Does My Child Need Vitamins?

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Vitamin Use in the US

Almost $2 billion spent annually on vitamin and mineral supplementation.
3rd most common category of medication in the United States
Preparations for older children and adolescents are not regulated by the Food and Drug Administration
According the HANES 1999-2004, 34.2% of 2 to 17 year old children and adolescents have used vitamins in the previous 30 days, and almost half of children and adolescents took VM daily

AAP Recommendations

- Supplemental vitamins are expensive and probably unnecessary for the healthy child older than 1 year who consumes a varied diet. Milk from a well-nourished mother contains sufficient vitamins for the young, healthy, term infant except for vitamins K and D.
- A vitamin pill containing the RDA given to the child daily, although unnecessary, probably does no harm.
Case 1

A 5-year-old boy who recently was adopted from India is brought by his parents for his first physical examination. They report that he has been doing well except that he seems to bump into objects frequently, particularly in the evenings. On examination, his height and weight are below the 5th percentile. He has some silver-colored patches in his conjunctiva, but the rest of the examination findings are normal. A diagnosis is made clinically and treatment initiated.

Clinical Manifestations of Vitamin A Deficiency

- Follicular hyperkeratosis (dry and scaly skin of the extensor surfaces)
- Xerophthalmia (dry eyes)
- Bitot spots (foam like patches that appear on the conjunctiva)
- Night blindness

Vitamin A Deficiency

- Key functions are maintenance of proper vision, epithelial cell integrity and regulation of glycoprotein synthesis
- Leading cause of preventable blindness in children
- Lessens the risk of severe infections
- More likely present in malnourished children and infants in developing countries and children with inadequate absorption as seen in celiac disease, cholestatic liver disease, cystic fibrosis, fat malabsorption and low fat and protein diets.
- Great sources are found in human milk, cow milk, and commercial formulas; as well as in green leafy vegetables, carrots, sweet potatoes, and liver.

Vitamin A Supplementation

- Supplementation during measles infection has been demonstrated to decrease overall morbidity.
- Several studies have looked at the effects of neonatal supplementation and found little to no effect decrease in mortality, except for the mild decrease in the first 3 months of life.
- No difference of clinical symptoms of non measles infection.
Vitamin A Toxicity

- Increased intracranial pressure
- Carotenemia
- Painful joints
- Loss of hair
- Caffey warned that the hazards of Vitamin A poisoning from the routine prophylactic use of concentrates of vitamin A to healthy infants and children in the US are considerably greater than the hazards of Vitamin A deficiency in healthy infants and children not feed vitamin concentrates.
- Found in excess chicken liver consumption

Case 2

A 2-year-old African-American boy is brought to the pediatrician for a routine visit. He was born at 30 weeks’ gestation, was exclusively breastfed until 1 year of age, and has been a poor feeder since then. His height and weight are less than the 5th percentile. His legs are slightly bowed, and he has frontal bossing. He has no teeth and is not yet walking. Laboratory tests reveal decreased phosphorus, decreased calcium, and elevated alkaline phosphatase concentrations. Radiography of his wrists documents osteopenia, with cupping and fraying of the metaphysis.

Vitamin D Deficiency

- HANES III demonstrated high prevalence rate of vitamin D deficiency in industrialized nations, with up to 14% in the United States.
- Calcitriol is the biologically active form and stimulates the intestinal absorption of Ca and P, renal reabsorption of filtered Ca, and mobilization of Ca and P from bone.
- Synthesized in the skin by the action of ultraviolet light.
- More likely to present in gastrectomy, celiac disease, fat malabsorption, extensive bowel surgery, inflammatory bowel disease, cystic fibrosis, pancreatitis, and cholestatic liver disease. As well as medications such as steroids and anticonvulsants.

