

What is Isotonic?

Isotonic ('iso' means 'the same' and 'tonic' means 'pressure'). When isotonic is used to describe solutions for human consumption, it means having the **same fluid pressure as body fluids**. Tears, blood plasma, lymph and other body fluids are all isotonic. Everything we eat and drink must be made isotonic before passing to the small intestine so the body can absorb it.

The fluid pressure of isotonic solutions across semi-permeable membranes, such as the walls of the small intestine, is generally referred to as having a particular osmolarity or tonicity. For the purposes of this discussion, osmolarity is measured in units referred to as milliosmoles/kilogram (mOs/kg). It can be said that when solutions on opposite sides of a membrane have the same osmolarity, they are **iso-osmotic** or **iso-tonic**. Normal human blood serum (the fluid portion without cells and platelets) has an osmolarity of 288 mOs/kg, as do most other fluids in the body. Therefore, in physiologic terms when a food solution's osmolarity is the same, or nearly the same, as that of normal human blood serum, it is referred to as **isotonic**.

To obtain this state, when we ingest food, drink a beverage, or ingest most nutritional supplements, the stomach must secrete diluting juices, enzymes, hydrochloric acid, and at least one vitamin-binding protein to continue the process of digestion. Muscular contractions of the stomach mix the contents until a reasonably uniform solution is achieved. This action is a relatively time consuming process – about 40 minutes to 4 hours depending on the size of the meal. Once isotonic, the **solutions of food** (or chyme) can then enter the small intestine for absorption.

Isotonix® products are formulated with the proper balance of fructose, d-glucose, citric acid, potassium bicarbonate and other key ingredients to assure that they are isotonic when properly mixed with water. This combination of ingredients is necessary to maintain the flavor, isotonic character, pH, and therefore delivery efficiency of these fine nutritional supplements.

These products are usually taken on an empty stomach, dramatically shortening the transit time into the small intestine. This minimizes the chance that important micronutrients will be trapped by fats, fibers, and tannins or inactivated by a highly acidic pH level which can neutralize the nutritional value. The solution can then flow into the small intestine almost immediately, where a sufficient volume of pancreatic digestive juice mixes with it, adding sodium bicarbonate to adjust the pH to neutral, thereby maximizing the potential uptake of micronutrients.

Importance of Gastric Emptying Time

Why is gastric (stomach) emptying time so important? The answer is simply this: Since no appreciable absorption occurs from the stomach, the time it takes for the tablet or capsule to disintegrate, and the nutrients to dissolve and equilibrate to the proper state (isotonic) in order to leave the stomach, determines how much the active nutrient then becomes diluted before finally reaching the absorption sites (villi and micro-villi) of the small intestine.

Why is gastric emptying time stressed when talking about the Isotonix®? Because it goes without saying that the fastest emptying time occurs when the solutions entering the stomach are already *isotonic*. When the biological sensors in the gastrointestinal tract detect that the ingested solution is isotonic, the pyloric or duodenal valve at the lower end of the stomach remains open, and the solution is squirted into the small intestine almost immediately. At that point the pancreas secretes digestive enzymes in a physiologic sodium

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bicarbonate solution that neutralizes the acidic material flowing from the stomach. Absorption of the nutrients by the intestinal mucosa then starts to occur.

Because Isotonix® products are powders, none of the fillers, binders, coatings, and lubricants that are common to tablet manufacturing are found in its formula. There are no gelatin capsules or fillers to make things fit the capsules. All that is in them is what is necessary to enable the maximum absorption of a high concentration of active nutrients, and nothing extra.

RAPID GASTRIC EMPTYING IS THE KEY TO RAPID ABSORPTION.

Isotonix® products are formulated for gastric emptying in minutes.

Concentration and Absorption

Concentration and absorption are factors that go hand in hand for the proper use of nutritional supplements. Concentration, the amount of nutrient dissolved in a given amount of solution, is directly related to the efficiency of nutritional absorption. It is known that the greater the concentration, as milligrams of nutrient per milliliter of solution, at the absorption site, the greater the rate and amount of absorption. Because Isotonix® solutions experience little dilution in the gastrointestinal tract, they arrive at the absorption sites in high concentration to assure efficient absorption.

