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Newsletter

Fall 2006

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*Le bulletin Anamol est disponible en anglais et en français.*
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***I dedicate this newsletter to professionals who are interested to widen their scope of connection between Chemistry and Metabolism.***

*Dr. George M. Tamari*

# About Bone Loss and its detection...

- Osteoporosis is a major public health threat affecting 28 million Americans, 80% of whom are women.
- In the U.S. today, 10 million individuals already have osteoporosis and 18 million more have low bone mass, placing them at increased risk for this disease.
- One out of every two women and one in eight men over 50 will have an osteoporosis-related fracture in their lifetime.
- More than 2 million American men suffer from osteoporosis, and millions more are at risk. Each year 80,000 men suffer a hip fracture and one-third of these men die within a year.
- Osteoporosis can strike at any age.
- Osteoporosis is responsible for more than 1.5 million fracture annually, including 300,00 hip fractures, and approximately 700,000 vertebral fractures, 250,000 wrist fractures, and more than 300,000 fractures at other sites.
- Estimated national direct expenditures (hospital and nursing homes) for osteoporosis and related fractures is **$14 billion each year**. (1)

The situation in Canada regarding osteoporosis is not less sever. At the present time, 1.4 million Canadians suffer from osteoporosis 25% of women over age of 50 has osteoporosis. 12.5% men over 50 also have the disease. **However, the disease can strike at any age.**

The cost of treating osteoporosis and the fractures it causes is estimated to be $1.3 billion each year in Canada alone. Long term, hospital and chronic care account for the majority of these costs.

Without effective action on osteoporosis prevention and treatment strategies, it is estimated that by **2018 Canada will spend at least $32.5 billion** treating osteoporotic fractures. Given the increasing proportion of older people in population, these costs will likely rise.

The statistic related to hip fractures are particularly disturbing. There were approximately 25,000 hip fractures in Canada in 1993. Seventy percent of hip fractures are osteoporosis-related. Hip fractures result in death in up to 20 percent of cases, and disability in 50 percent of those who survive. (2)

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# About Bone Loss and its detection

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## Nutritionally Induced Metabolic Acidosis

Osteoporosis is caused by negative calcium balance. Although, older people are more prone to get it, this disease can strike at any age, as it was spelled out by the Osteoporosis Society of Canada (1). It seems to be intriguing to find out the causes that may bring about producing condition(s) that will lead to negative calcium balance.

Recently, a large number of studies were undertaken aiming to study the role nutrition plays in bone health. Over the last 80 years numerous studies demonstrated that high protein intake increases urinary calcium excretion. This effect was related to the fact that consuming a high protein diet an average of 1 mg calcium was excreted in urine for every 1 gram rise in dietary protein (3). The explanation was given by the presence of sulfur and phosphorus-containing amino acids in animal and vegetable protein that will produce acidic end products. This acidic state will provoke a buffering reaction of the skeleton structure with the help of the osteolytic activity of the parathyroid gland. The detrimental effect of this osteolytic activity of the parathyroid gland leading to bone loss is well described by Wachtman (4) stating that "*the increased incidence of osteoporosis with age may represent, in part the result of a life long utilization of the buffering capacity of the basic salts of bone for the constant assault against pH homeostasis.* ***The loss of as little as 2 meq of calcium per day would, over a decade, assuming a total body content of 1 kg, account for a 15% loss of inorganic bone mass in an average individual***".

To clarify the question about the importance of quantity of protein in our diet and its contribution to cause of hypercalcuria and consequently bone loss was investigated by J. Bland (5). Conclusion of this study pointed out that the quantity of protein consumed is insignificant, rather the important factor is the ratio between calcium versus phosphorus in diet. X-ray density changes only after 25-30 percent of the bone was lost can detect the loss of skeletal mass (6).

