

# **The Physiological Impact of Boron**

By Dr. Howard W. Fisher

Boron is the fifth element in the periodic table of elements and has a number of important functions. The borate minerals have been known for thousands of years and have varied history from the deserts of Tibet to the alchemists of the middle ages. Boron occurs in most foods produced from plants. Since 1989 its nutritional value has been debated. Boron plays several biochemical roles in animals, including humans. However, it may be one of the most overlooked and unique elements and minerals in the periodic table when it comes to beneficial effects on our bodies.

Prior to 1981, boron was not considered an essential nutrient; boron was first shown to be an essential mineral for growing chicks. Boron was first discovered to influence the metabolism of calcium, magnesium, phosphorous, and vitamin D. Vitamin D deficiency increases the need for boron in these animal studies. Boron supplementation was shown to alleviate magnesium deficiency signs in chicks. It was not until 1990 that boron was accepted as an essential nutrient for humans.

Boron has an in-depth history being involved in radiation related issues. Boron shielding is used as a control for nuclear reactors by taking advantage of its high cross-section ability to capture neutrons. Boron has a large neutron capture cross section (i.e. absorbs neutrons very well) and as such, is commonly doped into control rods in nuclear reactors to control the fission chain reaction by regulating the neutron flux through the reactor and thus regulating the reactor core temperature and power output. Boron is combined with steel in nuclear utility plants to trap radiation.<sup>i</sup> Boron is also used for trapping neutrons in radiation therapy and it may play a protective role against uranium, radium, and radon's damaging effects.<sup>ii</sup> Boron is the only one mineral that is able to accept ionizing radiation without changing the cell structure or the nucleus. The protons and the neutrons do not change under any conditions in the boron molecule, allowing this element to absorb radiation and release it without upsetting this very delicate balance. Boron may also play a positive role in helping trap radiation poisoning from uranium, radium, and radon when adequate dietary levels are maintained. This ability makes Boron an excellent supplement to have in your system, whether the radiation is from excessive sunlight or spent uranium bullets that are being ionized and released into the atmosphere. Calcium and magnesium have been reported to protect against radiation, especially radioactive strontium.<sup>iii</sup>

When Boron is present in adequate concentrations in your body, your DNA is enabled with a buffering system to ward off radiation and the repair of chromosomal breaks can be facilitated physiologically. "Elemental boron is widely recognized as a neutron absorber," said Joel P. Moskowitz, Ceradyne chief executive. "The Russians used boron carbide during the Chernobyl nuclear power plant meltdown. It is routinely used at nuclear power plants to reduce pipe corrosion and as a safety element because it will absorb extra radiation." In 1999, there was an accident at a nuclear power facility in Tokaimura, Japan, when an improper mix caused a nuclear fission chain reaction explosion to occur. The company used mass amounts of boron to the plant to absorb the radiation. Long-term exposure to space radiation can lead to DNA damage and cancer. One of the shielding materials under study for use with astronauts is boron. Scientists

have known about the ability of boron to capture neutrons since the 1930s and use it as a radiation shield in geiger counters as well as a shielding layer in nuclear reactors.

Daily boron intake in normal human diets ranges from 2.1-4.3 mg boron/day. The backup system to force-fed potassium iodide in severe, acute radioactive poisoning is boron. Boron ingested in a liquid format decreased absorption time and has been found to be extremely bio-available. Suggested Boron Dosage: 4- 10 mg/day.

### **Hormonal Effects**

Boron is required for the maintenance of bone and normal blood levels of estrogen and testosterone;<sup>iv</sup> within eight days of supplementing boron women lost 44 percent less calcium, 33 percent less magnesium and less phosphorus through their urine. Boron markedly reduced the excretion of calcium in women between 48-82 years of age. Boron also increases estrogen and testosterone levels. <sup>v</sup> In these studies with post menopausal women, 3 mg of boron per day significantly reduced calcium lost in the urine.<sup>vi vii</sup> Boron supplementation in both animals and humans results in higher estradiol, natural human estrogen levels, higher testosterone levels, and higher vitamin D levels whereas decreased levels of boron has been linked to lower hormonal levels.<sup>viii</sup>

