

Nutritional Protocol for Type II Diabetes Mellitus/Metabolic Syndrome

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Metabolic syndrome (syndrome X), postprandial hypoglycemia and type II Diabetes Mellitus (DM) can all be considered a maladaptation to the typical Western diet. The diagnosis of metabolic syndrome is when a person has three of the following five conditions: high triglycerides, abdominal (android) obesity, elevated plasma glucose, low HDL levels, and hypertension. It is associated with an increased risk of developing both type II diabetes [1] and cardiovascular disease. Some studies estimate that 34% of the adult population of the U.S. has metabolic syndrome [2]. It is estimated that in 2011-2012, the estimated prevalence of diabetes was 12-14% among U.S. adults [3]. Although prediabetes and metabolic syndrome can be reversed in most cases through diet and lifestyle changes, many cases progress to type II DM. Normal fasting glucose levels are from ≤ 100 mg/dl [4]. If a person has a fasting glucose level of 126 mg/dl or higher on two separate occasions, the diagnosis is diabetes mellitus.

Exercise

Lack of exercise is a key component in the development of Type II DM. The U.S. government's Third National Health and Nutrition Examination Survey revealed that 69% of individuals with Type II DM did not exercise at all, 62% ate fewer than five servings of fruits and vegetables per day, and 82% were overweight or obese [5]. Exercise has been shown to induce activation of cellular antioxidant systems and produce anti-inflammatory myokines [6]. Exercise will also help the diabetic to achieve ideal body weight. A moderate exercise program needs to be tailored to the fitness level and ability of the patient.

Diet

It was long thought that a high carbohydrate diet was the culprit in the development of Type II DM. While refined carbohydrates definitely contribute to the disease, complex carbohydrates, especially those high in fiber are an excellent choice for the diabetic patient. A high-fiber diet was pioneered by James Anderson, M.D. for the treatment of diabetes with excellent results [7]. Glycemic Index (GI), is a numerical value assigned to foods based on how slowly or how quickly those foods cause an increase in blood glucose levels. The standard value of 100 is based on the ingestion of glucose. The ranges are 14 for cooked soybeans to 98 for a baked potato. The Glycemic Load (GL) is a better measure of how food impacts blood glucose and insulin levels [8,9]. The GL is determined by multiplying the amount of carbohydrates in a serving of a particular food by the GI and then dividing by 100. For example, pretzels (50 g) have a GI of 83. Skittles (62g) have a GI of 70. However, the GL of pretzels is 18.3 whereas the GL of the Skittles is 38.5.

Fats

An imbalance in dietary fats plays a central role in the development of Type II DM. An overabundance of saturated fats and *trans*-fatty acids with a deficiency in monounsaturated and omega-3 fatty acids has been shown to be the culprit [10]. Clinical studies have shown that increased intake of omega-3 fatty acids as well as monounsaturated fatty acids improve the utilization of insulin [11]. Eating fatty fish (salmon, mackerel, halibut, herring, trout, sardines) and eating nut oils and olive oil protect against the development of type II DM [12,13].

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Organic pollutants

Persistent Organic Pollutants (POPs) include Hexachlorobenzene (HBC), Poly-Chlorinated Dibenzofurans (PCDFs), Poly-Chlorinated Dinbenzo-p-Dioxins (PCDDs), biphenol A, DDE (Dichlorodiphenyldichloroethylene), and organophosphates. All of these chemicals are implicated in the development of Type II DM. They may even be a more important factor than obesity [14]. It is thought that some of these POPs cause a decreased expression of the insulin-responsive glucose transporter GLUT4. Other mechanisms are under investigation. Although measuring POPs directly is difficult and expensive, measuring Gamma-Glutamyltransferase (GGTP) is considered a good indirect measure. Those with the highest levels of POPs had an increased risk of metabolic syndrome [15] and a 20-fold increased risk of Type II DM [16].

Multivitamin/mineral

A high quality multivitamin/mineral (MV) supplement is critical for preventing nutritional deficiencies common in diabetics. These should be taken in divided doses (twice or three times daily) to optimize absorption. Taking an MV supplement has been shown to reduce infections and boost immune function in diabetics [17]. They have been shown to reduce birth defects in the offspring of diabetic women [18].

