



## CALCIUM, MAGNESIUM, AND VITAMIN D

Lifelong bone health... and much more.

For the maintenance of bone growth and health, and the prevention of osteoporosis, a very important factor is the availability of key dietary nutrients, especially calcium, magnesium and vitamin D. The inter-relationship of these nutrients in bone health is still a relatively new understanding with fresh discoveries occurring regularly. Emerging research continues to not only validate the necessity and synergistic effects of these nutrients to bone health, but is more importantly, demonstrating their benefits in other aspects of health as well.

### ESSENTIAL TOGETHER FOR EVERYONE'S BONES!

In a "pooled analysis" study, published in the January 2010 issue of the *British Medical Journal*, data from nearly 70,000 participants showed that not only are calcium and vitamin-D needed together for bone health, but neither work well alone. The combination of calcium and vitamin-D reduced fractures by 8% and hip-fractures by 16% while vitamin D on its own did not work. UC Davis Professor John Robbins states, "This study supports a growing consensus that combined calcium and vitamin D is more effective than vitamin D alone in reducing a variety of fractures."<sup>1</sup>

Too little magnesium has also been implicated in osteoporosis. With more than two-thirds of Americans failing to achieve magnesium sufficiency some researchers now believe magnesium insufficiency is a major contributor to bone density loss.

Normally, bone density decreases by 3 to 8% per year in the early years of menopause, and increases during that time are unusual. Data published in the November 2005 issue of the *Journal of the American Geriatric Society* found that women in early menopause who were given 250 to 750 mg of magnesium per day for one year had an increase in bone mineral density in 71% of cases.<sup>2</sup>

Additionally, in December 2006, researchers from the Yale University School of Medicine showed that daily supplementation with 300 mg of magnesium in girls, ages 8 to 14 resulted in significant increases in bone mineral content in just one year.<sup>3</sup> This is particularly important as more than one-third of adult bone mass is created during puberty and if this opportunity is missed, the body may never catch up.

In 1999, researchers showed that chronically low blood levels of potassium and calcium may actually be attributed to magnesium deficiency, prompting researchers to conclude that magnesium supplements could help correct potassium and calcium deficiencies.<sup>4</sup>



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I'm continually struck by the scale and scope of the biodynamics (speed of life) of the human body. Trillions of cells, each performing about 100 million metabolic events per second, every hour of every day, a controlled, contained and orchestrated "explosion" of activity that is life. Our skeletal system has amazing biodynamic activities of its own. Bones are in a constant state of construction and destruction, never dormant, always changing. Osteoblasts, the constructors, work together daily with osteoclasts, the destructors, to tear down, renew, repair and replace the structural skeletal framework that supports our bodies. When all is working well and there is a perfect balance between construction and destruction, our bones remain healthy and strong throughout our lives. Calcium, magnesium, and vitamin D, working together in synergy, are critically important every day in order to keep this high intensity of biodynamics in our bones in balance. When not present in adequate amounts, bone destruction becomes faster than construction. As a result, bone density drops and osteoporosis occurs. ■

# LOOKING BEYOND BONE HEALTH

Though calcium, magnesium and vitamin-D are essential synergistic partners in the development and maintenance of lifelong bone health, they each play other critical roles in the body as well. Here's a quick look at some of the latest findings for these three nutritional powerhouses.

## CALCIUM

Though most people will only associate calcium in the diet with bone health, scientists and medical professionals know it is critical for much more than that.

- **Muscle Contraction:** When calcium is not present in sufficient quantities in the body muscle cramping can become frequent. The connection is so well established that a taking calcium supplement before bed time is a common and effect way to prevent most nighttime muscle cramping.
- **Cardiovascular Health:** One of the most important signs of cardiovascular health is the ability of our blood vessels to expand and contract in sync with heart rate, blood pressure and blood flow needs. Calcium is known to play a direct role in vascular structure and exert influence of blood flow and pressure.<sup>5</sup>
- **And More...** Calcium is also essential for such other critical body functions as the secretion of hormones and enzymes, and transmitting impulses throughout the nervous system.

