Review Article

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MANAGEMENT OF TYPE 2 DIABETES MELLITUS WITH SPECIAL REFERENCE TO LIFESTYLE MODIFICATION

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Abstract

Diabetes Mellitus is a common disorder of fuel metabolism which is serious global health problem. . In India prevalence of disease in adults was found to be 2.4% in rural and 4.1 – 11.6 % in urban dwellers. The underlying mechanism for type 2 Diabetes mellitus is either due to diminished insulin secretion that is, an islet defect associated with increased peripheral resistance to the action of insulin resulting in decreased peripheral glucose uptake, or increased hepatic glucose output. Causes of NIDDM includes unscientific diet, overweight, sedentary life style, habits like smoking and alcohol, mental stress including genetic factors and anatomical as well as congenital deformities. Diabetes mellitus is a manageable disorder but is not curable. Smoking has been shown to cause elevations in blood glucose concentration and may increase insulin resistance. Problem with a diabetic consuming alcohol is the potential weight gain. It had been well established that obesity promotes insulin resistance through the inappropriate inactivation of a process called gluconeogenesis. On the other hand regular exercise and diet along with yoga and breathing techniques will reduce the risk of NIDDM. Diabetes is a life style related condition due to an imbalance in handling a glucose load and is not a disease. It is one of the several life style related chronic conditions and one inescapable conclusion is that the public health importance of diabetes prevention is indisputable. To reduce the burden of this devastating disease, prevention programs must target not only the affected individuals but also families, workplaces, schools, and communities.

Keywords: Yoga, Pranayama, Gluconeogenesis.

Introduction

Diabetes Mellitus is a common disorder of fuel metabolism which is serious global health problem. Diabetes mellitus has become one of the great epidemics of our time, affecting nearly 150 million adults worldwide in which around 70 million belongs to heavily populated developing countries. Today the health professionals are bewildered by the rapidity with which diabetes with its associations such as obesity, high blood pressure and high cholesterol, triglycerides are assuming epidemic proportions.[1]

This number is predicted to be double by 2025, a prevalence rate of about 5.4% with the greatest number of cases being excepted in China and India. In India prevalence of disease in adults was found to be 2.4% in rural and 4.1 – 11.6 % in urban dwellers.

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Diabetes occurs either because of a lack of insulin or because of the presence of factors that oppose the action of insulin. The result of insufficient action of insulin is an increase in blood glucose concentration (hyperglycaemia). Type 2 diabetes (NIDDM) ranges from those with predominant insulin resistance associated with relative insulin deficiency, to those with a predominantly insulin secretory defect with insulin resistance. The underlying mechanism is due either to diminished insulin secretion that is, an islet defect associated with increased peripheral resistance to the action of insulin resulting in decreased peripheral glucose uptake, or increased hepatic glucose output.[2]

Causes of type 2 Diabetes mellitus
- Unscientific diet
- Over weight
- Sedentary life style
- Habits (Smoking, alcohol etc)
- Mental stress
- Genetic factors
- Anatomical and congenital deformities

As it is well known that Diabetes mellitus is a manageable disorder but is not curable, the known patients of type 2 Diabetes mellitus should control over weight, stop smoking, maintain healthy food style and conduct regular physical activities like exercise, yoga and pranayama.

Discussion and conclusion
Smoking
Cigarette smoking may increase risk of diabetes in several ways. Smoking has been shown to cause elevations in blood glucose concentration and may increase insulin resistance.[3] A number of experimental and clinical studies suggest that smoking decreases insulin sensitivity, and consequently results in the disorders of glucose and lipid metabolism such as hyperglycemia and dyslipidemia including low HDL cholesterol and postprandial lipid intolerance.[4] Particular in diabetic patients, it is clear that cigarette smoking worsens the metabolic control. A larger insulin dose is needed to achieve similar metabolic control in smoking patients as in non-smokers.[5] This indicates that nicotine is more sensitive to DM2 patients in impairing insulin action of reducing blood glucose levels. This finding further suggests that nicotine given acutely does not directly impair insulin action but inhibits insulin mediating glucose metabolism. Another study was undertaken to determine whether the insulin-dependent phase of post exercise muscle glycogen synthesis is impaired in a fasting population of young healthy cigarette smokers. Impaired insulin-dependent muscle glycogen synthesis was observed in these young healthy smokers, much like that observed in pre diabetic subjects.[6]

