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EAP STATEMENT

Vitamin D in European children—statement from the European Academy of Paediatrics (EAP)

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Abstract Vitamin D is synthesized in human skin upon sun exposure and is also a nutrient. It regulates calcium and phosphate metabolism and is essential for the maintenance of bone health. Vitamin D supplementation during infancy, in order to prevent rickets, is universally accepted. Many human cell types carry vitamin D receptor, this being a drive for conducting studies on the possible association between vitamin D status and other diseases. Studies have affirmed that a considerable number of healthy European children may be vitamin D deficient, especially in high-risk groups (darker pigmented skin, living in areas with reduced sun exposure and other disorders). However, the definition of deficiency is unclear due to inter assay differences and due to a lack of consensus as to what is an "adequate" 25(OH)D level. Therefore, there is no justification for routine screening for vitamin D deficiency in healthy children. An evaluation of vitamin D status is justified in children belonging to high-risk groups. All infants up to 1 year of age should receive an oral supplementation of 400 IU/day of vitamin D. Beyond this age, seasonal variation of sunlight should be taken into account when considering a national policy of supplementation or fortification.

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Vitamin D requirements can be met by adequate sun exposure. However, it is also a nutrient that mainly regulates calcium and phosphate metabolism and is essential for the maintenance of bone health. Clinical research on vitamin D has been stimulated by the discovery that many human cell types carry the vitamin D receptor (VDR) and VDR may play a role in the regulation of cell proliferation and differentiation, for example, in cells of the immune system (T cells, macrophages, and monocytes). The plethora of vitamin D functions, as well as observational studies on the association between vitamin D status and diseases, are the reason why other health effects of Vitamin D have been proposed in children, including the prevention of immune-mediated diseases (asthma, type 1 diabetes mellitus), infectious diseases (respiratory infections, influenza), and cardiovascular disease. Interest in vitamin D has increased in recent years, and there have been many reports suggesting that vitamin D deficiency is common worldwide, including the Western world [4]. The aim of this statement is to help child health care providers in Europe to appreciate the clinical relevance of an adequate vitamin D status and to provide a practical approach to vitamin D supplementation.

Sources of vitamin D

The term vitamin D refers to its two major forms, vitamin D_2 (ergocalciferol) and D_3 (cholecalciferol). The skin is the major source of vitamin D, producing it via sun exposure, converting 7-dehydrocholesterol to vitamin D_3. Dietary sources of vitamin D are scarce and include mainly fatty fish and to a lesser extent egg yolk and nuts. Vitamin D supplementation to infants in order to prevent rickets is universally accepted and fortification of infant formulas is well established. In some European countries, certain foods are fortified with vitamin D, namely, milk, dairy products, margarine, breakfast cereals, and fruit juices.

In studies addressing vitamin D intake in European children, lower than recommended intake was documented [4].

Definition of vitamin D deficiency

The concentration of 25(OH)D is presently regarded as the best indicator of vitamin D status. However, considerable variability exists among the various assays available and among laboratories that conduct the analysis [7]. In addition, there is lack of consensus as to what are "adequate" serum 25(OH)D values. This lack of consensus stems from the scarcity of evidence correlating 25(OH)D concentrations with skeletal and non-skeletal health outcomes [1]. Furthermore, as discussed in the next paragraph, vitamin D measurement is difficult and may be inaccurate. The normative data for 25(OH)D concentrations in healthy populations does not take into considerations of factors as skin color, sun exposure, geographical latitude, and vitamin D dietary intake [7]. These considerations complicate the interpretation of vitamin D serum value in an individual healthy child.

Various cutoff points for the definition of vitamin D deficiency have been adopted by various organizations and different authors. ESPGHAN recommends the pragmatic use of a 25(OH)D serum concentration >50 nmol/L (20 ng/ml) to indicate sufficiency and a serum concentration of <25 nmol/L (10 ng/ml) to indicate severe deficiency [4].

Vitamin D testing in healthy children

The last decade has seen an explosion of widespread testing of vitamin D status. It is related to the vitamin's potential role in body regulatory systems, despite the uncertainty that surrounds the clinical significance of deficiency and the impact of supplementation. Reports from Australia, UK, Canada, and USA show an exponential rise in testing in recent years, which is claimed to be costly, confusing, and without credibility [2, 3, 9].

There is no justification for routine blood sampling screening for vitamin D deficiency in healthy children. An evaluation of vitamin D status is justified in situations at risk for significant vitamin D deficiency or bone disease: children with darker pigmented skin children, living in areas with reduced sun exposure, children with chronic liver/kidney disease or with malabsorption, dietary inadequacy, children with IBD, children on long-term parenteral nutrition, institutionalized children, and children receiving anticonvulsant medications. Testing must be done according to accepted laboratory criteria.

Health effects of vitamin D

The importance of vitamin D for bone health in infants and children is well established. Vitamin D supplementation in infancy prevents rickets and osteomalacia. Supplementation of vitamin D deficient children can result in increased bone mineral density. There is no evidence supporting vitamin D supplementation in children and adolescents with normal vitamin D concentrations to improve bone health.

Numerous epidemiologic observational studies have shown inverse associations of 25(OH)D concentrations with various non-skeletal diseases. However, randomized controlled trials of vitamin D supplementation in these conditions have yielded mixed results to date. Therefore, there is insufficient evidence to support vitamin D supplementation for other than skeletal health benefits in infants, children, and adolescents [4].

Recommendations for intake and supplementation in healthy infants, children, and adolescents

Vitamin D deficiency is evident throughout the European population at prevalence rates that are concerning [5]. Several studies performed in some European countries have affirmed that a considerable number of healthy European children and adolescents may be vitamin D deficient, especially in risk groups [4]. These groups include breastfed infants not adhering to the recommendation of supplementation, children with dark skin living in northern countries and children without adequate sun exposure.

Intake

Recommended dietary vitamin D intakes for children and adolescents without risk factors for vitamin D deficiency are:

- 400 IU/day during the first year of life
- 600 IU/day after the first year of life (1–18 years) [4, 8]

- Recommended vitamin D intakes for infants, children, and adolescents with risk factors for vitamin D deficiency are higher, and dosage depends on the disease (cholestatic liver disease, inflammatory bowel disease, bone disease, anticonvulsants) and the general risks for vitamin D deficiency (sun exposure, dark skin, etc.) [6, 8].

In accordance with the European Food Safety Authority, the upper limit of safety is set at 1000 IU/day for infants, 2000 IU/day for children ages 1 to 10 years, and 4000 IU/day for children and adolescents ages 11 to 17 years [4].

Supplementation

Healthy children and adolescents should be encouraged to follow a healthy lifestyle including a healthy diet with vitamin D-containing foods and adequate outdoor activities with associated sun exposure.

All infants should receive an oral supplementation of 400 IU/day of vitamin D. For children in high-risk groups, oral supplementation must be considered beyond 1 year of age. Seasonal variation of sunlight efficacy in vitamin D synthesis should be taken into account when considering supplementation. Therefore, every country should consider local factors involved in vitamin D status before adopting policies of supplementation (year-round, e.g., Nordic countries, UK, the Netherlands or winter, e.g., France, Austria, Germany) or food fortification (e.g., Nordic countries, UK) [10].

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