Ioniplex®

A clinically validated fulvic acid for cellular health, mitochondrial metabolism and healthy blood sugar levels.

MINERAL BIOSCIENCES®
Nature Knows Best®

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Ioniplex® *a fulvic acid complex*

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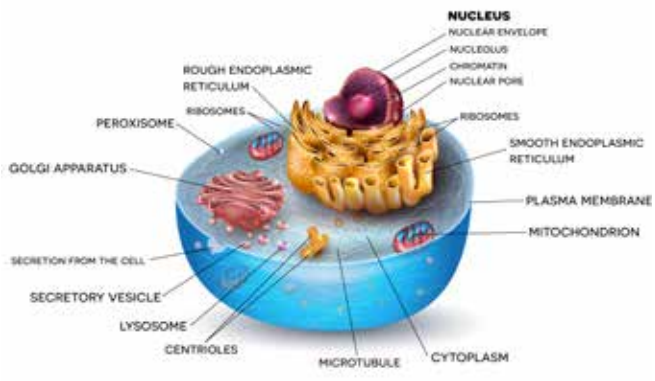
Mineral BioSciences®

Abstract

Glycation, pronounced "gly-kay-shun" is a condition in our bodies that can damage organs and contribute to disease and health issues, such as diabetes, inflammation, nerve damage, cardiovascular disease, skin aging and a host of other conditions[1]. The process begins with an excess of glucose in the bloodstream. This is generally caused by an overconsumption of carbohydrates (including sugar). Once in the bloodstream, this excess glucose reacts with macromolecules in the process known as glycation. This process creates Advanced Glycation End-products (AGEs), a group of complex compounds that disrupt the normal function of human tissues, trigger inflammation and clog the cardiovascular system.

Our patented product[2], Ioniplex®, has been shown to have the ability to reduce excess glucose by up to 75%[3]. This may be due to the blood sugar reducing effect of Ioniplex[4,5]. Thus, instead of lingering in the blood and causing glycation, glucose may be readily absorbed by cells. There, it provides energy and increases metabolic activity of mitochondria (Fig. 1) - often referred to as the "powerhouses of our cells".

Fig. 1 | Anatomy of a Cell



An Approach to Cellular Health

Ioniplex translocates rapidly through cellular membranes which makes it highly bioavailable[6]. Inside cells, it is capable of stimulating mitochondrial metabolism by up to 23%[7]. Thus, Ioniplex appears to protect and enhance cellular health in two distinct ways: by decreasing excess glycation in tissues, and by increasing the metabolic rate of mitochondria.

An Approach to Healthy Blood Sugar

Glycation is now recognized as a major cause of organ damage[1]. Since it is proportional to blood sugar concentration, the first step in prevention is to reduce the amount of sugar and other carbohydrates consumed. The second step is to monitor blood glucose levels (affordable blood glucose meters are available online and at pharmacies). Understanding blood sugar begins with knowing how the body reacts to the types of food consumed. Blood glucose does not have to be elevated to diabetic levels in order to cause damage. Clinical studies reveal that even moderately increased blood glucose can lead to cellular damage, which is often irreversible[8].

About Ioniplex

Ioniplex is a proprietary plant mineral extract, containing upwards of 25 major, minor and trace minerals, which are sourced from unique mineraloid veins located throughout North America. Millions of years ago, these areas were lush with vegetation, that overtime, were compressed into the earth- forming carbon-based compounds known as "humates" or "humic substances" that are rich in minerals and fulvic acid. Mineral BioSciences® (MBS) carefully identifies, segregates and recovers this material and transports it to our state

of the art facility in Goodyear, Arizona. Here it undergoes a complex, patented organic extraction process[9] where the mineral rich fulvic material is extracted from the humic. The resultant product is analytically tested for quality assurance, then stored in bulk to eventually be bottled or dehydrated into a water-soluble powder, for use in a broad spectrum of health and personal care products.

Ioniplex & Fulvic Acid

Ioniplex contains naturally occurring fulvic acid, the result is an ionic material full of electrolytes that contains millions of healthy bacteria. Some of the benefits of fulvic acid are: enhanced nutrient absorption, improved immune support and performance as a chelation agent.