Clinical Manifestations of Vitamin D Deficiency

- Infants: seizures and tetany, hypotonia, failure to thrive, widened cranial sutures, frontal bossing, craniotabes
- Older children: delayed milestones, potbelly, bowlegs, hypotonia, pelvic deformities, delayed dentition, and widened wrist
- Rachitic rosary
- Harrison groove
- Osteomalacia
- Diagnosed with serum Ca, P, AP, PTH, 1,25 Vit. D, aminoaciduria, x-rays.
**Vitamin D Supplementation**

- AAP Guidelines: Daily intake of 400 IU a day
  - Breast feed and partially breast feed unless 1 liter of Vit D fortified milk or formula consumed
  - All infants less than 1 liter of milk/formula or fortified foods
  - Adolescents less than 400 IU with milk or foods such as cereals and eggs
  - Serum 25-OH-D should be >50 nmol/mL
- Sunlight exposure in white children: need 30 min/wk clothed only with diaper or 2 hours per week fully clothed with no hat

**Vitamin D Toxicity**

- Hypercalcemia
- CNS depression
- Nausea
- Diarrhea
- Nephrocalcinosis
- Nephrolithiasis
- No evidence supports the claim that vitamin D in amounts greater the 400 IU/d leads to improved bone mineralization
- Overuse in Great Britain and Europe after World War II in value of 1400 IU – 2000 IU lead to increase in idiopathic hypercalcemia of infants

**Vitamin E Deficiency**

- Potent antioxidant
- Found readily in green plants, vegetable oils, milk and eggs
- Deficiency rarely occurs except in patients with fat malabsorption, pancreatic deficiency, short bowel syndrome, cholestatic liver disease, and very low birth weight infants
- Deficiency is manifested by progressive neurologic disorder, truncal and limb ataxia, hyporeflexia, muscle weakness, double vision, and hemolytic anemia in preterm infants
- Rare toxicity but nausea, diarrhea and vitamin K antagonism have been reported
- Initially thought to play a role in prevention of cardiovascular disease but recently not shown to have beneficial effect

**Case 3**

An 8-day-old infant presents to a rural emergency department with his mother who today noticed bleeding from his umbilical cord and nares. The child was born at home and delivered by a midwife. The mother had received no antenatal care, and this is the first time the child is being seen by a doctor. The history revealed significant bleeding with clots. On examination, the child exhibits slight tachycardia but has a normal respiratory rate and blood pressure. He has constant bleeding from the umbilical cord area and his nares. He has no other rashes, and the rest of his physical examination findings are normal. Laboratory evaluation reveals a prolonged prothrombin and partial thromboplastin time, with a normal platelet count. A diagnosis is made and treatment given.
**Vitamin K Deficiency**

- Obtained from leafy vegetables, soybean oil, fruits, seeds, and cow milk
- Involved in the carboxylation of factors II, VII, IX, X, and proteins C and S. Also induces osteocalcin which is involved in bone mineralization.
- Effects are more exaggerated in preterm infants
- More likely present in children with liver or pancreatic disease.

**Clinical Presentation of Vitamin K Deficiency**

- Often between the 2nd and 7th day of life
- More common in breastfed infants because of the small amount of Vit. K in breast milk
- Inherent poor placental transport
- Decreased number of gut bacteria
- Often results in nose bleeds, GI bleeds, and bleeding from the umbilicus and circumcision site.

**Vitamin K Supplementation**

- AAP Recommendations:
  - All newborn infants 1.0 to 0.5 mg IM
  - Oral form is available outside of the US and 2mg at birth, repeated at one week, and at 4 weeks of age in breastfed infants.
- No evidence of increase risk of cancer with administration
- Toxicity is rare but has been associated with hyperbilirubinemia and hemolytic anemia

**Vitamin B1 (Thiamine) Deficiency**

- Occurs most frequently in those with IBD, celiac, anorexia nervosa, food faddisms and gastric bypass surgery
- Has been documented in breastfed infants whose mothers alcohol abuse hyperemesis gravidarum, and HIV
- Plays a role in nerve impulse conduction and voluntary muscle action
- Found commonly in yeast, legumes, pork and whole grains. Some also in milk, vegetables and eggs.
Clinical Manifestations of Thiamine Deficiency

