



The Value and Uses of Calcium and Vitamin D in Obstetrics and Gynecology

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Introduction

You are what you eat, it has been said. Current focus on medical treatment is prevention and promotion of health, with focus on healthy living and nutrition. Recent attention has been on calcium and Vitamin D for certain reasons unique to women's health.

Physiology

Calcium is the most common mineral in the human body. About 99% of the calcium in the body is found in bones and teeth, while the other 1% is found in the blood and soft tissue. Calcium levels in the blood and fluid surrounding the cells (extracellular fluid) must be maintained within a very narrow concentration range for normal physiological functioning. The physiological functions of calcium are so vital to survival that the body will demineralize bone to maintain normal blood calcium levels when calcium intake is inadequate. Thus, adequate dietary calcium is a critical factor in maintaining a healthy skeleton.

Vitamin D (the physiologically active 1, 25-dihydroxyvitamin D [1, 25(OH)₂D],) also called the "sunshine vitamin" is actually a prohvitamin/ prohormone for 1,25 dihydroxyD₃. It promotes calcium absorption in the gut and maintains adequate serum calcium and phosphate concentrations to enable normal mineralization of bone and to prevent hypocalcemic tetany. It is also needed for bone growth and bone remodeling by osteoblasts and osteoclasts. Vitamin D has other roles in the body, including modulation of cell growth and differentiation, neuromuscular and immune function.

Calcium supplements: Calcium in food and supplements occurs in compound form. During digestion, calcium compound dissolves and elemental calcium becomes available for absorption. Calcium phosphate, lactate, gluconate have very small percentage of elemental calcium whereas citrate (21%) and carbonate (40%) forms have high percentage. High risk groups for developing calcium and vitamin D deficiency include those with malnutrition, faulty dietary habits, inadequate sun exposure, dark skin, postmenopausal women, and very old age.

Table 1: Recommended Dietary Allowances (RDAs) for Vitamin D [1]

Age	Male	Female	Pregnancy	Lactation
0-12 months*	400 IU(10mcg)	400 IU(10 mcg)		
1-13 years	600 IU(15 mcg)	600 IU(15 mcg)		
14-18 years	600 IU(15 mcg)	600 IU(15 mcg)	600 IU(15 mcg)	600 IU(15 mcg)
19-50 years	600 IU(15 mcg)	600 IU(15 mcg)	600 IU(15 mcg)	600 IU(15 mcg)
51-70 years	600 IU(15 mcg)	600 IU(15 mcg)		
>70 years	800 IU(20 mcg)	800 IU(20 mcg)		

Table 2: Recommended Dietary Allowances (RDAs) for Calcium [1]

Life Stage	Age	Males (mg/day)	Females (mg/day)
Infants	0-6 months	200	200
Infants	6-12 months	260	260
Children	1-3 years	700	700
Children	4-8 years	1,000	1,000
Children	9-13 years	1,300	1,300
Adolescents	14-18 years	1,300	1,300
Adults	19-50 years	1,000	1,000
Adults	51-70 years	1,000	1,200
Adults	>71 years	1,200	1,200
Pregnancy	14-18 years	-	1,300
Pregnancy	19-50 years	-	1,000
Breast-feeding	14-18 years	-	1,300
Breast-feeding	19-50 years	-	1,000

Table 3 : Serum 25-Hydroxy vitamin D [25(OH)D] Concentrations and Health

nmol/L	ng/mL	Health status
<30	<12	Vitamin D deficiency, leading to rickets and osteomalacia
30-50	12-20	Inadequate for bone and overall health
≥50	≥20	Adequate for bone and overall health
>125	>50	Potential adverse effects

Vitamin D deficiency: Myth or Reality??

As seen in Table 3 above, there are different laboratory methods and levels given. An easy way to correlate this is to remember that the levels in ng/ml of below 20 is deficiency, 20 to 30 is inadequacy, and 30 to 50 is normalcy. Apparently healthy individuals may be found to have alarmingly low levels!! Non-specific symptoms like bone pains, myalgia and fatigue may be due to this, which is easily treatable.

