

Sugar in Isotonix Products

Isotonix products are specifically designed to improve delivery of key nutrients and increase compliance for taking these products. We are not pounding our ingredients into tablets, so our Isotonix powders must taste excellent as well as look presentable and be effective in solution. We also have to have substantial doses of nutrients in our formulations so adding more sugar is one way to cover bitter and astringent off-tastes of vitamins, minerals, and plant extracts. I'll pat our manufacturer on the back for this aspect: The flavor technology is a major cut above what most other companies have in their powdered and liquid drinks. All of the 'base' ingredients in Isotonix products are utilizable by our bodies—consider THAT when looking at all of the binders, fillers, animal gelatin and colorants used in the manufacture of pills, soft gels, and hard capsules.

We say our products are isotonic and we mean this. We aim for an osmolality of 270 to 310 milliosmoles per kilogram of water and we hit the mark. How is isotonicity created in Isotonix? Well, mainly by the osmotic pressure generated by fructose and glucose, and to a far lesser extent by potassium ions, bicarbonate ions, calcium ions, magnesium ions and a few other osmotically active materials.

There are a total of three sugars that contribute to the sugar content in our Isotonix formulas - fructose, glucose, and maltodextrin. These sugars contribute to the isotonic character of the product.

Fructose is the major sugar in the formulations, NOT glucose, and this fact contributes to a much lower glycemic index (19 out of 100). Unlike ordinary table sugar or sucrose, the consumption of fructose does not produce extreme 'highs' and 'lows' in blood sugar levels. Glucose, also known as grape sugar and blood sugar, is the main source of energy for living organisms. Of course glucose is 100 out of 100, but we do not use this often, preferring instead to adjust the osmolality of the Isotonix solution with fructose and making up the difference in sweetness with stevia (stevioside A at 97%). Glucose is an interesting sugar in that it is actively transported into the enterocytes lining the gut and in so doing can 'drag' (stimulates the sodium pump mechanism of active transport) other nutrients in with the sugar molecules. So its purpose is greater than what most people think.

Let's consider how much fructose is in some fruit juices for the purposes of comparison to Isotonix products (most of which contain 1.5 -2.0 g of sugar -- fructose and glucose combined) per serving. An 8 oz glass of grape juice (253 g) contains 36 g of sugar (about half of which is fructose). Isotonix provide a very low sugar alternative to obtain nutritious components of these types of fruit juices. One of the best food sources of OPC's is unsweetened grape juice but an 8 oz glass contains a total of 121 mg of OPC's (with 36g of sugar). Two doses of OPC-3 contains 250 mg of bioflavonoids of which 150 mg are OPC's and contains only 4 g of sugar. This is a classic example of a supplement offering a significant advantage (9x more sugar in 8 oz of unsweetened grape juice than in two servings of OPC-3). Clearly the glycemic impact of the Isotonix supplements is FAR less for an equivalent quantity of OPC's.

Maltodextrin is a nutritive polysaccharide, derived from the hydrolysis of starch. If you can imagine starch as being a 'molecular' tree with a main stem and branches, then maltodextrin is a tree in which all of the branches have been cut at their attachment points, the alpha-limit. The starch is cooked and then acid and/or enzymes (a process similar to that used by the body to digest carbohydrates) are used to break the starch into smaller

chains (3-20 chains in maltodextrin). These chains are composed of several dextrose molecules held together by very weak hydrogen bonds.

Starch and maltodextrin are polyglucose compounds which offer caloric value. True, in many foods maltodextrin acts as a bulking agent but not the case with Isotonix products. Maltodextrin is used to coat potassium bicarbonate crystals to keep the potassium bicarbonate dry and prevent them from reacting with other ingredients, like citric acid, if the product is exposed to excessive moisture. Maltodextrin has also been shown to enhance the absorption of other nutrients, particularly calcium. Depending on the specific Isotonix product, there are about 30-50 mg of total maltodextrin in a 3.33 gram serving. So you can see that this material is not providing much caloric value ($4 \text{ calories} \times 0.050 \text{ grams} = 0.2 \text{ cal/serving}$). This adds very little to the calories and glycemic index and ability to stimulate the release of insulin by beta cells of the pancreas.

Let's review the advantages of fructose in Isotonix formulations:

1. Fructose acts as a bulking or dispersing agent in order to get uniform distribution of active vitamins, minerals and other nutrients in the powder.
2. Facilitates nutrient drag into enterocytes.
3. Flavor and improvement of compliance in taking nutritional supplements. Fructose has a clean flavor profile compared to many sweeteners, both caloric and non-caloric. Fructose has a sweetening factor of 1.3 X that of sucrose. If we did not sweeten our products with fructose (and sometimes little bit of glucose), they would taste horrible. Modern marketing research indicates that 95% of consumers want dietary supplements and functional foods to taste good, and not like medicine.
4. Contributes to osmolality. Fructose exerts significant osmotic pressure in solution. This goes to the heart of the Isotonix concept. Steviosides and rebaudiosides in Stevia extract are high intensity natural sweeteners. There are no data on the osmotic pressure exerted by stevia extract. We may use stevia extracts in our products, but it cannot replace fructose's mechanism of action.
5. A very modest contribution to calories in a person's daily diet (no greater than a small bite of sweet fruit) Our products offer no more than 2-4 grams of fructose per serving (depending on the product). Compare that small amount to the 30 grams of fructose in a 12 fluid ounce can of soda, or the 35 grams of fructose/glucose/sucrose in an 8 fluid ounce glass of orange juice.

I think the formulations of Isotonix products are elegant in their simplicity.

References:

Cesarone MR, Grossi MG, Di Renzo A, Errichi S, Schönlaui F, Wilmer JL, Lange M, Blumenfeld J. Accelerated Antioxidant Bioavailability of OPC-3 Bioflavonoids Administered as Isotonic Solution. *Phytother Res.* 2009 Jun;23(6):775-7.

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USDA's National Program for Nutrition database of the OPC content in foods:<http://www.nal.usda.gov/fnic/foodcomp/Data/PA/PA.pdf>