- **Beriberi**
  - Dry (Wernicke encephalopathy)
    - Increasing weakness, muscle wasting, difficulty walking, ataxia, loss of reflexes, and painful paresthesias
  - Ophthalmoplegia, nystagmus, and ataxia
- **Wet**
  - Edema is hallmark feature accompanied with cardiomyopathy and congestive heart failure

Vitamin B2 (Riboflavin) Deficiency

- Low socioeconomic adolescents in New York City 26.6% found to be deficient in riboflavin
- Found in many foods: meats, fish, eggs, milk, green vegetables, yeast, enriched foods
- More likely in those consuming less than 1 cup of milk a day.
- Mild nature and nonspecific signs including cheilosis, glossitis, seborrheic dermatitis, and anemia
- Those deficient tend to have other deficiencies of Vitamin B complex vitamins

Vitamin B3 (Niacin) Deficiency

- Found in animal protein mostly dairy, eggs, and meat, beans and fortified cereal
- Can be synthesized in the liver and kidney by the amino acid tryptophan
- Causes pellagra:
  - Diarrhea (glossitis, angular stomatitis, cheilitis)
  - Skin rash on sun exposed areas, very painful and usually on the dorsum of hands, face and neck.
  - Dementia (insomnia, fatigue, nervousness, irritability and depression)
- Seen in homeless, anorexia, malabsorptive syndromes and Hartnup disease
- Also seen in those on isoniazid and long term anticonvulsant therapy

Vitamin B6 (Pyridoxine) Deficiency

- Found in banana, fish, milk, eggs and fortified cereal
- Causes refractory seizures, peripheral neuritis, dermatitis, and microcytic anemia
- Associated with a few syndromes: vitamin B6-responsive anemia, xanthurenic aciduria, cystathinuria, and homocystinuria
- One of the few water soluble vitamins that can result in toxicity which includes peripheral sensory neuropathy.
Population in Need of Vitamin Supplementation

- Children on medically prescribed diets (allergen-free, ketogenic, or tube feedings)
- Restricted diets because of developmental or behavioral disability
- Parent selected dietary regimens

Celiac Disease

- The more strict the worse the deficiency
- Read labels for gluten and addition of thiamin, riboflavin, niacin, folate and iron.
- Gluten free multivitamin is a prudent recommendation.

Food Allergy

- Children with cow milk allergy and the presence of 2 or more food allergies are at higher risk.
- Nutrients most likely affected are calcium, vitamin D, vitamin E, and zinc.
- Substitutes should be found, thus making vitamins a good option

Ketogenic Diet

- No change in height for weight during the first 6 mo but noticeable change by 1.2 years.
- Study noted a deficiency of 19 known essential micronutrients despite using nutrient dense foods.
Commercially available formulas supply the demand if taken in the appropriate amounts. Those with low caloric expenditure may not get all of the micronutrients needed. Those that are preparing their own foods.

Of most concern is Vegan diets that avoid all meat, fish, poultry, eggs, and dairy. More of a concern for children less than 24 mo.
- High bulk of foods results in early satiety
- Lower digestability of plant amino acids
- Vitamin A, Vitamin D, and Vitamin B12 are also big concerns.

More often in younger (2-4yr), white, and nonpoor patients. More prevalent in children with a pediatrician and more frequent visits to the health care provider. More in those with a greater activity level. More common in those that are underweight. More common in those with healthier diets. More common in those with less media time.

Lack of data on the efficacy of vitamin supplementation on improving quality of life in children with an absence of disease and a varied diet. Vitamin deficiencies are often subtle and must be considered in a patient with chronic disease and with an altered diet history. Most frequent users of vitamins are not those who may need it the most.
References


