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Metabolic Changes and Management of Diabetes

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About the Study

Diabetes mellitus is indeed associated with the alteration of metabolic changes. Most important among them are hyperglycemia, ketoacidosis and hypertriglyceridemia. Increase in blood glucose concentration when compared to the optimum level is the signature of uncontrolled diabetes. Hyperglycemia occurs due to reduction in glucose uptake by tissues and its enhanced production by two processes namely gluconeogenesis and glycogenolysis. When the blood glucose level exceeds the renal threshold level, glucose is excreted into urine and this condition is termed as glycosuria. High concentrations of glucose can be harmful which leads to osmotic effects/hypertonic effects (water drawn from cells into the extracellular fluid and excreted into the urine resulting in dehydration), beta cell damage by free radicals (due to enhanced oxidative phosphorylation, oxidative stress and increased free radicals) and glycation of proteins (associated with diabetic complications such as neuropathy, nephropathy, retinopathy). Excessive movement of fatty acids or triacylglycerols results in overproduction of ketone bodies which often leads to a condition known as ketoacidosis. Conversion of fatty acids to triacylglycerols and the secretion of Very Low Density Lipoproteins (VLDL) and chylomicrons is comparatively higher in diabetics. Insulin reduces the action of hormone-sensitive lipase and thus reduces the release of fatty acids from stored fat in adipose tissue. The mobilization of fatty acids from liver is also suppressed by insulin. Further, the activity of the enzymes lipoprotein lipase is low in diabetic patients. Consequently the VLDL plasma levels, chylomicrons and triacylglycerols are increased. Hypocholesterolemia is frequently seen in diabetic patients.

Hyperglycemia is indeed associated with various types of complications which include atherosclerosis, retinopathy, nephropathy and neuropathy. The biochemical alterations of the complications associated with hyperglycemia is not clearly understood. It is believed that some complications are associated with microvascular changes caused by glycation of proteins. Diet, exercise, drugs (recommended dosage by physician) and finally insulin are the management options in diabetic patients. Approximately, half (50%) of the new cases of diabetics can be adequately controlled by diet alone, whereas 20%-30% are in need oral hyperglycemic drugs while the remaining 20%-30% require insulin.

A diabetic patient is advised to consume low calories, (low carbohydrate and fat) high protein and fiber rich based diet. Carbohydrates should be consumed in the form of starches and complex sugars. It is highly recommended that refined sugars (sucrose, glucose) should be avoided. Fat intake should be intensely reduced inorder to meet the nutritional requirements of unsaturated fatty acids. Diet intake and exercise will help to a large extent obese non-insulin dependent diabetes mellitus patients. The oral hypoglycemic drugs are categorized into two types such as sulfonylureas and biguanides. The biguanides are less commonly used in present days due to side effects. Sulfonylureas are again subdivided into three types such as acetohexamide, tolbutamide and glibenclamide which are most frequently used. They promote the secretion of endogenous insulin and thus helps in lowering blood glucose level. Two types of insulin preparations are commercially available such as short acting preparation and long acting preparation. The short acting insulin preparations are unmodified and their mode of action lasts for about 6 hours. The long acting insulin preparation are the modified ones such as adsorption to protamine and their mode of action last for several hours, which depends on the type of preparation. The advent of genetic engineering is a boon to diabetic patients since bulk quantities of insulin can be produced in the laboratory within a short period of time.