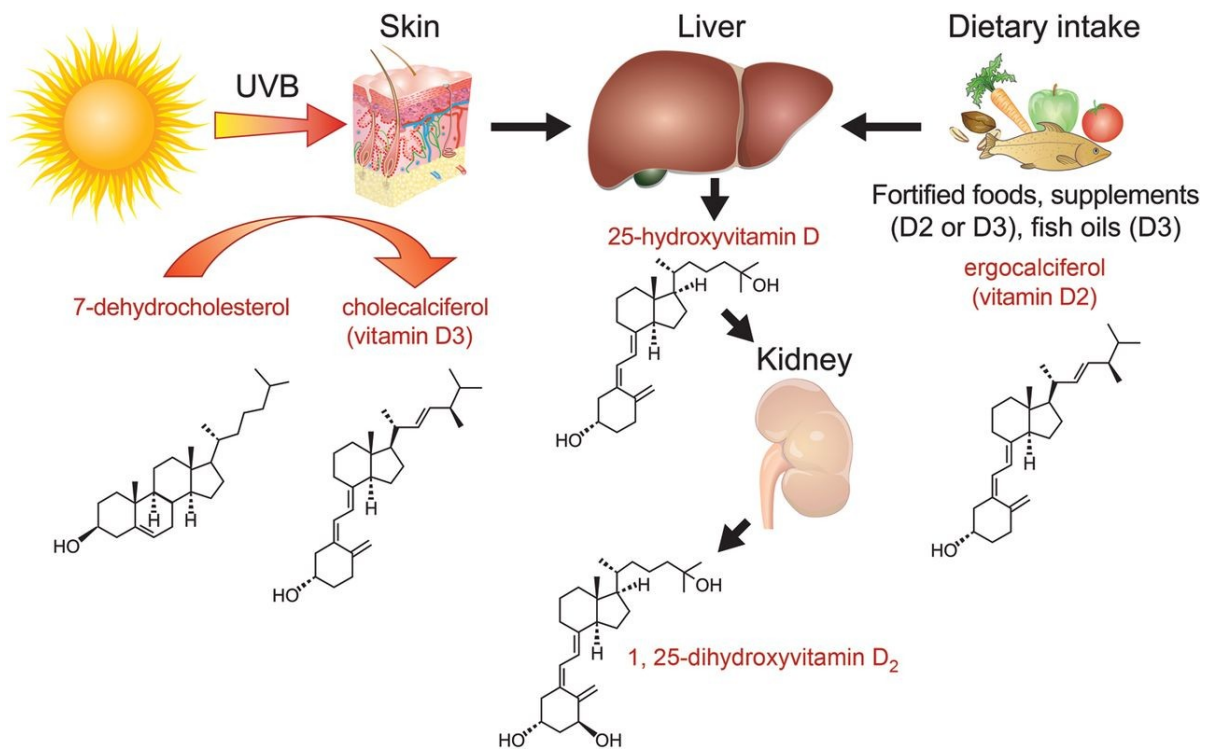


Vitamin D deficiency in pregnancy and early childhood

Actually Vitamin D is not a vitamin but a strong steroid hormone that acts on almost every cell in the body and participates in numerous vital processes. It is important to clarify that vitamin D deficiency is hormone deficiency and its consequences are further more harmful than any vitamin deficiency for the body. Vitamin D is unique among hormones as it is produced in the skin under ultraviolet B radiation. Epidermis naturally contains cholesterol and when UVB strikes the skin cholesterol is converted to cholecalciferol - Prohormone vitamin D. Cholecalciferol is biologically inert and requires further activation in the liver and kidneys. First step of activation takes place in the liver and 25(OH)D₃ is produced; then it is transported into kidneys where final process of activation produces 1,25(OH)₂D an active vitamin D or hormone D. It is also called calcitriol.



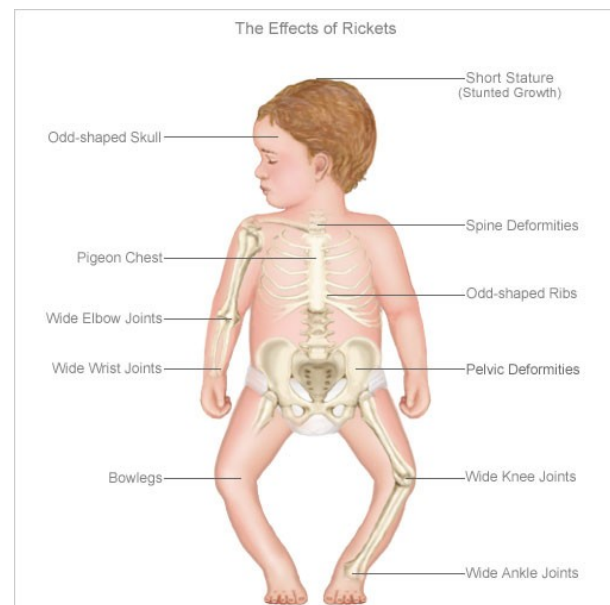
Everybody knows that vitamin D is important for calcium and phosphate homeostasis, strong bones and healthy teeth, but few may know that it is essential for proper function of most organs and organ systems, including: immune system, endocrine glands, insulin production, regulation of blood pressure, reproductive system and fertility as well as neuromuscular strength, psycho-emotional field and general well-being. Vitamin D acts as an inducer and repressor of various genes and regulates more than 500 genes' expressions. Therefore its deficiency is associated with many different diseases, such as: various metabolic diseases, autoimmune derangement, neurological and neuromuscular disorders, psychiatry and several types of cancers, also cardiovascular system disorders and reproductive system diseases.

