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 withina narrow range. After a carbohydrate meal, blood sugar increases for several hours, then returns to baseline in response to homoeostatic 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 B_6 are present in **Bio-Glycozyme Forte™** as thiamine pyrophosphate, riboflavin 5-phosphate and pyridoxal 5-phosphate. These phosphorylated derivates represent

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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 B_6 is required by enzymes called transaminases in the first step of the break down of most amino acids for energy production. Serum B_6 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 peroxyl and superoxide radicals, and it can regenerate alpha tocopherol from its radical after it has neutralized lipid peroxyl 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 dysinsulinismradicals.[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 tissues[21] 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 Corporation 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.

References

1. Zimmet PZ. The changing faces of macro vascular disease in non- insulin-dependent diabetes mellitus: an epidemic in progress. *Lancet 1997;350 (supplement) 1-4.*
2. Hauger HN. The blood concentration of thiamine in diabetics. *Scand J Clin Lab Invests 1964; 6:260-266.*
3. Reddi AS *et al.* Tissue concentration of water-soluble vitamins in normal and diabetic rats. *Int J Vitamin Nutr Res 1993; 63:140-144.*
4. Davis RE *et al.* Serum pyridoxal and folate concentrations in diabetics. *Pathology 1976; 8: 151-156.*
5. Munshi MM *et al.* Hyperhemocysteinemia following a methionine load in patients with noninsulin-dependent diabetes mellitus and macro vascular disease. *Metabolism 1996; 45:133-135.*
6. Wilkinson JF.Diabetes mellitus and pernicious anemia. *Br Med J 1963; 1:676-677.*
7. Reddi *et al.* Biotin supplementation improves glucose and insulin tolerances in genetically diabetic KK mice. *Life Sci 1988; 42:1323-1330.*
8. Van Gossum A *et al.* Deficiency in antioxidant factors in patients with alcohol-related chronic pancreatitis. *Dig Dis Sci 1996; 41:1225-1231.*
9. Tuitock BJ *et al.* Intestinal absorption of vitamin A in streptozotocin- induced diabetic rats. *Diabetics Research 1994; 25:151-158.*
10. Stankava L *et al.* Plasma ascorbate concentrations and blood cell dehydroascorbate transport in patients with diabetes mellitus. *Metabolism 1984; 33:347-353.*
11. Hutchinson ML *et al.* Effects of glucose and select pharmacologic agents in leukocyte ascorbic acid levels. *Fed Proc 1983; 42:930.*
12. Vinson JA *et al. In vitro* and *in vivo* reduction of erythrocyte sorbitol by ascorbic acid. *Diabetes 1989; 38:1036-1041.*
13. Paolisso G *et al.* Pharmacologic doses of vitamin E improve insulin action in healthy subjects and non insulin dependent diabetic patients. *Am J Clin Nutr 1993; 57:650-656.*
14. Jain SK *et al.* The effect of modest vitamin E supplementation on lipid peroxidation products and other cardiovascular risk factors in diabetic patients. *Lipids 1996; 31:587-590.*
15. Gaziano JM *et al.* Discrimination in absorption or transport of beta carotene isomer after oral supplementation with either all trans or 9-CIS-beta carotene. *Am J Clin Nutr 1995; 61:1248-1252.*
16. Corica F *et al.*. Magnesium levels in plasma, erythrocyte and platelet in hypertensive and normotensive patients with Type II diabetes mellitus. *Bio Trace Element Res 1996; 51:13-21.*
17. Iseri LT *et al.* Magnesium: Nature's physiologic calcium blocker. *Am Heart J 1984; 1:188-193.*
18. Lakshmanan *et al.* Magnesium intakes, balances and blood levels of adults consuming self-selected diets. *Am J Clin Nutr 1984; 40:1380-1389.*
19. Seigel G *et al.* Effects of hypokalmia in carbohydrate and lipid metabolism in the rat. *Diabetes 1967;16: 312-318.*

20. Norbiato G *et al.*. Effects of potassium supplementation in insulin binding and insulin action in human obesity. *Eur J Clin Invest 1984; 14:414-419.*

