STUDY OF VITAMIN D IN CHILDRENS UPTO THE AGE OF 18 YEARS

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ABSTRACT

Objectives:1) To determine the Vitamin D in children up to age of 18 years

Methods: A prospective observational study was done from June 2019-Feb 2020 from 0 to 18 years of children's

Results: Severe Vitamin D deficiency may cause rickets in infants and children However, subclinical vitamin D deficiency is more prevalent, and it is associated with falls or fractures. It has been observed that maximum children with rickets were breastfed, breast milk contains less vitamin D

Conclusion: Vitamin D is an essential nutrient not only important in bone health but also beneficial to many other systems. Therefore, Pediatricians should provide information to patients who are at higher risk for vitamin D deficiency on how to get sufficient dietary or supplemental vitamin D.

Key words: Vitamin D, Rickets, AAP, Calcium

INTRODUCTION

Vitamin D deficiency also cause rickets in children. However, vitamin D deficiency is more prevalent, and it is associated with falls or fractures. It has been observed that 97% children with rickets are breastfed, because breast milk contains less vitamin D. The American Academy of Paediatrics 2008 recommended infants who were exclusively or partially breastfed required 400 International Units Vitamin D daily from the first few days of life. Vitamin D are present all over the body, less vitamin D levels may affect skeletal defects and immune dysfunction. The present study discusses vitamin D effects, the possible risk factors leading to vitamin D deficiency, and the recommendations of vitamin D requirements. It is known that vitamin D can also be obtained by sun exposure and limited natural dietary sources. Many Paediatricians recommend vitamin D supplementation to achieve plasma concentration. Rickets, a condition with impaired mineralization of bone tissue and growth plates, may result in weak bones in infants and children .McCollum et al. coined the term "Vitamin D" in papers suggesting the existence of a vitamin which promotes calcium deposition.[1].Few foods naturally contain vitamin D (oily fish, such as sardines, herring, tuna,

mackerel, salmon, and cod liver oil, egg yolks, shiitake mushrooms, liver or organ meats), so dermal synthesis after ultraviolet-B (UVB) radiation remains the major route to obtain vitamin D, accounting for 90% of vitamin D replenishment.[2] Cholecalciferol (vitamin D3) is from animal sources and ergo-calciferol (vitamin D2) is from plants.[3]

METHODS

First, it undergoes 25-hydroxylation in liver to 25(OH)D (calcidiol), the major circulating form of vitamin D, Then it is converted in kidneys through 1-alpha-hydroxylation to its most active form, $1,25(OH)_2D$ (calcitriol), This process is driven by parathyroid hormone (PTH) and other mediators, including hypophosphatemia and growth hormone.[4,5] It functions through a vitamin D receptor (VDR) that is universally expressed in nucleated cells. Its important biological role is enterocyte differentiation and intestinal calcium absorption which facilitate calcium homeostasis. At the time of hypocalcaemia, the plasma level of ionized calcium falls and this is detected by parathyroid gland calcium receptors. PTH is secreted by parathyroid gland, which stimulates 1-alpha-hydroxyl-ation in kidneys to make more $1,25(OH)_2D$ from circulating 25(OH)D. The elevation of $1,25(OH)_2D$ increases calcium transport within intestines, bones, and kidneys, and further regulates the osteoblast and osteoclast activity.

RESULTS

Vitamin D deficiency may result in inadequate circulating 25(OH)D, which decreases $1,25(OH)_2D$ synthesis and calcium absorption, elevating PTH levels. Rickets is caused by Vitamin D deficiency in children. Discovery of vitamin D Metabolism and bioactivity of vitamin D Skeletal and extra-skeletal effects of vitamin D Vitamin D and bone health Can vitamin D prevent falls and fractures? Vitamin D Need in Pregnancy and Lactation Vitamin D and immune system Vitamin D and other systemic effects Vitamin D deficiency Definition of vitamin D deficiency Risk factors of vitamin D deficiency Recommended vitamin D requirement Vitamin D supplementation Vitamin D intoxication and complications Risk factors of Vitamin D deficiency. Inadequate cutaneous vitamin D synthesis, Dark skin, Age (infants, adolescents and elderly) Obesity, Physical blocking of ultraviolet-B exposure (clothing, using of sun screens),Geographic-related factors (higher latitude, winter season, lower altitude),Inadequate dietary intake of vitamin D Unbalanced diet, Malabsorption syndrome, Intestinal malabsorption (Celiac disease, Crohn's disease, ulcerative colitis),Pancreatic insufficiency (Cystic fibrosis) Cholestasis syndrome (Biliary atresia), gut resection (short bowel syndrome) Perinatal factors, Maternal vitamin D deficiency during pregnancy Prematurity, Exclusively breastfed beyond three to six months of age Genetic or endocrine disorders, Hyperparathyroidism, growth hormone deficiency, diabetes mellitus, Hereditary resistance of vitamin D Medications

