



Micronutrients: Boron

Transcript

Hello and welcome to our Micronutrients Module on Boron, and I'm excited to share what little information there is on boron. It's not one of those major nutrients that has tons and tons of research, but there are some interesting studies and there are some interesting things for you to know about it, and we'll get started on it.

It is an important nutrient for the bones. It's a very often overlooked nutrients that's used and very helpful in osteoporosis. Before we begin, I want to make sure that you're aware that this isn't intended to replace a one-on-one relationship with a qualified healthcare professional. It's not medical advice. I'm just sharing from my knowledge and experience with you, and I want you to do the same with your clients and just make sure that unless you have a license to diagnosis and treat disease, then everything that you're doing nutritionally with them is strictly evaluating them and helping them to remove the blocks and increase their well-being and vitality as a result.

Let's take a look at boron. Boron is a trace mineral. It's considered a trace mineral. It's just needed in small amounts, anywhere from a half milligram to 3 milligrams, and it's an interesting one we'll look at in a bit, but it doesn't really have an RDA because it's still one of those in the, like what do we need it for and what really is the exact right requirement? It's still up in the air, but we'll share some of the recommendations in terms of ranges.

It's definitely needed for healthy bones and muscle growth, and we'll look at that in a little bit more detail. It definitely assists in the production of steroid hormone compounds with the body, and we know that that's related to adrenal function and reproductive function and inflammation. It's absolutely necessary for the metabolism of calcium, phosphorus, and magnesium and there are interactions between those nutrients. It works to enhance brain function and promote alertness, and I'll show you the mechanism by which it does that.

It plays a role in how the body utilizes energy from fats and sugars, so it's part of that process, and then up until the 1920s, the boric acid version of boron was used to preserve foods. Then in the 1920s, people got the idea that boric acid was toxic, and they stopped using it all together. Then, later it was discovered to be an essential nutrient, so it's come full circle around. I remember using boric acid for various things. When we we're kids, my mother would make a paste out of boric acid and use it for ... I don't remember what, but I do remember boric acid.



Let's take a look at some of the functions. Number 1, it helps to prevent postmenopausal osteoporosis and helps to build the muscle, so it's really important in the bone metabolism cycles. It's also important for inflammation. It helps to mediate inflammation by reducing COX-2, that's cyclooxygenase 2, and LOX enzymes and decreases leukotrienes and increases the removal of reaction oxygen species. It could even reduce T cells.

A leukotrienes, if you think about the fatty acid cascades that we looked about in detail in our Fatty Acids Module, and you might recall that the dietary fats come down any number of pathways, and that at the very bottom, the reactive inflammatory species are generally leukotrienes and prostaglandins and leukotrienes, so they're really potent inflammatories. One of the ways that drug-wise is intervening with decreasing leukotrienes is with these drugs that are called COX-2 inhibitors. These COX-2 inhibitor drugs do similar things to having the right nutrition, and boron is one of the nutrients that fits in there in reducing the COX-2s, so that's that.

It helps to preserve cognitive function, and we'll look a little bit more detail there. Some of the other functions that it has, it has a role in cell membrane function and stability in terms of the membrane in the cell transmitting nutrients in and toxins out. It played a role in embryo genesis, which means that's the development of a baby. Boron is important so in pregnancy in the development of the growing fetus in the uterus.

It enhances the estradiol action on bone and promotes the absorption of minerals. We know that in the premenopausal age that women are not as susceptible to osteoporosis as they are in the postmenopausal era, so why is that? One of the things is estradiol, which is one of our estrogens, one of our major 3 estrogens, acts on bones and promotes the bones to absorb minerals, and during menopause, that tends to go down, which means that we tend to have some issues with bone remineralization, so the boron actually helps to promote that action of estradiol, assuming you have enough estradiol.

It also plays a role in the glucose cycle. It helps to reduce blood glucose and also triglycerides, and it plays a role in the prostate. In men who have prostate cancer, boron has been shown to reduce the size of the tumor. It's also been shown to reduce levels of prostate-specific antigen and has been shown protective, is promising in protecting from prostate cancer.