The absorption of vitamins, minerals and other supplements takes place in the small intestine by several mechanisms known as active transport, passive diffusion, and facilitated diffusion. **Active transport** is an energy-requiring process usually stimulated by the presence of sodium in the lumen, the cavity or channel of the small intestine. This mechanism is important for the assimilation of vitamin C and many trace minerals. While this mechanism will work 'up the concentration gradient', that is from a lower concentration in the intestine to the higher concentration in body tissue, it is most efficient when there is a higher concentration in the small intestine.

Passive diffusion works only when the concentration in the lumen of the small intestine is higher than that in the membrane of the small intestine and the blood. For this mechanism to operate efficiently, there must be a concentrated solution of nutrient at the absorption site. For example, if there are more milligrams of niacin (vitamin B₃) per milliliter of blood in the blood stream than there are in the solution of niacin that reached the small intestine after ingesting a niacin supplement, the niacin will not be absorbed. Therefore, it is very important that very little dilution of the supplement occurs after ingestion.

Facilitated diffusion works best when there are certain nutrients present that help other nutrient molecules pass through cell membranes. For example, the active transport of glucose, a simple sugar found in Isotonix®, across cell membranes facilitates the enhanced diffusion of some minerals.

Because of their physiological character (isotonic), Isotonix® solutions undergo very little dilution in the body before they reach the absorption site. They are the ideal vehicle for rapid nutrient utilization.

What's All This About pH?

pH is a reference number, from 1 to 14, used to indicate the degree of acidity or alkalinity of a solution. A solution at pH 1 is extremely acidic and one at pH 14 is extremely alkaline, or basic. The pH of most body fluids is between 6 and 8, and a pH of 7 is referred to as being 'neutral'. The stomach is an exception. Solutions in the stomach are in the acid range and are usually between pH 1 and 2.8.

When food is ready to leave the stomach in the form of chyme, it is at a pH between 1.5 and 2.8. Before any absorption can take place, the pH of the chyme must be altered by the body of bring it into the neutral range at about pH 6.5 and 7.0. To accomplish this, the pancreas secretes a large volume of sodium bicarbonate solution to adjust the pH. Once this secretion and some preliminary mixing has occurred, the absorption process can begin. Isotonix® solutions have a pH between 3.5 and 4.0. Since they don't stay in the stomach for very long, when they move into the small intestine, they also require sodium bicarbonate to adjust their pH, but not nearly as much. This means that Isotonix® solutions are diluted very little, leading to a high concentration of nutrients at the absorption site.

Now, why not make the Isotonix® pH 7.0 so no adjustment is necessary, and therefore, no dilution is necessary? That would mean that there would be no sodium bicarbonate entering the lumen of the small intestine. For some vital nutrients, vitamin C for example, sodium must be present for absorption. Since the products are sodium free, they must be able to stimulate sodium secretion by the body. Keeping the pH between 3.5 and 4.0 provides this stimulus.

Overall, the pH of Isotonix® is in an ideal range.

The Isotonix® Base

Pure crystalline **FRUCTOSE** is a naturally occurring nutritive sweetener. Fructose is present in almost all sweet fruits, berries, vegetables and honey. It is synthesized in the human body. Fructose is the sweetest of all natural sugars, and for this reason, it was chosen as the sweetener for Isotonix®. Unlike ordinary table sugar or sucrose, the consumption of fructose does not produce extreme 'highs' and 'lows' in blood sugar levels. In particular, many experts consider high blood sugar and insulin levels to be risk factors in the development of certain disease conditions. Since blood sugar and insulin levels are far lower after eating fructose than after eating ordinary sugar (or sucrose), fructose offers a clear alternative to people concerned about their health. It contributes to the tonicity of Isotonix®.

d-GLUCOSE, also known as grape sugar and blood sugar, is the main source of energy for living organisms. It occurs naturally and in the free state in fruits and other parts of plants. Normal human blood contains 0.08-0.1% d-glucose. It is included to (1) stimulate the sodium pump mechanism of active transport, (2) help maintain the isotonic character of the products, and (3) cover the bitter taste of certain micronutrients and plant extracts.

CITRIC ACID is widely distributed in plants, especially citrus varieties, and in animal fluids and tissues. Citric acid is a necessary ingredient for pH stability of the product in solution. It contributes to the osmolarity of Isotonix® and is a flavor enhancer.

MALIC ACID is a mild, food grade organic acid that acts as a flavoring agent. It helps achieve a clean, pleasant taste. Malic Acid, when reacted with calcium carbonate, also helps produce calcium malate, which helps provide maximum effervescence.