Ioniplex & Bioavailability

bi • o • a • vail • a bil • i • ty
/ˌbīōˌəvālə ˈbiləd ē/
noun

the proportion of a substance that enters the circulation when introduced into the body and so is able to have an effect.

The effectiveness of any mineral supplement depends on its bioavailability. For example, Calcium is available in many forms (calcium citrate, calcium carbonate, oyster shell calcium etc.) each with varying levels of bioavailability, all of which deliver only fractions of the labeled ingredient to target organs. Ioniplex is classified as highly bioavailable, thus allowing it to penetrate through cellular membranes and deliver its full impact to metabolic sites within cells.

Description of Test: Bioavailability[6]

Report 697-BIOAV

To study bioavailability, human cells were incubated with Ioniplex to measure:

1. Binding: The binding of Ioniplex to cells.

2. Intracellular Delivery: The delivery of Ioniplex within cells, using cell-permeant mineral binding dye (Mg-Green AM).

3. Intracellular Detoxification: The detoxification properties of Ioniplex within cells using cell-permeant mineral binding dye (Calcein AM). In the first experiment, cells were incubated with either 5% Ioniplex or double-distilled water for 45 minutes, followed by rinsing. Cells were observed with an epiflourescence microscope, in order to visualize and capture the intrinsic fluorescence of Ioniplex.

Results

1. Binding: When cells were rinsed and subjected to fluorescence quantification, it was found that the signal in the Ioniplex treated cultures was over **10 times higher** than the treated controls. Therefore, it can be concluded that Ioniplex associates with cells or cell membranes - a strong indication of its bioavailability.

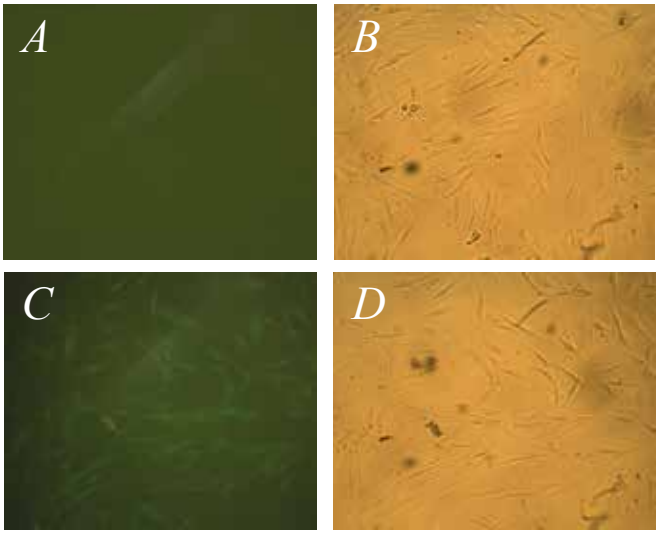
2. Intracellular Delivery: The quantification of Mg-Green AM fluorescence, which is proportional to the concentration of intracellular magnesium, showed an overall increase in Ioniplex in treated cell populations.

3. Intracellular Detoxification: Microscopic observations of the Calcein AM-loaded cells revealed an increase of Calcein fluorescence in the Ioniplex-treated cells. Calcein AM fluorescence increases when the amount of pro-oxidant ions such as cobalt, nickel, iron, and copper decreases. Pro-oxidants induce oxidative stress, therefore, the intracellular increase of Calcein AM in Ioniplex treated cells demonstrates Ioniplex's detoxification / scavenging activity. Together, these results indicate that Ioniplex is a bioavailable vehicle capable of binding cells, delivering ionic mineral payloads inside cells, while detoxifying them by chelating pro-oxidative ions (Fig. 2).

Fig. 2 | Bioavailability Panels

Epiflourescent (left panels) and corresponding bright-field (right panels) images of Calcein AM-loaded control (A,B) and Ioniplex-treated (C,D) human cells.

Note the appearance of fluorescent signal in Ioniplex-treated cells, suggestive of calcein de-quenching. Mag x40.



Ioniplex & Mitochondrial Health

mi • to • chon • dri • a
/ˌmīdəˈkändrēən/
plural noun

Mitochondria are an integral part of a cell and are responsible for metabolizing, or breaking down, carbohydrates and fatty acids in order to generate energy.