Let's look at how boron is digested and absorbed. There's 2 processes of getting nutrients into the body. One is active transport and one is passive diffusion. Passive diffusion means that a nutrient passes from a concentration, a higher concentration to a lower concentration. If inside the blood stream we've got a certain level of boron and in the digestive tract, we have a much higher, it passes through passively.



If we have active absorption, it means there's some carrier proteins that grab a hold of that nutrient and carry it through the channels through the cell membranes to get from the gut into the blood stream. 85% of the boron is ingested by passive diffusion.

Just to look at this a little bit detailed, and this applies to other nutrients as well. When you look at, say, the blood stream has got very little of a nutrient, what's in the lumen of the small intestine as you're eating it, is going to be higher than the blood stream, so it's going to flow, but if you already have plenty in your blood stream, it's not going to be able to passively flow from higher concentration to lower, so you don't have as much absorption, which protects the body from too much.

We see that in things like vitamin C, and magnesium absorption. If you take in too much magnesium, more than your body needs, it no longer diffuses into the blood stream, passes through the intestine, grabs onto a lot of extra fluid, and you end up with diarrhea. This passive diffusion is protected. Other nutrients are absorbed pretty much strictly by an active diffusion or an active transport.

There's different forms in the blood, so the boron is absorbed and excreted, so it comes in through the gut as food and excreted as boron with 3 OH groups attached to it, 3 alcohol groups attached to it. It's found in the blood as boron with 2 OH groups, and that's called boric acid $(B(OH)_2)$. It's also found in the blood as $B(OH)_3$, which is the same as it's absorbed and excreted, which is called orthoboric acid, and then the boron with 4 alcohol groups is called a borate anion $B(OH)_4^-$, and that has a little minus there because it changes the...what do you call it...the valence numbers.

Boron is found, stored in the body you'd mainly find it in the hard tissue: the bone, the teeth, the hair, and the nails. If people that you're working with are dealing with osteoporosis, tooth decay, nails that are brittle and falling off, hair that's unhealthy and is falling off, you can actually look at maybe they have a problem with boron, either an absorption problem with boron or not enough boron in the diet.

70% of all the boron that we take in is excreted in the urine, 13% or less in the feces, and small amounts in the sweat. Oftentimes when you do testing for various nutrients, we look at various channels, and one of the tests for metals is the urine test, and if 70% is excreted in the urine, then we know that there is a fair amount of boron in the system. If there's very little excreted into the urine, then we know that we may have a deficiency in the body.

What does boron interact with? It can increase estrogen levels in the body. That's good to know if you're dealing with a postmenopausal woman who has been shown to be low in estrogen and doesn't really want to do any replacement therapy. Boron supplements can lower the amount of magnesium that's flushed out in the urine, so it helps to retain the magnesium, so that's a good thing.



Boron supplementation might also reduce the blood phosphorus levels in some people, not in everybody, but in some people. These are just various studies that we've seen on boron, and I've got a link at the back to some of the study.

Boron deficiency. Boron deficiency is rather rare. We don't see it a lot, although we may see some subclinical signs of low boron in folks that are having trouble with bone and hair and nails, and they're not maintaining their calcium and their magnesium and mineralization in their bone. Boron is one of the essential nutrients for bone. We get hung up in our country about calcium being it. Osteoporosis, make sure somebody has enough calcium, but there's a lot of other nutrients. There's 20 or 22 different nutrients that are important for bone formation, and boron is one of them.

If you've got a deficiency of boron, it could accentuate a vitamin D deficiency, so if you're working with somebody who just keeps taking vitamin D and taking vitamin D, but they don't seem to be getting better, maybe they also have a deficiency in boron. Definitely can see osteoporosis and osteopenia, although those are very complex types of conditions. Boron isn't the only nutrient that would be down, but when we're looking at osteoporosis and osteopenia, we want to be regulating that person's bone metabolism using as many of the nutrients that are required as possibly, and boron should not be overlooked.