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POTASSIUM BICARBONATE makes the slight effervescence ('fizz') which helps distribute all components of the product uniformly in the solution for consumption. It also contributes to producing the isotonic state in solution and plays a role in stimulating absorption.

SILICA (food-grade, amorphous) has been included to help prevent product caking in high moisture situations. Crystalline silica is the most abundant mineral in the earth's crust. It is essential to human nutrition and contributes to bone and cartilage formation, collagen synthesis, and skin elasticity.

MALTODEXTRIN, a natural polymer of d-glucose or a nutritive polysaccharide, is used to coat the citric acid crystals to keep them from reacting with other ingredients if the product is exposed to excessive moisture. Maltodextrin has been shown to enhance the absorption of other nutrients, particularly calcium.

The **100% NATURAL FLAVOR** is an extract containing the natural essence from lemons, limes, oranges, and other fruits.

These ingredients, carefully balanced and adjusted to accommodate the active ingredients, help comprise the delivery vehicle, which leads to the rapid assimilation of Isotonix®. These ingredients, as well as all our other ingredients, are from the finest and most natural sources available. They have been obtained from some of the world's foremost manufacturers and meet the rigorous standards of the United States Pharmacopoeia, the National Formulary, and the National Research Council's Food Chemical Codex.

Absorption

Ingested foods, drugs and nutrient supplements pass through several biological environments prior to absorption. During this passage, they will traverse biological membranes, which form part of every cell in the human body. Each cell membrane is maintained in a delicate osmotic and electrophysiological balance, for optimal integrity.

Foods are digested and metabolized in three stages:

- 1) Ingestion and digestion in the alimentary tract degrade whole foods into simple nutrients such as fatty acids, amino acids, nucleic acids, simple sugars, vitamins, minerals, coenzyme Q10, and numerous phytonutrients such as proanthocyanidins and carotenoids.
- 2) Absorption of the macro- and micronutrients by the intestine and transport by the blood to cells throughout the body for chemical modification and incorporation into cellular molecules.
- 3) Oxidation of nutrients such as fatty acids in the cell mitochondria for the production of energy-bearing molecules such as ATP and the generation of heat.

When the nutrients are ingested, many factors affect the rate at which they are absorbed. For example, when a vitamin tablet is ingested, the vitamins in it should be released into solution in the stomach before they are passed into the intestine for absorption. So the dissolution of a vitamin tablet by gastric juice is a rate-limiting factor. The **concentration of the solution after dissolution** of the tablet can be another rate-limiting factor. If the nutrient concentration is high, it may be *hypertonic* compared to body fluids and will need to be diluted before it is emptied from the stomach into the small intestine from absorption. Another limiting factor is the content of the stomach and the **interaction of the nutrient with stomach contents**, which also affect the rate of nutrient absorption and the amount of the nutrient eventually absorbed.

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Therefore, it becomes obvious that in formulating dietary supplements, it is essential to maximize the benefits by providing an **increased rate of absorption** resulting in **use of a high concentration of active ingredients**.

It is well established that the rate of intestinal absorption of nutrients is regulated by the stomach. Stomach emptying into the intestine is in turn regulated by **osmoreceptors** in the duodenum, which trigger **opening and closing of the duodenal valve** for emptying gastric content into the intestine for absorption. Such receptors are **triggered by the osmotic pressure of the stomach content**.

The osmotic pressure of a solution which is designed to be mixed readily with body fluids should have an osmotic pressure similar to body fluids. Such a fluid is termed isotonic and is more compatible with body fluids. An isotonic solution is more effective, safer, and faster to utilize. It empties faster from the stomach than a hypertonic solution, which has to be diluted before absorption and use, and is absorbed more effectively and with ease for maximum use and metabolism.

All biochemical and physiological processes require energy. Such energy is derived from macronutrients, including carbohydrates, fats, and protein. Such energy sources are essential for maintenance, growth, repair and energy production. These major nutrients are used by the body through the metabolic cycle, which required enzymes, vitamins, coenzymes, and minerals.

To maximize efficacy and use of macro- and micronutrients, it is recommended that nutrient supplements be administered in an isotonic form.

The Product at Work

Physical fitness has become a way of life for many Americans in the new millennium. One of the keys to keeping physically fit is good, sound nutrition. Wholesome food, properly prepared, will go a long way in this area, but the stresses of the increased physical activity often make supplements a wise choice to insure nutritional adequacy.