### DID YOU KNOW?

- How efficient we are at absorbing calcium changes with age. The older we get the less efficient we are. Absorption is as high as 60% in infants and young children, who need substantial amounts of the mineral to build bone. Absorption decreases to 15%-20% in adulthood and continues to decrease as people age; this explains the higher recommended calcium intakes for age's  $\geq 51$  years.

## MAGNESIUM

Research continues to validate the importance of magnesium to multiple biochemical and physiological functions in the body.

- **Heart Health:** One of the more serious signs of magnesium deficiency is abnormal heart rhythms which can lead to the potential for coronary spasms.<sup>6</sup> In addition, a December 2009 study published in the *Journal of the American Academy of Nurse Practitioners* concluded that "oral magnesium supplementation is recommended" for men suffering from or are at risk aof heart disease and for people who are not sure their diet is providing enough.<sup>7</sup>
- **Blood Pressure:** Epidemiologic evidence suggests that magnesium may play an important role in regulating blood pressure.<sup>8</sup> One study that spanned 6 years found that the risk of developing hypertension in women decreased as dietary magnesium intake increased.<sup>9</sup> In fact, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommends that diets providing plenty of magnesium are positive lifestyle modifications for individuals with hypertension.
- **Diabetes:** Magnesium plays an important role in carbohydrate metabolism. It may influence the release and activity of insulin, the hormone that helps control blood glucose (sugar) levels. Low blood levels of magnesium (hypomagnesemia) are frequently seen in individuals with type-2 diabetes.<sup>10</sup> More recent data from a 2007 meta-analysis (combined review of several studies) suggested that 100 mg of magnesium was equated to a 15% reduction in risk for type-2 diabetes.<sup>11</sup>
- **Healthy Colon:** Researchers from the School of Public Health at the University of Minnesota found that in 35,196 women with an average age of 61, the relative risk of colon cancer was 25 per cent lower in those with the highest intakes of magnesium (more than 356 mg per day).<sup>12</sup>

### DID YOU KNOW?

- Magnesium is the 4th most abundant mineral in the body. Approximately 50% of it is found in our bones.

## VITAMIN D

First discovered by Adolf Otto Reinhold Windaus a German chemist who won the Nobel Prize in Chemistry in 1928 for his work on sterols and their relation to vitamins.

Vitamin-D is unique among nutrients as it is the only nutrient considered a “prohormone” meaning it is the precursor of a hormone...though it has essentially no hormonal activity of its own. There are two forms; vitamin D<sub>2</sub> and vitamin D<sub>3</sub>. Vitamin D<sub>2</sub> is the form made by plants from the natural sterol ergosterol while D<sub>3</sub> is made in the skin of humans and animals from a natural form of cholesterol (7-dehydrocholesterol) and exposure to UVB rays from sunlight. Both forms are active in humans.<sup>13</sup>

Some medical experts believe that we are suffering through a vitamin D deficiency “crisis.” Sunlight is a primary source of vitamin D. But, because of the growing awareness of skin cancer risk from sunlight exposure, the trend towards decreasing exposure to sunlight is leaving many of us without optimal levels of vitamin D. The December 2009 issue of the *Harvard Heart Letter* endorsed vitamin D supplementation that delivers 800 to 1,000IU as the “simplest way” to assure your daily diet contains adequate vitamin D.<sup>14</sup>