Sunlight is the best and most natural source of vitamin D. Very few food naturally contain or are fortified with vitamin D. We can ingest maximum 10% of vitamin D from food to meet recommended daily requirements, other 90% we produce endogenously with the help of the UVB. Therefore vitamin D deficiency is mainly caused by inadequate sun exposure and/or using the sunscreens with $SPF \geq 30$. Breastfeeding infants and children in early childhood can take vitamin D by two sources: mother's milk or supplementation. Only 10% of mother's vitamin D is transported into milk thereby mother should take high doses of vitamin D every day to sufficiently supply baby with adequate amount of it; Or infants and children in early childhood up to 2 years should take vitamin D supplementation under medical doctor's recommendation, including summer periods too.

Pregnancy and lactation, as well as early childhood, represent high risk factors for vitamin D deficiency. Therefore screening and adequate supplementation when needed, is crucial for normal course of pregnancy and fetal development. Vitamin D deficiency is mainly asymptomatic. The only way to confirm and diagnose vitamin D deficiency is to measure $25(OH)D_3$ level in the blood. The test does not need fasting or any kind of special preparation.

During the first and second trimesters, the fetus is developing most of its organ systems and laying down the collagen matrix for its skeleton. During the last trimester fetal skeleton calcification is taking place, therefore maternal demand for calcium is increased. To meet this demand, during whole pregnancy mother's kidneys, as well as placenta, produce increased amount of active vitamin D. Circulating concentrations of $1,25(OH)_2D$ gradually increases according to trimesters, reaching its maximum in third trimester, that reflects its responsibility for enhancing intestinal calcium absorption during pregnancy.

Vitamin D deficiency may have harmful and deleterious consequences during pregnancy and early childhood. Vitamin D deficiency increases the risk of preeclampsia, preterm delivery, cesarean section, spontaneous abortion, low birth weight and gestational diabetes for pregnant women. And for infants vitamin D deficiency may have even worse results. Infants whose mother's had a severe vitamin D deficiency may have inborn rickets. Also in early childhood, vitamin D deficiency may cause rickets, that is characterized by softening of bones and its deformities. These children are often found to have started walking late and prefer to sit down for longer periods. The link between vitamin D deficiency and rickets is very clear and has been known



for a long time. However very recent data shows us that vitamin D deficiency during pregnancy and early childhood may be far more dangerous than we could imagine.



Recently conducted studies show an association between developing a type 1 diabetes in adulthood and vitamin D deficiency during pregnancy and early childhood. Infants, who have vitamin D deficiency during pregnancy and first year after birth, are at increased risk for developing type 1 diabetes later in life. In one study that was done in Finland, infants who received particular dose of vitamin D during the first year of life, reduced their risk of developing type 1 diabetes in the ensuing 31 year by 88%. Vitamin D deficiency has negative impact on immune system in terms of decreasing its ability to fight against infections. There is strong correlation between frequent oral and respiratory tract infections and vitamin D deficiency in childhood. In one Japanese study children who received particular amount of vitamin D from

December through March compared with placebo, reduced their risk of influenza A by 42%. Vitamin D is essential for cardiovascular health in children and adolescents. African-American normotensive children who received high dose compared with low dose of vitamin D for 16 weeks in a randomized controlled trial had significantly lower arterial wall stiffness. Many observational studies confirm that children whose mothers were vitamin D deficient are more prone to develop autoimmune and neurological disorders later in adulthood including such serious diseases as: multiple sclerosis, asthma and autism.

Obviously we know only a small piece of the puzzle what vitamin D deficiency may cause during pregnancy and what consequences it may have later in life. To answer these questions larger and better organized randomized controlled trials are needed. Before it is done we should try to diagnose and treat vitamin D deficiency during pregnancy and early childhood on time to avoid its known and potential harms and gain its skeletal and non-skeletal benefits.

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