Isotonix® products are well suited for those who are engaged in athletics. From the once-a-week golfer to the marathon runner, Isotonix® can be used to sustain your nutritional integrity. It helps to replace nutrients rapidly used in strenuous activity. The use of fructose as a sweetener is very advantageous, because it leads to a much lower rate of muscle glycogen depletion, compared to glucose. This is because fructose does not cause a rapid rise in either blood sugar or insulin. It provides a steadier supply of blood sugar and helps the energy stored in the muscles to last longer. This carries the potential for greater endurance during periods of sustained exercise.

Isotonix® also helps to maintain the sodium-potassium balance by replacing potassium lost during heavy physical activity. Much potassium is lost through perspiration. The potassium in Isotonix® will help maintain proper potassium levels in the body.

The efficiency of the Isotonix® delivery system helps to ensure that maximum benefits are derived from the supplements. Because the nutrients arrive at the absorption site more rapidly in a highly concentrated solution, excellent utilization of the nutrients should be achieved.

The Most Frequently Asked Questions and Answers

Q. Are Isotonix® FDA approved?

A. Isotonix® and all vitamin supplements fall into a general category known as 'dietary supplements' and are regulated under the terms of the Dietary Supplements Health and Education Act of 1994.

Q. How many calories are in Isotonix®?

A. A single level capful of any of the Isotonix® products contains about 8 calories. This would be equivalent to the fructose in two to three grapes or one-half teaspoon of honey.

Q. Why is fructose in Isotonix®?

A. Fructose is the sweetest of all naturally occurring sugars and helps make Isotonix® pleasant tasting with fewer calories. The consumption of fructose does not produce the extreme 'highs' and 'lows' in blood sugar levels like ordinary table sugar might and can be safely taken by diabetics. Some experts consider high blood sugar and insulin levels to be contributing factors in the development of certain diseases.

Q. Are Isotonix® products hypoallergenic?

A. Current scientific literature cites no known instances of 'vitamin allergies'. Many vitamin tablets available include dyes, fillers, binders, coatings and extenders which may cause allergic reactions in some people. The exclusion of these substances in Isotonix® products was carefully planned: therefore, no reports of allergic reactions are expected.

Q. What is the best time to take Isotonix® supplements?

A. Basically, any time the stomach is empty is a good time, in order to take advantage of the 'isotonic state', and the processes of gastric emptying and absorption of nutrients. The products may be taken in any combination as long as the amounts of powder and water are proportional. Two Isotonix® products, Advanced B Complex and Digestive Enzyme Formula with Probiotics, should be taken during or immediately after meals. The uptake of vitamin B-12 is greatly aided by the presence of a special binding protein called Intrinsic Factor that is secreted by the stomach during digestion. Digestive enzymes in Isotonix® work well over the pH ranges found in the gastrointestinal tract, and so it is important to allow the enzymes to begin working as soon as possible in the digestive process in order to supplement our own salivary, stomach, and pancreatic enzymes.

Q. What are Daily Reference Intake values?

A. Daily Reference Intake (DRI) values for essential nutrients are established by the Committee on Dietary Allowance of the Food and Nutrition Board of the National Academy of Sciences. These 'recommendations' are based on the judgment of the Committee as to available scientific knowledge regarding the known nutritional needs of almost all healthy individuals. Since the RDIs are defined for 'almost all healthy persons', there is no consideration given to special needs that require special nutritional attention. Whereas the older term 'Recommended Daily Allowance (RDA)' defined the minimum doses of vitamins and minerals derived from all dietary sources that should be taken daily to prevent disease caused by nutritional deficiencies (i.e. anemia, scurvy, pellagra, etc.). The newer term 'DRI' defines adequate doses of micronutrients that contribute positively to a state of good health. Typically Isotonix® products meet or exceed DRI values.

- Q. What are some of the special needs Daily Reference Intake values do not address?**
- A.** Many factors such as physical activity, climate, stress, aging, chronic disease, dieting, smoking, alcohol, and prescription drug use constitute 'special needs'. It is difficult to assess exactly how any one of these 'special needs' may affect nutrient demand for an individual. However, an increased requirement for some nutrients would certainly be indicated for many individuals with 'special needs'.
- Q. Do Daily Reference Intake values pertain to vitamin and mineral supplements only?**
- A.** No. The Daily Values are designed to reflect ALL of the vitamins and minerals consumed in one day, including those nutrients which occur in foods or are added to foods as fortification and dietary supplements. The use of multi-vitamin/multi-mineral products offering 100% of the USDRI serves as excellent insurance that at least the basic needs are met.

