Prebiotic Fiber 2.0: Updated Research on NUTRAFLORA® scFOS for Bone Health

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An expanding aging population and increased consumer awareness are two contributing factors for the growing U.S. bone health market. Millions of Americans — 52 million to be exact according to the National Osteoporosis Foundation — have low bone density or osteoporosis. Osteoporosis is often known as "the silent thief" because, until fracture occurs, bone loss happens without symptoms. It is important to note that it is not a natural part of aging but a major public health threat.

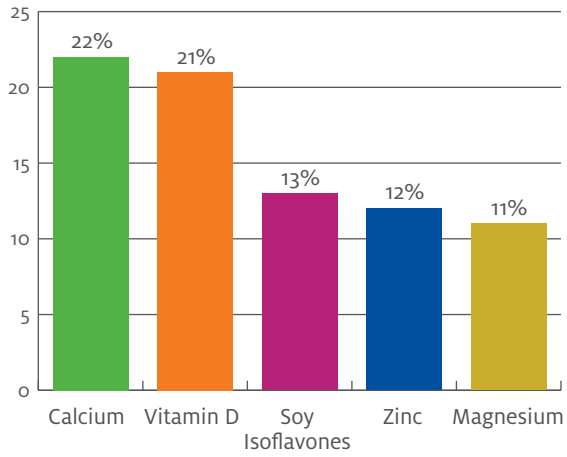
With the aging of Americans, osteoporosis is becoming increasingly common. In fact, about one in two women and up to one in four men over the age of 50 will break a bone due to osteoporosis. By 2020, half of all Americans over age 50 are expected to have low bone density or osteoporosis.

The World Health Organization has defined osteoporosis as the second leading health care problem after cardiovascular disease, affecting more than 200 million women worldwide. Therefore, the rise in the incidence of osteoporosis reinforces the need for well-researched ingredients that deliver tangible health benefits and address this issue which then enhance the quality of life for consumers.

Consumer attitudes toward bone health

Today's increasingly individualistic consumers place considerable value on self-expression and asserting their individual identity this is leading to a growing trend of nutritional individualization. The individualism mega-trend represents consumers' desires to be themselves and be

FIGURE 1: NUTRITION DEFICIENCIES AS PERCEIVED BY CONSUMERS



recognized as having personal needs rather than being part of the mass market. Food companies are being careful not to offer "one size fits all" nutritional products. The challenge is how to bring products to market to be appealing to one group, but without alienating other potential users.

In a recent study done by NMI (Natural Marketing Institute) in 2011, they found that consumers felt they had perceived deficiencies and calcium was at the top of the list (Figure 1).

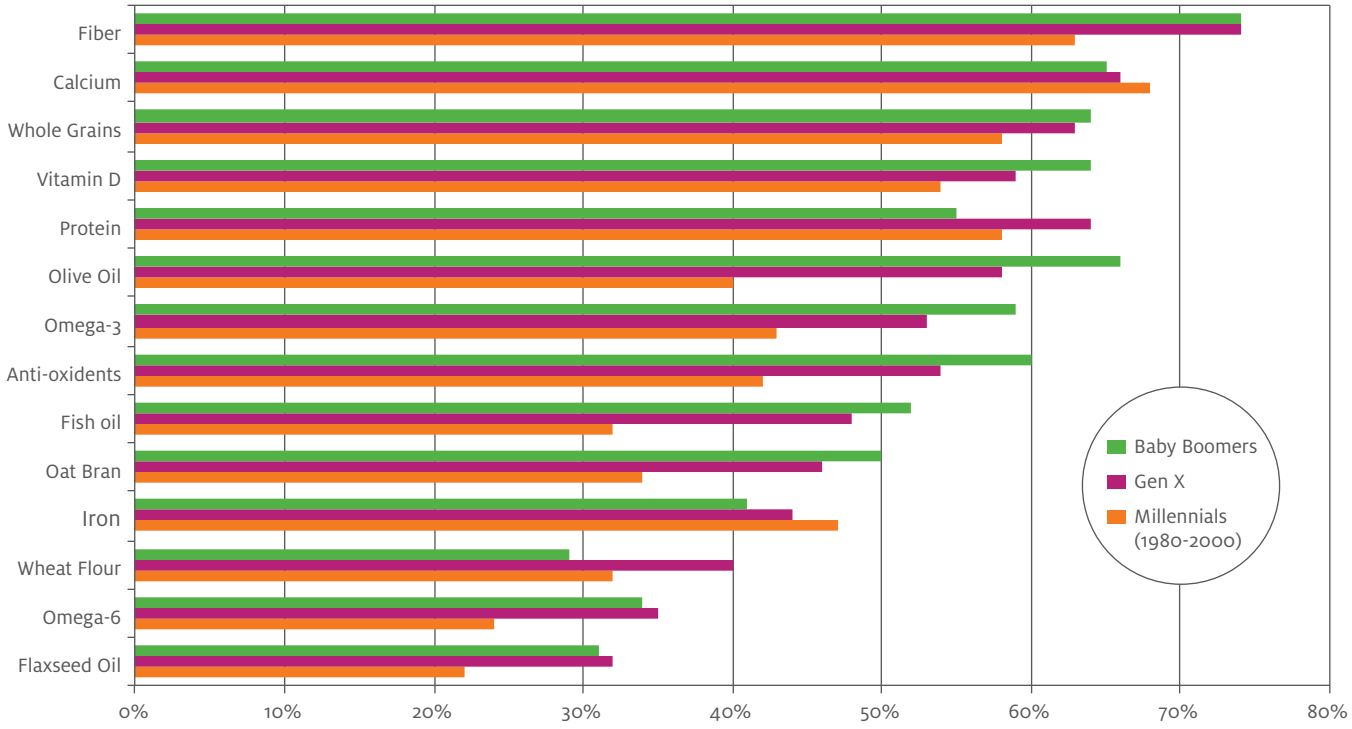
While a different study from the Hartman Group found consumers are making a conscience effort to increase certain ingredients like calcium and fiber in their diet (Figure 2).