Mitochondrial health and metabolism is essential for the overall healthy condition of the body, especially since mitochondrial metabolic activity and number decreases with age. Several *in vivo* studies have shown Ioniplex's ability to promote mitochondrial metabolism. These results are consistent with the notion of Ioniplex having beneficial activity towards maintaining mitochondrial health.

Finally, the gene expression profiling of Ioniplex treated cells revealed an overwhelming stimulation of genes involved in aerobic energy production.

Description of Test: Mitochondrial Metabolism[10]
Report 466A

Ioniplex was added to the popular muscle enhancement product, Ensure® to determine if it would increase metabolic activity in the mitochondria, more so than the standalone product, which acted as the control. To test this theory, cells were incubated either with only Ensure or with Ensure and Ioniplex.

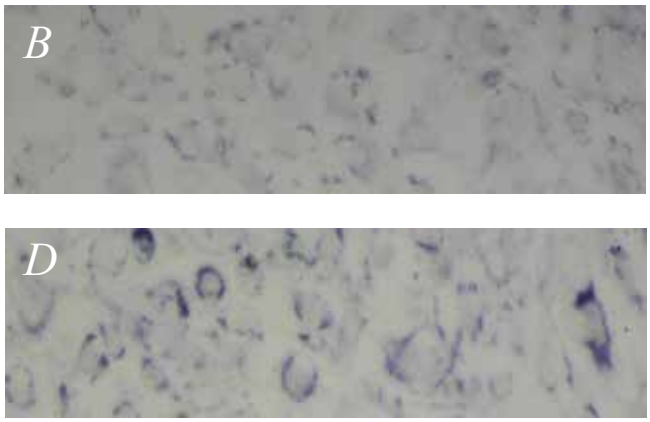
Results

Cells incubated with only Ensure (Fig 3 - Panel B) generated less metabolic activity than cells incubated with Ensure and Ioniplex (Fig. 3 - Panel D). Furthermore, when added, Ioniplex stimulated the expressions of genes that aid in muscle contraction and motility (measured by quantitative PCR).

Fig. 3 | Mitochondrial Panels

Effect of Ensure (top panel) on metabolic activity in mitochondria of human skeletal muscle cells. Cells incubated with Ensure generated less metabolic activity than cells incubated with Ensure and 200microg of Ioniplex (bottom panel).

Note panels B and D show bright field illumination. Magnification x40 with Nikon Eclipse TS100 inverted microscope.



Description of Test: Mitochondrial Metabolism[7]
Report 439

An additional study utilized the colorimetric assay to determine the effects of Ioniplex on mitochondrial metabolism. This test compared the effects of different dosages of Ioniplex with two leading energy drinks, No Fear® and Full Throttle®.

Results

Among test materials, Ioniplex achieved the greatest stimulation, (over 23% at certain concentrations), and was above or on par with No Fear and Full Throttle.

Finally, in a cell-based DNA microarray study, where the expression of over 20,000 genes was measured in the absence or presence of Ioniplex, it was established that Ioniplex stimulates a whole array of genes involved in mitochondrial metabolism respiration and ATP production[4],[11].

Taken together, these results are consistent with the notion of Ioniplex having beneficial activity towards maintaining mitochondrial health.

Ioniplex & Glycation Defense

gly • ca • tion
/glaɪˈkeɪʃən/
noun

Glycation (sometimes called non-enzymatic glycation) is a chain of reactions that results in the cross-linkage of sugars with macromolecules, such as proteins and lipids. These cross-linked macromolecules are called Advanced Glycation End-products (AGEs).

In the human body, non-enzymatic glycation often results in alterations of the physiochemical properties of macromolecules, triggering undesirable processes, such as inflammation. In fact, AGEs are markers of physiopathologies such as diabetes and atherosclerosis, and are associated with the aging and photo-aging processes.

As previously discussed, Ioniplex may increase metabolic activity by re-routing excess glucose (that would, otherwise, create Advanced Glycation End-products) out of the bloodstream into the cells. The direct result of that action is a decrease in the amount of excess glucose available to mutate into AGEs, which consequently, leads to a decrease in glycation.

To confirm, the following studies were conducted.