Preparation of Isotonix® Solutions

Isotonix® nutritional supplements are packaged ready-to-use and easy to take.

For best nutritional results:

- Take Isotonix® products on an empty stomach (if possible, first liquid of the day). Wait 10 to 15 minutes before eating or drinking anything else. The exceptions to this suggestion are Advanced B Complex and Digestive Enzyme Formula with Probiotics, which should be taken during or immediately after meals.
- Age or weight may change how much of a supplement that you will take.
- Measure both the Isotonix® and water carefully (2 oz. water / 1 powder serving) to assure an isotonic solution.
- You can mix several Isotonix® powder supplements together—keep ratio of 2 oz. water / 1 powder serving.
- Keep container closed in a cool, dry place.

Just follow these simple directions:

1. Remove the overcap from the bottle.
2. Unscrew the bottle cap.
3. Measure powder using:
 - **Bottle Cap:** (*not* overcap): Fill the bottle cap level (3.3g) with Isotonix® and pour into a glass.
 - **Dispenser:** Close dispenser device and turn bottle upside down over a glass, shake bottle slightly, open dispenser – the correct measure of powder (3.3g) will fall into the glass.
4. Fill the overcap to the middle line (2 oz.) with water and pour into a glass containing Isotonix® powder.
5. Stir and allow solution to fizz for 15 seconds in the glass.
6. Drink the Isotonix® nutrient solution.
7. Replace the bottle cap or close dispenser.
8. Do not replace overcap on bottle. Save it for daily measurement use.

Remember these three things as you enjoy the benefits of your Isotonix®:

1. Isotonix® products deliver pharmaceutical grade quality, all naturally derived nutrients into your system faster, using an isotonic-capable formula that maximizes nature's own nutrient delivery system.
2. With Isotonix®, your body can absorb at least 5 times more of the active nutrient per serving (up to 95%) than with conventional, even high quality tablets or capsules. The already isotonic liquid is not broken down and diluted by digestive fluids, arriving at the absorption site more rapidly in a highly concentrated solution.
3. Isotonix® products taste great.

Isotonix®: Simply the world's most advanced and potent nutraceutical taken orally – using nature's own nutrient delivery system – isotonics.

The Advantages and Benefits of Isotonix®

1. Advantage/Benefit: Pharmaceutical Grade, Isotonic-capable, Economical

Isotonix® products become *isotonic* when mixed with water. Isotonix® solutions offer the fastest and most efficient absorption and are therefore the most potent of ALL oral forms of nutritional supplementation when taken on an empty stomach. At least 5 times (95% compared to 10-20%) the concentration of the nutrient is available for absorption into the bloodstream compared to conventional supplements. The health-conscious consumer gets the maximum absorption and benefit for their dollars spent by choosing Isotonix®.

2. Advantage/Benefit: Great Tasting Liquid Vitamins vs. Tablets or Capsules

Isotonix® products are liquid when mixed with water. In an informal survey we found that nine out of ten people prefer a liquid supplement when given a choice. Liquids are simply more comfortable to take! Most children and older people especially have difficulty swallowing capsules—so for those who don't like to or simply cannot take conventional oral supplements, a liquid is a blessing. Easier for those who take a variety or multiple supplements. Add to that, all the Isotonix® formulas taste great!

3. Advantage/Benefit: Does not linger in the stomach. Prevents discomfort.

Because isotonic fluids pass through the stomach quickly and are rapidly absorbed into the bloodstream, many gastrointestinal discomforts can be avoided. No more unpleasant nausea, stomach-ache, burning sensation, or 'burping up' of the tablet dissolving in an empty stomach. Thousands who have shied away from supplements to avoid that 'unsettled' feeling may find the answer when taking Isotonix®.

4. Advantage/Benefit: No Binders or Fillers to break down and burden the body

Isotonix® products are not encapsulated or compacted into a 'form'. There is no need for fillers, binders, coatings, lubricants, disintegrators or artificial coloring and flavoring. All Isotonix® ingredients are from the finest naturally derived sources available. All ingredients meet USP specifications for identity, quality and purity.

5. Advantage/Benefit: Convenient and Functional

The Isotonix® package is designed not only to contain the product but to be functional. The durable plastic bottle protects the product, plus the overcap functions as the pre-measured drinking cup to ensure the amount of water added to the nutrient is accurate to create isotonicity. Isotonix® products do not need to be refrigerated, so are easy and convenient to take with you when you are traveling.