Bone health 101

The health of our bones is instrumental to our health and longevity in general because:

- **Bones provide support and structure**
- **They closely interact with the muscle system in our bodies. Bones are necessary because the muscles need something to attach to in order to contract and cause motion**
- **Red & white blood cell production occurs from bone marrow**
- **Lastly, bones are responsible for the regulation of calcium levels**

FIGURE 2: INGREDIENTS CONSUMERS ARE DELIBERATELY INCREASING IN THEIR DIET



Bones are a living growing tissue, consisting of different components including:

MINERAL	EFFECT ON BONE
Calcium	The most abundant mineral in the body, 99% is stored in the bones
Magnesium	60% of Mg in our bodies is found in our bones. Appears to enhance bone quality, may improve bone mineral density. In adequate amounts may interfere with the body's ability to process Ca
Phosphorous	A component in every cell in the body. Supports building bone and other tissue during growth. About 85% of the P in the body is found in bones
Zinc	Assist in the formation of optimal bone matrix or structure for bone strength
Manganese	Assist in the formation of optimal bone matrix or structure for bone strength

Did you realize that bones go through a constant tug of war process called "Bone Remodeling"? This process consists of resorption and formation. The body constantly breaks down old bone and rebuilds new bone. During formation, cells called osteoblasts are constantly churning out new bone, while during resorption a second set of cells called osteoclasts, destroys bone by gobbling it up.

In childhood and adolescence, the body builds more bone than it removes, and so bones grow and get stronger. You often hear how important it is for women to get enough calcium. But it's just as important — maybe even more important — that kids and teens get ample bone-boosting calcium. It's also important for them to exercise daily to build strong bones.

The total amount of bone peaks somewhere between the ages of 25 and 30 for men and women. When the total amount of bone peaks, the tide turns. While some bone is lost each year after age 30-35, and for several years, the breakdown of bone occurs at a much greater pace than the building of new bone. However, in the 5-10 years after menopause the rate of bone loss increases dramatically.

Bone health support

According to a new report published by the International Osteoporosis Foundation (IOF), women may expect to live longer but their quality of life will be seriously jeopardized if action to protect their bone health is not taken.

Two ingredients which are easy to add to the diet and enhance bone health include:

- **Calcium, at the recommended daily intake level**
- **Prebiotic fiber, to enhance mineral absorption**

Calcium is an important mineral that is essential to maintain strong bones and carry out many important functions. The body also needs calcium for muscles to move and for nerves to carry messages between the brain and body parts. In addition, calcium is used to help blood vessels move blood throughout the body and to help release

hormones and enzymes that affect almost every function in the human body.

According to the National Institute of Health (NIH), the recommended daily amounts of calcium include:

AGE	CALCIUM RDA (MG/DAY)
Infants (0-6 months)	200
Infants (6-12 months)	260
1-3 Years old	700
4-8 years old	1000
9-13 years old	1300
14-18 years old	1300
19-30 years old	1000
31-50 years old	1000
51-70 years old	1000
71 + years old	1200

There are distinct disadvantages of not getting enough calcium in your diet. Many people consume less than half of the amount recommended in order to build and maintain healthy bones. These insufficient intakes of calcium do not produce obvious symptoms in the short term because the body maintains calcium levels in the blood by taking it from bone. Over the long term, intakes of calcium below recommended levels have health consequences, such as causing low bone mass (osteopenia) and increasing the risks of osteoporosis and bone fractures. Additionally, when calcium absorption is compromised, due to a number of factors including aging and gastric or intestinal impairment, improving mineral absorption becomes critical to bone maintenance.