Description of Test: AGE Inhibition[3]
Report MX3

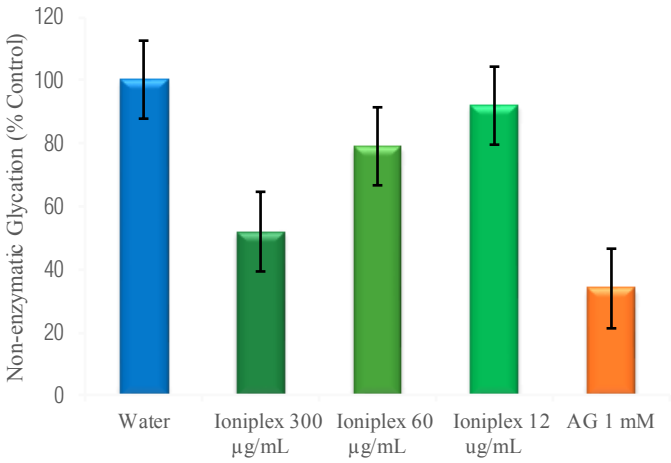
This test measured the inhibition of AGEs using Ioniplex at different doses in comparison to a negative control (water) and a positive control (aminoguanidine).

Aminoguanidine is a medicinal inhibitor of non-enzymatic glycation.

Results

Various batches of Ioniplex triggered up to a 50% decrease of AGEs, which directly correlates to a decrease in the levels of glycation within the body (Fig. 4). These results conclude that Ioniplex has the ability to inhibit AGEs in a dose-dependent manner comparable with aminoguanidine.

Fig. 4 | Inhibition of AGEs



Description of Test: AGE Inhibition[12]
Report AD070618

To ensure the inhibition properties of Ioniplex, another test was performed to determine if results could be replicated.

A quantitative glycation assay based on the measure of Advanced Glycation End-products in proteins was performed. In this protocol, confluent cells are inactivated prior to the labeling experiment. In this model, glycation occurs in mature deposited collagen fibers.

Results

Ioniplex was tested at different dosages against a control (water) and a reference (aminoguanidine). All dosages of Ioniplex showed a decrease in AGEs.

Ioniplex & Healthy Blood Sugar

blood • su • gar
/blәd/ /SHoogәr/
noun

Blood sugar, or blood glucose, is the main sugar that the body makes from the food in a persons diet. Glucose is carried through the bloodstream to provide energy to all cells in the body. However, too much glucose in blood can cause serious health issues.

Another effect from the re-routing of excess glucose to the cells and away from the potential for glycation is less glucose present in the bloodstream. Mineral BioSciences is conducting wide ranging human studies to further confirm this process.

Preliminary data suggests Ioniplex positively effects glucose management. Previously an *in vitro* study was conducted with diabetic mice at the Molecular Medicine Research Institute.

Description of Test: Anti-Diabetic Effects[4]
Report 359

This project aimed to determine the effects of Ioniplex in drinking water on genetically diabetic mice over a period of four weeks. There were two groups that received different dosages of Ioniplex as well as a control group. Water consumption, body weight, blood glucose, glycated hemoglobin and other body chemistry parameters were tested.

Results

Water Consumption: Water consumption between groups was not significantly different.

Body Weight: All groups gained weight during the duration of the experiment. The group drinking 2% Ioniplex gained 6% less weight and the group drinking 10% Ioniplex gained 23% less weight than the control group.

Blood Glucose: All groups registered an increase in glucose levels in the blood, however this increase was reduced by approx. 60% in both groups drinking Ioniplex.

Glycated Hemoglobin (HbA1c): The Ioniplex groups registered a 3.5% decrease in the amount of glycated hemoglobin compared to the control.

Among blood chemistry parameters tested, alkaline phosphatase (AP) and albumin/globulin (A/G) ratio were significantly flexed towards non-diabetic levels.

Alkaline Phosphatase (AP): Decreased by approx. 15% by both Ioniplex treated groups. The decrease in AP may be associated with an improvement in diabetic condition, as increased AP has been long known to be a feature of diabetes metillus[13].

Albumin/Globulin (A/G): Increased in a dose dependent manner by 22% (2% Ioniplex) and 35% (10% Ioniplex). An increased ratio of A/G may indicate an attenuation of the prothrombotic environment, characteristic to the physiopathology of diabetes[13].

All other parameters remained unchanged (within 5% of the control), except blood urea nitrogen (BUN), which was moderately increased in the 2% Ioniplex-treated group, and whose significance is unclear, because it was not reproduced in the 10% Ioniplex-treated group.