Deficiency in adolescent girls: Dietary calcium intake has declined dramatically over the past several decades among adolescents, and inadequate serum vitamin D levels have been documented in up to 54% of teens. A recent trend of decreasing consumption of dairy foods, especially milk, has contributed to this problem. Calcium and vitamin D are critically important for bone mineral accrual during adolescence, and altered calcium homeostasis can impact optimal bone acquisition. Serum and cellular calcium concentrations are controlled, in part, by the actions of vitamin D. Dietary calcium intake has declined dramatically over the past several decades among adolescents, and inadequate serum vitamin D levels have been documented in up to 54% of teens. A recent trend of decreasing consumption of dairy foods, especially milk, has contributed to this problem. We need to emphasize to our young people that the bony skeleton is a “bank”- what you put in during the early years is what will pay you dividends later!! A comprehensive program to prevent vitamin D deficiency in children and adolescents is strongly suggested. Strategies may include improved judicious exposure to sunlight, improved dietary supplies of highly bioavailable calcium (eg, milk) and vitamin D from food fortification, and the integration of the topic of vitamin D deficiency into school physical examinations and the health education syllabus. (2)

Calcium and Vitamin D in pregnancy and lactation: Significant changes in maternal vitamin D and calcium metabolism occur during pregnancy, to provide the calcium needed for fetal bone mineral accretion. Approximately 25-30 grams of calcium are transferred to the fetal skeleton by the end of

pregnancy, most of which is transferred during the last trimester. It has been estimated that the fetus accumulates up to 250 mg/d calcium during the third trimester. The three possible calcium sources that may supply the mother with the necessary calcium to support fetal growth include increased intestinal absorption from the diet, increased renal conservation, and increased bone mobilization. Decreased skeletal mineralization in utero may be manifested as rickets or osteopenia among newborn infants. Vitamin D and calcium deficiency in mother may manifest as impaired fetal bone ossification. Infants of mother receiving Vitamin D supplementation have more serum calcium levels and lower incidence of neonatal hypocalcaemia and sequelae.(3)

It has also been suggested that calcium supplementation in pregnancy at community level is an essential intervention as per WHO 2011, and may help to reduce the incidence of preeclampsia and hypertension in pregnancy. (4) In areas where dietary calcium intake is low, calcium supplementation during pregnancy (at doses of 1.5–2.0 g elemental calcium/day) is recommended for the prevention of pre-eclampsia in all women, but especially for those at high risk of pre-eclampsia.

Menopause and Osteoporosis: Ensuring adequate vitamin D supplementation is a key component of therapy in the prevention and treatment of osteoporosis. Although it might not be sufficient as the sole means of therapy for osteoporosis, routine supplementation with calcium (1000 mg/d) and vitamin D3 (800 IU/d) is still recommended as a mandatory adjunct to the main pharmacologic agents (antiresorptive and anabolic drugs). Vitamin D in doses of 800 IU daily has been shown to be effective in reducing the risk of falls by 49% over a 12-week period of therapy. Vitamin D supplementation at a dose of 10 000 IU once weekly has been suggested for women unable to take daily supplements of vitamin D in areas where such a preparation is available. Doses of 100 000 IU of vitamin D3 given orally every 4 months has been shown to be effective in reducing the risk of osteoporotic fractures.(5)

Concerns about calcium usage

- Nephrolithiasis- Calcium intake up to 1500 mg/day does not appear to increase risk of renal calculi, however for women at high risk of developing calculi; food may be the best source of calcium. If supplements are needed, each dose is to be taken with large amount of water. (6)
- Myocardial Infarction-Results of WHI study taken together with the results of other clinical trials of calcium supplements, with or without vitamin D, strongly suggest that calcium supplements modestly increase the risk of cardiovascular events, particularly myocardial infarction. These data justify a reassessment of the use of calcium supplements in older people. (7)
- Relation to other conditions: Some of the studies have shown association between high calcium intake and decreased proliferation of colorectal cancer (beneficial for colorectal cancers). Similarly some of the studies have demonstrated beneficial effects in hypertension. However data is insufficient to support general recommendation. There is a reduced incidence of insulin resistance syndrome with increasing dairy intake in overweight individuals, and serum 25 hydroxyvitamin D levels are positively correlated with insulin sensitivity. Vitamin D receptor is expressed in all calcium-regulated tissues, including the ovary; thus, calcium and vitamin D appear to be necessary for full ovarian function. (2)

Summary

The role of nutrition and appropriate intake of calcium and Vitamin D needs to be highlighted and our women should be encouraged to take adequate care from a young age, not only for bone health but also for other far-reaching effects of these important factors. Recommended dietary allowance of these substances should be achieved by balanced diet and healthy lifestyle, if not then by adequate supplementation.

Source References

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