21. Heyliger CE *et al.*. Effect of vanadate on elevated blood glucose and depressed cardiac performance on diabetic rats. *Science 227:1474-1477.*

22. Fagin JA *et al.* Insulinotropic effects of vanadate. *Diabetes 1987; 36:1448.* 23. Falnis N, Moechegian E. Zinc, human diseases and aging. *Aging Clin Exp Res 1995; 7:77-93.*

24. Toepfer EW *et al.* Preparation of chromium-containing material of glucose tolerance factor activity from brewer's yeast extracts by synthesis. *J Agric Food Chem 1977; 25:163-166.*

25. Anderson RA and Kozlovsky AS. Chromium intake, absorption and excretion of subjects consuming self-selected diets. *Am J Clin Nutr 1985; 41:1177-1183.*

26. Klevay LM. An increase in glycosylated hemoglobin in rats deficient in copper. *Nutr Rep Int 1982; 26:329-334.*

27. Everson GS, Shrader RE. Abnormal glucose tolerance in manganese- deficient guinea pigs. *J Nutr 1968; 94:89-94*

28. Christiansen K. Glandular: Comparison of sources. *American Chiropractor 1985; September.*

Supplement Facts

Serving Size: 3 Capsules
Servings Per Container: 30

	Amount Per Serving	% Daily Value
Vitamin A (as natural mixed carotenoids and acetate) (IU ratio 1:1)	1,500 mcg RAE	167%
Vitamin C (as calcium and magnesium ascorbates, and ascorbic acid)	120 mg	133%
Vitamin D (as cholecalciferol)	5 mcg	25%
Vitamin E (as d-alpha tocopheryl acetate)	20 mg	133%
Vitamin K (as phytonadione)	10 mcg	8%
Thiamin (B1) (as cocarboxylase chloride)	11 mg	917%
Riboflavin (B2) (as riboflavin-5-phosphate)	11 mg	846%
Niacin (as niacinamide)	25 mg	156%
Vitamin B6 (as pyridoxal-5-phosphate)	33 mg	1,941%
Folate (as calcium folinate)	400 mcg DFE	100%
Vitamin B12 (as methylcobalamin)	100 mcg	4,167%
Biotin	300 mcg	1,000%
Pantothenic Acid (as calcium pantothenate)	100 mg	2,000%
Choline (as choline bitartrate)	35 mg	6%
Calcium (as calcium citrate, ascorbate and gluconate)	40 mg	3%
Magnesium (as magnesium citrate, ascorbate and gluconate)	40 mg	10%
Zinc (as zinc gluconate)	15 mg	136%
Selenium (from vegetable culture †)	20 mcg	36%
Copper (as copper gluconate)	2 mg	222%
Manganese (as manganese gluconate)	5 mg	217%
Chromium (from vegetable culture †)	100 mcg	286%
Potassium (as potassium chloride)	99 mg	2%

Vanadium (from vegetable culture †) 10 mcg*, Inositol 35 mg*, Neonatal Adrenal complex (bovine) 40 mg*, Lamb Pituitary/Hypothalamus complex (ovine) 20 mg*, Neonatal Pancreas (bovine) 15 mg*, Neonatal Liver (bovine) 15 mg*, Lamb Brain (ovine) 5 mg*, Lamb intestine (ovine) 5 mg*, L-Lysine hydrochloride 40 mg*, L-Methionine 20 mg*, Superoxide Dismutase (from vegetable culture †) 20 mcg* and Catalase (from vegetable culture †) 20 mcg*

*** Daily Value not established**

Other ingredients: Capsule shell (gelatin and water), food glaze and magnesium stearate (vegetable source).

† Specially grown, biologically active vegetable culture containing **Phytochelated Trace Elements™** and/or naturally associated phytochemicals including polyphenolic compounds with SOD and catalase, dehydrated at low temperature to preserve associated enzyme factors.

This product is gluten and dairy free.

RECOMMENDATION: One (1) to three (3) capsules each day as a dietary supplement or as otherwise directed by a healthcare professional.

KEEP OUT OF REACH OF CHILDREN
Store in a cool, dry area.
Sealed with an imprinted safety seal for your protection.

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To place your order for **Bio-Glycozyme Forte™** or for additional information please contact us below.

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