Taken together, these results demonstrate that administration of Ioniplex in drinking water had multiple beneficial effects on the diabetic animals. These effects included significantly reduced growth of body weight and blood sugar, as well as improved alkaline phosphate and albumin/globulin levels.

Description of Test: Glucose Management[5,14]
Report 697-DIAB / Report 809HbA1c

To determine if the results in the *in vivo* study conducted on diabetic mice could be replicated in an *in vitro* study. This test sought the effect of Ioniplex consumption on the blood glucose and glycated hemoglobin of an elderly diabetic patient medicated for hyperglycemia with Metformin.

Hyperglycemia (high blood glucose content) is a hallmark of Type 2 diabetes and a physiopathological

effector in this disease. Metformin is one of the most common first-line medications prescribed for lowering hyperglycemia in diabetic patients.

Results

Fasting Blood Glucose: Ioniplex was supplemented at 20 ml/day while maintaining the original Metformin dosage (1 gram/day) which resulted in rapid decrease of fasting blood sugar from an average of 112mg to 92mg.

While maintaining the Ioniplex, Metformin was decreased by 25%. This resulted in the fasting blood glucose sugar level to rise back to the starting average (112mg). However, this indicates that Ioniplex removed the need for 25% of the Metformin medication.

Further improvement of blood glucose levels were observed when the Ioniplex dosage was increased from 20 ml/day to 40 ml/day. This change allowed the Metformin dose to be decreased by another 25%. The result was a blood sugar drop from 112 mg to 105mg. This represents a decrease of about 7% in fasting blood glucose levels and a 50% reduction in medication.

Glycated Hemoglobin: In another clinical case study, HbA1c, also referred to as "glycated hemoglobin", of the study subject was found to decrease proportionally to the length of the patients' Ioniplex supplementation.

HbA1c levels were tested multiple times during this 17 week study, at every testing, glycated hemoglobin levels were reduced.

Conclusion

Several clinical studies have shown that Ioniplex is a safe, bioavailable mineral complex with specific properties in: mitochondrial metabolism, glycation defense, and maintaining healthy blood sugar levels. This makes Ioniplex an attractive addition to dietary supplements, functional foods, and personal care products, especially those with a focus on cellular health and/or sugar related issues.

References

All internal reports are available upon request.

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[4]Deneau, J. et al. (2011, January). *Anti-Diabetic Activity of a Mineraloid Isolate, invitro and in Genetically Diabetic Mice*. International Journal of Vitamin and Nutrition Research, 81(1).

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About Mineral BioSciences

Mineral BioSciences, is a division of the Global Organics® Group of Companies, and is focused on human and animal wellness. For more than 20 years, we have been producing nutrient-rich mineral complexes for our domestic and international customers. Formulated using patented technology and refined state of the art, USDA certified facilties, our products are Generally Recognized as Safe (GRAS) Affirmed and Kosher Certified.

Subscribing to our corporate motto "Nature Knows Best", and working in concert with our Integrated Life Science Research Center® (ILSRC), Mineral BioSciences continues to identify new and innovative applications of life enhancing mineral formulations for plants, animals and humans.

www.mineralbiosciences.com
www.glycationdefense.com

Mineral List

Ioniplex has over 65 minerals in its formulation, including:

Carbon (Total Organics), Selenium, Zinc, Magnesium, Calcium, Iron, Sodium, Potassium, Phosphorus, Copper, Silicon, Boron, Manganese, Iodine, Molybdenum, Chromium, Cobalt, Germanium, Gold, Platinum, Chloride, Sulfur, Bromide, Fluoride, Niobium, Iridium, Zirconium, Strontium, Titanium, Palladium, Tungsten, Tin, Vanadium, Rhenium, Nickel, Lithium, Barium, Gallium, Yttrium, Neodymium, Bismuth, Hafnium, Cadmium, Thorium, Antimony, Cerium, Tellurium, Beryllium, Samarium, Dysprosium, Erbium, Indium, Silver, Scandium, Ruthenium, Tantalum, Rhodium, Rubidium, Thulium, Thallium, Holmium, Ytterbium, Terbium, Litetium, Gadolinium, Europium, Praseodymium, Lanthanum.

Disclaimer

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.