There's a lot of studies where the level of boron in the soil is low, and there is a correlation there. Remember, correlation does not necessarily mean causation, but we learn things from correlations. In the areas where there's low level of boron in the soil, there's a great number of people suffering from arthritis, so perhaps the arthritis can be helped with supplemental boron if the person needs the extra boron.

Let's look at what we need in terms of boron, and then let's look at where it comes from. There's no RDA that's been established for boron. There's a few nutrients like that. We know they're needed, but we don't know exactly how much we need, so there's no RDA. Oftentimes there's an upper limit or an acceptable limit that's set for these things. When we look at diets that appear to be high in boron, they provide about 3.25 milligrams of boron per 2,000 calories, and diets low in boron provide about 0.25 milligrams of boron per 2,000 calories. There's a big differential. That's like 12, 13 times the amount in the upper level and the lower level.

When we look at what seems to be safe, it's pretty wide range, 3 milligrams for children 1 to 3; 6 for children 4 to 8; 11 for children 9 to 13. That's pretty wide range and quite a bit over the diets that we're thinking are high in boron, so this leads me to say that it's got a very low toxicity level. You've got to eat a tremendous amount of it, which may be hard to do, and that's why it's considered not necessarily easy to become deficient in it. Then, for adults, regular adults, 20 milligrams per day and a little bit more than that if they're breast feeding.



Where do we find it? I searched the internet far and wide to try to find a good list. The place I usually go for good lists and charts that I can put in is WHFoods. WHFoods did not have a list for boron, and every time I found a chart that had list, it didn't really say how much of the food you had to eat to get it. These are the foods that pretty much universally are seen to be good sources, apples, carrots, grapes, dark green leafy vegetables, almonds, raw nuts, pears, and whole grains, so it seems that someone who's eating a really good healthy diet that's high in produce is not going to be really low in boron.

This is the closest I could find to a chart, but it seemed to be that it was milligrams per kilogram, so for an apple, it's 2.73 milligrams per kilogram, and a kilogram is about 2.2 pounds. In order to get 2.73 milligrams of boron in an apple, you're needing to do about 2.2 pounds. I'm hoping that this is accurate, but this is the best I could find. Even on the USDA database I couldn't find it. Cherries, a little bit lower. Dates really high. Prunes, look at that, so the dried fruits seem to have a lot of it in there. It seems to be higher in fruits than it is in veggies. Beans, not so great. Broccoli, 1.85. That seems a little easier to eat 2 pounds of broccoli, but that's quite a hefty amount of broccoli.

Almonds seem to be the highest, really good, but 2.2 pounds of almonds? I don't think anybody can eat that across a day. I'm not sure how they got people to have the high levels of 20 per day in their range of supplementation, but it would have to be with a boron supplement. Although it said that deficiencies are rare, because of the relatively scanty levels that are in our food supply, I'm thinking that it might be not as rare as people are thinking that it is.

What do we have to be careful with about boron? You don't want to take more than 3 to 6 milligrams a day unless prescribed by a healthcare practitioner. Why that came about, I think it's just erring on the side of caution because studies have shown that up to 20 can be taken without adverse effect. It's toxic in high doses but not really carcinogenic or mutagenic. No studies out there that are showing that there's cancer that comes from taking high doses of boron, nor even mutagenic effects.

Boric acid, borates, and other compounds contained in boron are potentially toxic if ingested or absorbed through non-intact skin. If you're doing a topical application of boron, boric acid, and you've got cuts and lesions on the skin, it's probably not a good idea to put too much of that in there ... and there's some references. It's scanty, the amount of information out there. The book that we've been using for the course, *Advanced Nutrition and Human Metabolism*, usually every nutrient have pages and pages and pages and pages, and this one have a page and a half, I think, and then there's 2 links there that are articles that we found on boron and things that you can find out there.