

Bio-Glycozyme Forte™

Blood Glucose Regulation:

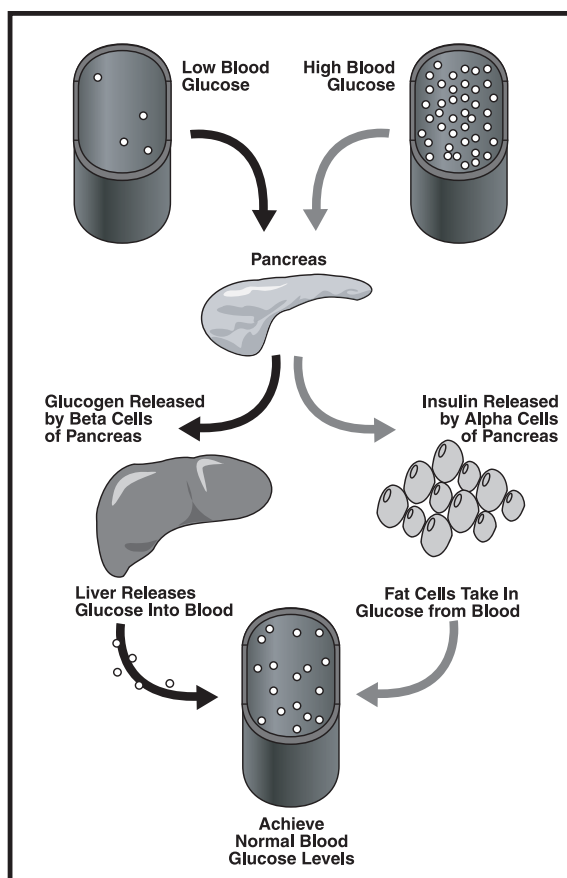
Effective blood glucose regulation is fundamentally important for health. Even mild disruptions of glucose homeostasis can have adverse consequences.¹ On the other hand, reactive hypoglycemia may result in a variety of physical and psychological symptoms, though it does not involve organ failure. Normally, fasting blood glucose is maintained within a narrow range. After a carbohydrate meal, blood sugar increases for several hours, then returns to baseline in response to homeostatic mechanisms. The rise in blood glucose is due to the intestinal absorption of glucose, released from starch and sugars by amylase and disaccharidases. Fructose and galactose are more slowly metabolized to glucose by the liver. Insulin secreted by beta cells of the endocrine pancreas is released in response to elevated blood sugar. Insulin, a major anabolic hormone, stimulates skeletal muscle and adipose tissue to take up glucose from the circulation. The liver, brain and red blood cells do not require insulin for glucose uptake. The central nervous system requires glucose as its primary fuel. Though the brain accounts for only about 10% of body weight, it uses more than 30% of blood glucose. To maintain fasting blood glucose levels in the face of this steady drain of glucose, a variety of hormones are required, chiefly, glucagon from alpha cells of the endocrine pancreas and glucocorticoids from the adrenal glands. Glucagon acts rapidly on the liver to break down stored glycogen to glucose, while glucocorticoids more slowly stimulate protein breakdown; for example, in skeletal muscle to release free amino acids. Many amino acids can be converted to glucose by the liver (gluconeogenesis). Fat breakdown to free fatty acids is also stimulated by glucagon in order to provide an alternative fuel for most of the body, exclusive of the CNS. Other glands involved: the thyroid gland helps determine the metabolic rate, while the pituitary orchestrates most endocrine activity including the thyroid. The kidneys resorb most of the glucose in the filtrate. However, when blood glucose increases above a threshold, the kidneys spill glucose into the urine, a sign of abnormal glucose regulation.

Nutritional Support

The interaction of the endocrine system with organs and tissues to maintain blood glucose requires a full array of micronutrients. A diet compromised by processed, refined foods may not supply adequate amounts of these nutrients. In addition, individuals with blood glucose disorders may have special dietary needs for such nutrients.

The B Complex

The B vitamins work together in central roles to produce energy from amino acids, fat and carbohydrate via the



tricarboxylic acid cycle. Thiamine, riboflavin, and vitamin B6 are present in **Bio-Glycozyme™** as thiamine pyrophosphate, riboflavin 5-phosphate and pyridoxal 5-phosphate. These phosphorylated derivatives represent biologically active, coenzyme (enzyme helper) forms of B vitamins. Imbalanced glucose metabolism can be linked to low thiamine status.² Diabetic mice were shown to be riboflavin deficient.³ Vitamin B6 is required by enzymes called transaminases in the first step of the break down of most amino acids for energy production. Serum B6 levels were below normal in 25% of diabetics.⁴ Vitamin B6 deficiency is related to impaired nerve function. Niacinamide forms NAD and NADP, essential redox coenzymes. Pantothenic acid forms coenzyme A. This coenzyme is required to oxidize protein, carbohydrate and fat via the tricarboxylic acid cycle. Therefore, it is essential for efficient energy production. Vitamin B12 and folic acid are responsible for utilization of glycine and serine from glucose as methyl donors and for the conversion of the by-product homocysteine to either methionine or to cysteine. Hyperhomocysteinemia is often associated with impaired vascular function.⁵ Vitamin B12 may be required for glucose homeostasis.⁶ Biotin assists in the formation of glucose from amino acids and lactate, and supports liver utilization of glucose via the enzyme glucokinase.⁷