### **Detoxification**

Clinical diagnostic procedures and follow-up assessments suggested that boron, in combination with other helpful nutrients, played an important role in neutralizing the effects of several heavy metal toxicities. Elsair et al found that high dietary intake of boron alleviated fluoride induced hyperparathyroidism, hypercalcemia, hypophosphatemia, and depressed phosphorous absorption in rabbits, indicating that boron may play a regulatory role in activating minerals that have primary effects on protecting the body against heavy metal toxicity.<sup>ix x</sup>

By enhancing the levels of beneficial minerals known to affect heavy metal poisoning such as calcium, boron may play a regulatory role in helping the body block uptake of heavy metals and help expel them. It is known that deficiencies in calcium, potassium, iodine, and other minerals result in an increased uptake of toxic radioactive elements, but with increased levels of these nutrients, the body is able to excrete these toxins.<sup>xi</sup> In lead poisoning, deficiency in calcium and other minerals are known to increase absorption of lead.<sup>xii</sup> Boron is known to raise levels of calcium in calcium deficient animals.<sup>xiii</sup> Calcium's role in the prevention of toxic absorption and enhancement of detoxification is well documented. <sup>xiv</sup> Boron has been reported to enhance the uptake and spare the loss of calcium, magnesium, and phosphorous from the body.<sup>xv</sup> Evidence indicates that boron is a regulator of many minerals, in addition to calcium, magnesium, and phosphorous.<sup>xvi</sup>

### **Natural Sources of Boron**

Fruits like apples, oranges, almonds, avocados, red grapes, pears, plums, kiwi, sultanas, dates, vegetables, legumes, soybeans and nuts are rich sources of Boron. Chickpeas, hazel nuts, currants; peanut butter, red kidney beans, tomato, lentils, olive, onions, are also notable sources of Boron.

### **Toxicity**

Boron is very safe. The LD 50 (lethal dose in 50% of animal subjects) is about 3-6g per Kilo of body weight. This means that doses up to 18 mg of boron daily would be safe for adults even if taken for prolonged periods of time. This is double the dose of even the most liberal amounts suggested by advocates of boron use. There is also no evidence to suggest that boron is either carcinogenic or mutagenic. Symptoms of acute toxicity typically include nausea, diarrhea and abdominal cramps.

## **Benefits**

- **Arthritis:** Boron is an option for arthritis and in more than 95% of cases significant improvement was noticed by bringing about effective calcium integration into the cartilage and bone. In a study of 20 patients with osteoarthritis, the 50% who received a daily supplement of 6 mg of boron all reported improvement (less pain on movement), compared to only 10% who reported likewise in the control group. Another mechanism is found in boron's ability to inhibit prostaglandins and leukotrienes which are mediators in inflammatory conditions.
- **Estrogen production:** Boron may improve the production of estrogen in menopausal women. Boron increases the level of natural sex hormones in the body, thereby reducing the need for Hormone Replacement Therapy.
- **Reduces the severity of rheumatoid arthritis:** Boron greatly reduces the inflammatory conditions that are typically associated with rheumatoid arthritis.
- **Cancer therapy:** Boron neutron capture agents are used for cancer therapy and in the development of strong enzyme inhibitors. In a UCLA Public School of Health study, boron has been shown to inhibit the incidence of prostate cancer by 64%.
- **Improves brain function and cognitive performance:** Studies have shown that boron plays a significant role in brain function, eye-hand coordination, short memory, cognitive performance and concentration.
- **Prevention of post menopausal osteoporosis:** The bone building capacities of boron are often ignored in favor of calcium. Large numbers of human experiments show that boron is vitally involved in bone metabolism and works in unison with calcium to strengthen the bones. It plays a very important role in minimizing the risks of osteoporosis and arthritis. Boron helps in the metabolism of minerals that are involved in bone development such as calcium, magnesium and copper and substitutes for magnesium during bone formation. Boron also affects the hormones of estrogen and testosterone that are also related to the overall health of the bones.
- **Anti-inflammatory effects:** Boron inhibits enzymatic functions causing an anti-inflammatory effect.

The above statements have not been evaluated by the FDA. The nutritional information, suggestions, and research provided are not intended to diagnose, treat, cure, or prevent disease and should not be used as a substitute for sound medical advice. Please see your health care professional in all matters pertaining to your physical health

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