- **Health risks associated with deficiency:** Vitamin D deficiencies are prevalent in as much as 50% of the population. Vitamin D malnutrition can be associated with an increased susceptibility to several chronic diseases, such as high blood pressure, tuberculosis, cancer, periodontal disease, multiple sclerosis, chronic pain<sup>15</sup>, seasonal affective disorder<sup>16</sup>, peripheral artery disease<sup>17</sup>, cognitive impairment<sup>18</sup>, and several autoimmune diseases<sup>19</sup> including type 1 diabetes.
- **Metabolic Syndrome:** Also known as Syndrome X, has now also been associated with a lack of vitamin D. A 2009 study published in the *Journal of Clinical Lipidology* showed that people with the lowest blood vitamin D levels had a 31% greater prevalence of metabolic syndrome than those with the highest levels.<sup>20</sup>
- **Health and Longevity:** Findings published in the September 2009 issue of the journal *Nutrition Research*, equated low levels of vitamin D with a 150% increase in risk of death from all causes. As a point of comparison the authors pointed out that “In addition, a recent meta-analysis suggested that vitamin D supplementation was associated with decreased mortality.”<sup>21</sup>
- **Modulating Immune Function:** The connection between vitamin D deficiency and the onset of multiple sclerosis was reported in a 2006 study published in the *Journal of the American Medical Association*. Researchers speculate that for patients with MS, an autoimmune disorder, this association may be a result of the immune-response suppression properties of vitamin D.<sup>23</sup> The results of another study in 2009 suggests that vitamin D also plays a role in the activation of a gene that differentiates proteins between healthy individuals, and those at risk of MS.<sup>24</sup>
- **Long term colon, breast, and prostate health:** A 2005 meta-analysis of 63 published reports found that the additional daily intake of 1,000IU of vitamin D reduced colon cancer risk by 50%<sup>25</sup> and breast and ovarian cancer risks by 30%.<sup>26</sup>

In April 2009, results of a UK study published in the *British Journal of Urology International* suggest that a once daily dose of vitamin D can reduce PSA levels, an indicator of prostate cancer risk, by as much as half.<sup>27</sup>

Published in the *International Journal of Cancer*, a study supported by a grant from the U.S. Department of Defense, appears to provide further compelling evidence of the potent anti-cancer benefits of vitamin D.<sup>28</sup> ■

### DID YOU KNOW?

- Some people who take a cholesterol-lowering statin stop because of muscle pain. In a study of 128 men and women with statin-related muscle pain, two-thirds of them had low 25-hydroxyvitamin D levels (under 20 ng/mL). Among those who took a vitamin D supplement while continuing the statin, muscle pain disappeared in 90% of the cases.<sup>14</sup>
- Harvard School of Medicine surveys suggest that at least one-third of American adults, and 75% of adults with cardiovascular disease, fall into the deficient category for vitamin D intake.

## RECOMMENDED AMOUNTS

(Developed by the U.S. Food & Drug Administration)

### Calcium

**1000 mg**

Daily value (DV) for adults and children aged 4 and older.

### Magnesium

**400 mg**

Daily value (DV)

### Vitamin D

**400 IU**

Daily value (DV) for adults and children aged 4 and older; currently being revised. Research suggests 1000IU as the recommended daily intake level.

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## CALCIUM, MAGNESIUM, AND VITAMIN-D INTAKES<sup>22</sup>

Age in years	CALCIUM		MAGNESIUM		VITAMIN D	
	Adequate Intakes (AI, mg)	Rate of Deficiency (%)	Average Requirements (EAR, mg)	Rate of Deficiency (%)	Adequate Intakes (AI, IU)	Rate of Deficiency (%)
Males & Females:						
1-3	500	5	65	<3	200	30
4-8	800	32	110	<3	200	41
Males						
9-13	1300	83	200	22	200	47
14-18	1300	58	340	69	200	50
19-30	1000	44	330	51	200	61
31-50	1000	42	350	45	200	55
51-70	1200	74	350	58	400	93
71 and over	1200	86	350	80	600	>97
Females						
9-13	1300	88	200	30	200	53
14-18	1300	90	300	89	200	75
19-30	1000	72	255	65	200	78
31-50	1000	67	265	48	200	68
51-70	1200	92	265	55	400	>97
71 and over	1200	93	265	70	600	>97
Pregnant						
19-30	1000	27	290	46	200	37
31+	1000	27	300	46	200	37
Total		64		48		69

According to data from the 2005-06 NHANES study and the Food & Nutrition Board, Institute of Medicine, USA

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