**Table I**
**Dietary Calcium Phosphorus Study**
***(Ratios are dietary Ca/P)***

| | Ca/P =0.58:1 | | Ca/P = 1:1 | |
|---|---|---|---|---|
| | **X** | **SD** | **X** | **SD** |
| **Serum -** *Unit mg/100 ml* | | | | |
| Ca | 9.74 | 0.12 | 9.52 | 0.34 |
| P | 3.45 | 0.13 | 3.65 | 0.48 |
| Ca/P | 2.74 | 0.16 | 2.64 | 0.27 |
| **Hair -** *Unit in ppm (mcg/g)* | | | | |
| Ca | 303 | 14.21 | 952 | 62.45 |
| Mg | 43.2 | 2.04 | 156 | 18.24 |
| P | 162 | 1.93 | 186 | 4.72 |

By inspecting the analytical results between the two groups, it is clear that there are no significant differences in blood tests, however, there are significant differences when the analysis was performed on hair tissue (HMA). According this study, **elevated levels of Calcium, Magnesium and Phosphorus** in HMA provides an important pattern that can ring a warning bell about the presence of *nutritionally induced secondary hyperparathyroidism*. This fact is reinforced by the 24 hour urine analysis of the calcium excretion whereas the group of Ca: P 0.58:1 excreted 267 +/- 89 mg, the group of Ca:P 1:1 excreted 136 +/- 46 mg/24 hr; this means a 96% increase in calcium excreted by the Ca:P 0.58:1 compared to the Ca:P 1:1 (5).

Using HMA as a screening tool for detecting loss of bone mass has the advantage of realizing the *process of bone loss* ***before*** *it can be measured by any presently available methods*. Consequently, this may provide the Health professional an opportunity to effectively treat this secondary hyperparathyroidism by adjusting the patient's dietary plan.

### *References:*


1. *National Institutes of Health, Osteoporosis and Related Bone Diseases - National Resource Center, 2 AMS Circle, Bethesda MD 20892-3676, Oct.2000*
2. Osteoporosis Society of Canada, 2005
3. Ginty F. Dietary protein and health. *Proc Nutr Soc* 2003;62:867-876

4. Wachman A. Diet and Osteoporosis. *The Lancet* 1968; May 4:958-959
5. Bland J. Dietary Calcium, Phosphorus and Their Relationship To Bone Formation and Parathyroid Activity. *The John Bastyr College of Naturopathic Med* 1979 1;185-189
6. Stevenson JC, Marsh MS. An atlas of osteoporosis. Park Ridge, IL., *Pantheon*, 1992;27-29

# Literature Review

## Changes in Bone Turnover in Young Women Consuming Different Levels of Dietary Protein

Although high protein diets are known to increase urinary calcium excretion and induce negative calcium balance, the impact of dietary protein on bone turnover and fractures is controversial. We therefore evaluated the effect of dietary protein on markers of bone turnover in 16 healthy young women. The experiment consisted of 2 weeks of a well balanced diet containing moderate amounts of calcium, sodium, and protein followed by 4 days of an experimental diet containing one of three levels of protein (low, medium, or high). On day 4, serum and urinary calcium, serum PTH, 1,25-dihydroxyvitamin D, serum osteocalcin, bone-specific alkaline phosphatase, and urinary N-telopeptide excretion were measured. Urinary calcium excretion was significantly higher on the high than on the low protein diet. Secondary hyperparathyroidism occurred on the low protein diet. Urinary N-telopeptide excretion was significantly greater during the high protein than during the low protein intake (48.2 ± 7.2 vs. 32.7 ± 5.3 nM bone collagen equivalents/mM creatinine; $P < 0.05$). There was no increase in osteocalcin or bone-specific alkaline phosphatase when comparing the low to the high diet, suggesting that bone resorption was increased without a compensatory increase in bone formation. Our data suggest that at high levels of dietary protein, at least a portion of the increase in urinary calcium reflects increased bone resorption.