DISCUSSION

Studies Indicated the connection between maternal vitamin D deficiency and high risk pregnancy births.[6] A Cochrane systematic review in 2016 identified that regular or irregular intervals vitamin D supplementation in pregnant women increases Vitamin D levels at term and decreases the incidence of premature birth deliveries, even though the

standard of the evidence was low to moderate.[7] However, Vitamin D and calcium may increases the risk of premature birth.[7] With very less evidence available to evaluate the benefits and harm of vitamin D supplementation during pregnancy, this intervention is not recommended by the WHO as routine antenatal care.[8] However, Oxford University Hospital put forward for consideration that the decision of maternal vitamin D supplementation should be discussed with all pregnant and breastfeeding women.[9] High dose of vitamin D (1000 IU per day) in combination with calcium (1000 mg calcium daily) is indicated in high-risk pregnant women . Recently, a meta-analysis also demonstrated that vitamin D supplementation during pregnancy could reduce the risk of small-for-gestational-age infants and improve infant growth after birth.[10] Further guidelines and recommendations for optimal serum 25(OH)D level in pregnancy, timing of vitamin D supplementation, and dosing safety and efficacy should be established. As for breastfeeding women, a report in 2006 showed that higher maternal vitamin D intake (4000 to 6400 IU per day) might achieve sufficient vitamin D concentration in breast milk for exclusively breastfed infants.[11] Elsewhere, it was found to be more efficient to give at least 400IU daily for exclusively breastfed infants.[12] The best indicator of human body's vitamin D status is the concentration of serum 25(OH)D. The optimal 25(OH)D level for either skeletal or extra-skeletal health varies for different populations. In children, optimal vitamin D status is based upon clinical evidence for rickets or bone turnover, such as elevation of serum ALP. The consensus for adequate 25(OH) D concentration in children has not yet been established because of inconsistent evidence. The definitions for vitamin D status are summarized in 1. In 2008, the American Academy of Pediatrics (AAP) classified 25(OH) D > 20 ng/mL as sufficiency, whereas the Pediatric Endocrine Society used a higher threshold in 2011, regarding 25(OH)D < 30 ng/mL as insufficiency. More recently in 2016, the Global Consensus also defined 25(OH)D > 20 ng/ mL as sufficiency but adjusted other criteria.[13]

Table 1: Vitamin D Deficiency in Children up to the age of 18 Years

25(OH)D (ng/mL)	American Academy of Pediatrics (2008)	Pediatric Endocrine Society (2011)	Global Consensus (2016)
Severe deficiency	<5		
Deficiency	5 to 15	< 20	< 12
Insufficiency	16 to 20	< 30	12 to 20
Sufficiency	21 to 100		< 20
Excess	101 to 150		
Intoxication	>150		< 100

In 2010, the IOM committee assumed only minimal sun exposure when establishing daily dietary intake requirements for calcium and vitamin D.[14] Upper limits of intake indicate the level above which vitamin D may be risky for toxic or adverse events. The Recommended Dietary Allowance (RDA) of vitamin D for infants up to 12 months is

400IU daily, and 600IU for children of 1 to 18 years. Even infants born to excess vitamin D levels mothers become vitamin D deficient after 6-8 weeks of life, if supplemented during infancy. AAP recommends food or vitamin D supplementation should be preferable. Therefore, AAP and Lawson Wilkins Pediatric Endocrine Society suggests infants who are exclusively breastfed or partially breastfed requires 400 IU to 1000 IU vitamin D daily beginning first few days of life. This should be continued till infants should feed on greater than 1000 ml per day of vitamin D-fortified food. Most of the infant formula's food contains at least 400 IU/ L of vitamin D, formula-fed infants may also need vitamin D supplementation till they consume above 1000 mL per day. As for obese children or those on chronic medications, requirements may be 2 to 4 times more. In 2010, the European Society of Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) Committee on Nutrition updated a guideline for preterm infants, suggesting 800 to 1000IU of vitamin D, 110 to 130 mg of calcium and 55 to 80 mg of phosphorus per day, as essential for pre-term bone health.[15] Later in 2013, an expert report from the AAP recommended 200 to 400IU vitamin D daily in very-low-birth-weight preterm (<1500 g), and 400IU in babies weighing >1500 g. This lower dosage is adjusted according to smaller size of preterm babies and relatively lower need of vitamin D to achieve adequate 25(OH)D levels.

Table 2 : Dietary reference intake for calcium and Vitamin D by Institute of Medicine.

Age group	Calcium Recommended dietary allowance(mg/day)	Calcium Upper intake level (mg/day)	Vitamin D Recommended dietary allowance (IU/day)	Vitamin D Upper intake level (IU/day)
0 to 6 mo	200	1000	400	1000
6 to 12 mo	260	1500	400	1500
1 to 3 year	700	2500	600	2500
4 to 8 year	1000	2500	600	3000
9 to 18YR	1300	3000	600	4000

CONCLUSION

Vitamin D is an essential nutrient not only important in bone health but also beneficial to many other systems. Therefore, Pediatricians should provide information to patients who are at higher risk for vitamin D deficiency on how to get sufficient dietary or supplemental vitamin D. Trials assessing the effects of vitamin D supplementation and establishing the optimal serum level of 25(OH)D are ongoing.

Conflict Of Interest

Nil.

Ethical Approval

The study was approved by the Ethics Committee of Pediatric Department, Prathima institute of medical sciences Karimnagar.

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