Other Vitamins and Factors

Vitamin A is required for the maintenance and development of normal mucosa and epithelial tissues. A decreased vitamin A status correlated with altered pancreatic functioning and glucose metabolism.⁸ Vitamin A deficiency coupled with induced diabetes in lab animals impaired gut absorptive functions.⁹ Vitamin K activates certain blood clotting factors and it is required to synthesize osteocalcin required in calcium homeostasis. Choline and inositol are considered lipotropes, nutrients able to normalize fatty acid and ketone body metabolism in laboratory animals. They are precursors of a variety of phospholipids that serve essential functions in liver, including the transfer of lipids as lipoproteins. Lysine and methionine are precursors of L-carnitine, which acts to transport fatty acids for mitochondria energy production. In addition, methionine functions as a methyl donor for phospholipid synthesis and is classified as a lipotropic nutrient to help normalize liver fatty acid metabolism.

Antioxidants

Vitamin C represents a major water-soluble antioxidant of plasma. Vitamin C scavenges free radicals including peroxy and superoxide radicals, and it can regenerate alpha tocopherol from its radical after it has neutralized lipid peroxy radicals. In addition, vitamin C is required for collagen synthesis and for the integrity of the vascular walls, basement membranes and capillaries. Plasma vitamin C levels may be inversely related to blood sugar levels.¹⁰ Vitamin C transport across cell membranes may be impaired with dysinsulinism radicals.¹¹ Furthermore, vitamin C may reduce the accumulation of sorbitol, thus helping to normalize cellular functions.¹² Vitamin E is the major lipid-soluble antioxidant of the body and prevents oxidation of membrane polyunsaturated fatty acids due to oxidative stress. There are many complications associated with free radical damage. For example, excessive peroxide-mediated damage may be related to lower vitamin C and vitamin E. Vitamin E supplementation may improve insulin.¹³ Vitamin E supplementation can lower lipid peroxide levels.¹⁴ Natural mixed carotenoids provide alpha carotene, lutein, cryptoxanthin and zeaxanthin in addition to beta carotene. They may be better absorbed by humans and function more effectively as antioxidants than synthetic beta carotene.¹⁵ Selenium is classified as an antioxidant nutrient because it functions as a cofactor for glutathione peroxidase. This family of enzymes destroys hydrogen peroxide and lipid peroxides.

Minerals

Magnesium complexes with ATP in most energy-dependent reactions of the body. Magnesium deficiency may play a role in the development of insulin resistance. Serum magnesium was reported to be low in certain individuals.¹⁶ Magnesium has been called Nature's physiologic calcium blocker.¹⁷ Magnesium intake of Americans was below the RDA and 80% or more of American women consume inadequate magnesium.¹⁸ Calcium levels in serum are tightly regulated, a reflection

of the fact that calcium is required for muscle contraction, nerve impulse transmission and ion transport. Free calcium is involved in many signal transduction pathways of cells. Low calcium uptake with aging may be a factor in abnormal cellular calcium distribution. Potassium-deficient lab animals exhibited elevated blood glucose.¹⁹ Obese patients on a modified fast experienced decreased insulin and glucose utilization unless supplemented with potassium.²⁰

Trace Minerals

Vanadium as vanadate possesses insulin-like activity. It increases insulin sensitivity in animal tissues²¹ and stimulated insulin secretion in vitro.²² Zinc is required for insulin processing. The typical American diet is low in zinc; low zinc levels may adversely affect glucose tolerance.²³ Chromium as "glucose tolerance factor" potentiates the action of insulin.²⁴ This factor is a complex of niacin, chromium and amino acids and is the form of chromium common in foods. Chromium levels decline with age among Americans, and fewer than 50% of Americans consume adequate chromium.²⁵ Copper is involved in insulin binding. Copper deficiency is linked with increased glucosylated hemoglobin, an indicator of inadequate blood glucose regulation.²⁶ Manganese is a cofactor for key enzymes involved in carbohydrate metabolism. The usual diet may be low in manganese. Manganese-deficient animals were characterized by irregular pancreatic beta cells and abnormal glucose tolerance.²⁷

Glandular Support

Bio-Glycozyme Forte™ contains neonatal bovine adrenal complex, pituitary/hypothalamus complex, pancreas, liver, brain, and duodenal substance. Glandular tissues are prepared by Biotics Research under mild conditions to maintain peptide and enzyme factors. Adrenal, pituitary/hypothalamus complex, liver, pancreas, and duodenum are organs implicated in the regulation of carbohydrate metabolism in blood glucose regulation. Biotics Research Corporation selected neonatal tissues because such tissues possess high anabolic activity. Factors associated with rapid growth are more likely to be present than in adult animals. In addition, neonatal tissues have not been subjected to life-long exposure to pollutants and environmental stressors. For example, independent evaluation of common pesticides in neonatal glandulars has indicated that levels are below the limits of detection. Histologic examination of adult (2-5 years old) bovine glands and neonatal (new born) bovine glands dramatically illustrates the differences due to aging and environmental exposure.²⁸ These effects contribute to a loss of organ function, accumulation of lipofuscin and/or increased fat deposition. As an example, neonatal adrenal glands reveal three distinct cortical zones, but these zones are much less distinct in the adult bovine gland. In addition, the zona glomerulus of adult cortex exhibits a large amount of lipofuscin, indicating cumulative free radical damage. These deposits are absent from the neonatal bovine glands. All glandular supplements produced by Biotics Research Corporation are obtained from domestic, USDA approved animals.

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