Kerstetter JE, Mitnick MaryAnn E, Gubdberg Caren M, Caseria Donna M, Ellison Alice F, Carpenter Thomas O, Insogna Karl L. *J Clin Endocrin & Metabol* 1999;84:1052-1055

## Excess Dietary Protein Can Adversely Affect Bone

The average American diet, which is high in protein and low in fruits and vegetables, generates a large amount of acid, mainly as sulfates and phosphates. The kidneys respond to this dietary acid challenge with net acid excretion, as well as ammonium and titratable acid excretion. Concurrently, the skeleton supplies buffer by active resorption of bone. Indeed, calciuria is directly related to net acid excretion. Different food proteins differ greatly in their potential acid load, and therefore in their acidogenic effect. A diet high in acid-ash proteins causes excessive calcium loss because of its acidogenic content. The addition of exogenous buffers, as chemical salts or as fruits and vegetables, to a high protein diet results in a less acid urine, a reduction in net acid excretion, reduced ammonium and titratable acid excretion, and decreased calciuria. Bone resorption may be halted, and bone accretion may actually occur. Alkali buffers, whether chemical salts or dietary fruits and vegetables high in potassium, reverse acid-induced obligatory urinary calcium loss. We conclude that excessive dietary protein from foods with high potential renal acid load adversely affects bone, unless buffered by the consumption of alkali-rich foods or supplements.

Barzel US, Massey LK *The Journal of Nutrition* 1998;128:1051-1053

## Vitamin D Deficiency and Secondary Hyperparathyroidism in the Elderly: Consequences for bone Loss and Fractures and Therapeutic Implications

Vitamin D deficiency is common in the elderly, especially in the housebound and in geriatric patients. The establishment of strict diagnostic

# Literature Review

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criteria is hampered by differences in assay methods for 25-hydroxyvitamin D. The synthesis of vitamin D3 in the skin under influence of UV light decreases with aging due to insufficient sunlight exposure, and a decreased functional capacity of the skin. The diet contains a minor part of the vitamin D requirement. Vitamin D deficiency in the elderly is less common in the United States than elsewhere due to the fortification of milk and use of supplements. Deficiency in vitamin D causes secondary hyperparathyroidism, high bone turnover, bone loss, mineralization defects, and hip and other fractures. Less certain consequences include myopathy and falls. A diet low in calcium may cause an increased turnover of vitamin D metabolites and thereby aggravate vitamin D deficiency. Prevention is feasible by UV light exposure, food fortification, and supplements. Vitamin D3 supplementation causes a decrease of the serum PTH concentration, a decrease of bone turnover, and an increase of bone mineral density. Vitamin D3 and calcium may decrease the incidence of hip and other peripheral fractures in nursing home residents. Vitamin D3 is recommended in housebound elderly, and it may be cost-effective in hip fracture prevention in selected risk groups.

Lips P. *Endocrine Reviews* 2001;22(4) 477-501

## Colored Email Reports

Since January 2002, our ***Hair Analysis Reports*** have been printed out in colors. With the growing requests for e-mail reporting, the importance of a colored first page became an issue. As a response to the wishes of the large number of Health Professionals, starting Spring 2006, we'll be able to provide you with ***COLOURED FIRST PAGES*** identical to our office copies.

If you want to receive your results by e-mail, please e-mail or fax us your email address.

***Please note:*** *We will send e-mail to doctors only. - No patient's e-mail addresses please.*

## Worth Repeating...

Though we have experienced considerable improvement during the past two years, there is still some measure of the same difficulties. Therefore we find necessary to reprint the information with some additional requests and suggestions:

- *Write patient's name on the sample envelope.*
- *Results are printed on the language of the requisition form. Please indicate if the report wanted in any other language.*
- *Requests for free supply should be indicated on the bottom of the same form.*
- *We have to ask our new customers to send in a copy of your letterhead or business card, as Anamol Laboratories does not deal with the public.*
- *It is not necessary to issue an individual cheque to each sample in the same shipment.*
- *Please indicate form of payment by checking the appropriate space.*
- *Change of address or phone number should be highlighted.*
- *Please advise us if there is any change in your credit card number.*

## Services:

- Educational Seminars
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## *Anamol Laboratories Ltd.*

83 Citation Drive, Unit #9
Concord Ontario, L4K 2Z6
www.anamol.com
anamol@bellnet.ca
Tel. 905-660-1225
1-888 254 4840
FAX 905 660-1955



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