The gut microbiota plays an important role in human health.[1] For example, bacteria in the gut synthesize vitamins and aid in the absorption of minerals by fermenting dietary fiber. NUTRAFLORA®, a short-chain fructooligosaccharide, is one type of prebiotic fiber that is readily fermented by gut microbes producing short-chain fatty acids (SCFA). It is the production of these fatty acids, such as butyrate, propionate and acetate, that enhances mineral absorption. In the gastrointestinal tract, minerals must stay in solution in order to be absorbed, and tend to precipitate out of solution at higher pH ranges, the production of SCFA lowers luminal pH to an optimal level for keeping minerals in solution longer, thereby enhancing their absorption.[2-5]

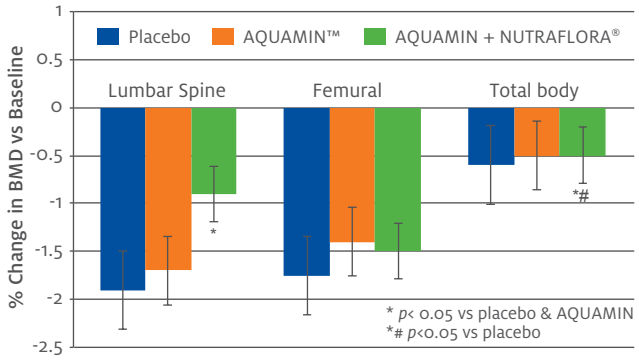
Calcium absorption was significantly increased by 13-41% in healthy women[6,7] and men[8] taking 3 grams of scFOS. In addition, no induction period was required for the gut microflora to adapt to the ingredient. In fact, the subjects were not allowed to consume scFOS containing foods for an interval prior to the study period. Therefore, an immediate beneficial effect was observed from the use of only 3 g of scFOS per day.

Recent research on NUTRAFLORA®

In a recent 24 month randomized, double-blind, controlled trial,[9] 300 non-osteoporotic postmenopausal women were randomly assigned to one of three treatment groups with a total of 100 individuals in each group. The participants received two supplements delivering 800 mg Ca (derived from AQUAMIN™) or 800 mg Ca (derived from AQUAMIN) with 3 g scFOS (NUTRAFLORA) per day or a maltodextrin control for 24 months. These visually identical supplements were formulated as a chocolate flavored chewable supplement. Bone mineral density (BMD) and bone turnover marker (BTM) were measured pre and post intervention.

The study demonstrated that there was no significant difference in bone loss between the Ca and maltodextrin or between the Ca + scFOS and maltodextrin groups. However, in exploratory sub-analysis, women classified with osteopenia and taking Ca + scFOS had significantly less reduction in spinal BMD compared to the control (P=0.03). The decline in total-body BMD was significantly less in Ca + scFOS compared to the control (P=0.03). This effect was seen only in those with a higher total body BMD at the baseline (Figure 3).

FIGURE 3: CHANGE IN BONE MINERAL DENSITY (BMD) IN OSTEOPENIC WOMEN AFTER 24 MONTHS



The results support those of others and which indicate that Ca supplementation alone may not be sufficient in post-menopausal women who should be provided with other nutrients, such as the prebiotic fiber scFOS, to enhance Ca absorption, particularly in those with a reduced absorption through physiologic changes and aging.

Summary

The skeletal system and the bones that comprise it are an integral part of our bodies which is instrumental to our health and longevity. Bones are made up of several different components and are actually "alive" in the sense that the body breaks down old bone and rebuilds new bone. However, the total amount of bone peaks (depending on age and gender) and eventually the breakdown of bone occurs at a greater pace than building of new bone.

The "silent thief" of osteoporosis can make itself unknown to the individual until the unfortunate occurrence of a fracture is felt. There are many factors contributing to osteoporosis and it can affect an older and aging population more, putting a bigger burden on an already strained healthcare system.

However, there are ingredients that support bone health such as Calcium and scFOS prebiotic fiber which can help maintain healthy strong bones. Calcium (supplemented or fortified in foods) can help replenish the calcium utilized from bones, but when calcium absorption is compromised, due to a number of factors including aging and gastric or intestinal impairment, mineral absorption becomes critical to bone maintenance. scFOS has demonstrated in previous studies to help increase absorption of essential minerals, like calcium, and the more recent study discussed suggests changes in bone mineral turnover from the supplementation of Ca + scFOS may provide a more favorable bone healthy profile in women.

scFOS prebiotic fiber add values to the nutritional profile of foods while providing marketable claims of enhanced mineral absorption that resonate with the consumer need and desire to prevent the erosion of their skeletal system, thus impacting their quality of life as they get older and finding preventative methods to offset that prospect.

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