Chromium

There are a multitude of studies supporting the use of chromium in the diabetic patient [19-21]. Chromium is critical for the production, secretion and utilization of insulin. Unfortunately, it appears that nearly 90% of Americans are not getting enough chromium. It was reported in 2015 that the incidence of metabolic syndrome in young American adults was related to chromium deficiency [22]. Chromium polynicotinate (glucose tolerance factor) and chromium picolinate have been shown to yield the best results at dosages between 400 and 600 mg/day.

Vitamin C (Ascorbic Acid)

Insulin is needed for the transport of vitamin C into cells. Therefore, diabetics suffer from a relative deficiency of ascorbic acid. Vitamin C is the most important water soluble antioxidant in the body. Damage from free radicals is an important factor in the development of many of the problems that develop in diabetics. Since it is needed for the proper formation of collagen, it is needed for proper integrity of blood vessels [23]. The intracellular accumulation of sorbitol is another mechanism of damage in diabetics. Vitamin C has been shown to consistently lower intracellular levels of sorbitol [24]. Dosing is between 500 and 1000 mg/day in divided doses. High levels of vitamin C (usually over 5000 mg/day) can cause diarrhea.

Vitamin E (Mixed Tocopherols)

Nerve cells are particularly vulnerable to oxidative damage with a deficiency of vitamin E. Diabetics have an increased need for vitamin E. It has been shown to enhance the function of insulin, prevents free radical damage to LDL cholesterol and the endothelium, increases magnesium intracellularly, improves blood vessel integrity and function, decrease C-reactive protein, improves conduction of nerve impulses throughout the nervous system, improves blood flow to the eye, increases glutathione levels, and improves creatinine clearance in the kidneys [25-29].

These effects were noted at doses of 400-800 IU/day. Begin with the lower dose of vitamin E and then increase by 200 IU every two weeks until the desired dosage is reached. A sudden high dose of vitamin E can cause a transient hypertension.

Touchi Extract

Touchi is a fermented soybean product that has been used for over 3000 years in both Japan and China. It is a natural α -glucosidase inhibitor (enzyme that breaks down carbohydrates into glucose) and therefore diminishes post-prandial increase in blood glucose. Several clinical studies have demonstrated its ability to reduce elevations in blood glucose levels after a meal [30,31]. Dosage is 300 mg of Touchi extract. There were no reported side-effects in the studies.

Mulberry Extract (*Morus indica*)

This extract is another α -glucosidase inhibitor that contains other compounds that appears to improve blood glucose control [32]. Dosages were 3-5 g/day. Mulberry extract has a positive effect on blood lipids as well.

Gymnema sylvestre

Gymnema is a plant from India that has a long history of use for the treatment of diabetes. Some studies indicate that it may regenerate beta cells in the pancreas, increasing insulin production [33,34]. An extract of the leaves of *G. sylvestre* was shown to reduce insulin requirements and improve blood glucose control [35,36]. It should be standardized to contain 24% gymnemic acid. The dosage is from 400-2400 mg/day in divided doses. No side effects were reported.

Bitter melon (*Mormodica charantia*)

Bitter melon, or balsam pear, is a tropical fruit found in Asia, Africa and South America. A green cucumber-shaped fruit covered with gourd-like bumps, it resembles an ugly cucumber. Extract of the unripe fruit or fresh juice has been clearly established in human clinical trials as well as experimental models [37]. It has several compounds that have antidiabetic properties, including charatin and mormordica. Charatin is a mixed steroid compound that has been shown to be more potent than the oral hypoglycemic drug tolbutamide. *Mormordica* contains an insulin-like peptide, polypeptide-k [38], which lowers blood glucose levels in diabetics. It has fewer side-effects than insulin and has been suggested as a possible replacement for insulin in some patients. Oral administration of bitter melon has demonstrated good results for type II diabetics in clinical trials [39]. Unripe bitter melon is available primarily at Asian grocery stores.

Conclusion

Diabetes mellitus is a disease that can be modified by diet, exercise and supplements. In type II diabetics, the disease can even be brought into remission with a combination of these approaches. Considering the high cost of traditional pharmaceuticals and the devastating complications that result from poor management, employing these natural approaches can result in improved outcomes.

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