Nicotine influences insulin secretion through nAChRs on beta-cells Recently, many studies have found neuronal nicotinic acetylcholine receptors (nAChRs) expressed on many different non-neuronal cell types including pancreatic islet cells.[7] Basal insulin secretion can be modulated by an endogenous pancreatic ganglionic mechanism. The effects of ganglionic pre- and postsynaptic nAChRs antagonism were studied in the *in vitro* canine pancreas. Results suggest that nAChRs are present at the ganglionic level in the pancreas and modulate insulin secretion by a complex intraganglionic mechanism. On the other hand, the exposure to nicotine for 48 hours inhibited insulin releases even at basal glucose levels in rat and human islets.

These findings indicate that functional nicotinic receptors are present in pancreatic islets and beta cells and nicotine could, at least in part, negatively affect pancreatic beta-cell function. Thus, the presence of neuronal nicotinic receptors sensitive to nicotine in pancreatic cells may be a switch to modulate pancreatic cells physiological function by acetylcholine and can be involved in tobacco toxicity. Nicotine increases apoptosis of islet -cells There are several lines of studies have shown that nicotine can increase apoptosis of islet -cells in nicotine exposed animal models. In a rat model, prenatal nicotine exposure affected early endocrine pancreas and adipose tissue development in pups before weaning. Results proved a direct association between fetal nicotine exposure and offspring metabolic syndrome with early signs of dysregulations of adipose tissue and pancreatic development.[8] All these studies in animal models have indicated that prenatal or neonatal exposed to nicotine will lead to loss of pancreatic -cells, thus less insulin secretion. Mitochondrial dysfunction, oxidative stress, and inflammation are involved as underlying mechanisms for the direct toxicity induced by nicotine via nAChRs. These findings facilitate the understanding of nicotine effects on

both smoking preceding DM2 development and the aggravation of DM2.

Alcohol

A major problem with drinking alcohol as a diabetic is that other people will have trouble knowing whether you are experiencing hypoglycaemia. Another problem with a diabetic consuming alcohol is the potential weight gain. Gaining weight while battling diabetes will cause a diabetic to lose control over their disease. Alcohol can affect diabetes in following ways

- Moderate amounts of alcohol can cause blood sugar to rise, excess alcohol can actually decrease your blood sugar level sometimes causing it to drop into dangerous levels.
- Beer and sweet wine contain carbohydrates and may raise blood sugar.
- Alcohol stimulates your appetite, which can cause you to overeat and may affect your blood sugar control.
- Alcohol may also affect your judgment or willpower, causing you to make poor food choices.
- Alcohol can interfere with the positive effects of oral diabetes medicines or insulin.
- Alcohol may increase triglyceride levels.
- Alcohol may increase blood pressure.

Obesity

Obesity is a worldwide epidemic with multiple obesity-associated health problems including type 2 diabetes, hypertension, and cardiovascular disease. Adipose tissue serves as a fuel storage depot, but also plays a pivotal role in homeostasis of energy expenditure, appetite regulation, glucose regulation, and immunity. Both genetics and environment play important roles in adipose tissue function and dysfunction. Obesity represents an abnormal accumulation of adipose tissue resulting from chronic over nutrition and reduced physical activity. The nature of this increased accumulation of fat tissue, whether hyperplasia or hypertrophy, local or ectopic, is associated with deleterious perturbations including excess fatty acid secretion, increased production of inflammatory cytokines, and abnormal adipocyte hormone signaling resulting in insulin resistance. In the setting of obesity, insulin resistance and chronic inflammation is postulated to play a role in development of type 2 diabetes.

It had been well established that obesity promotes insulin resistance through the inappropriate inactivation of a process called gluconeogenesis, where the liver creates glucose for fuel and which ordinarily occurs only in times of fasting. Being overweight increases the chances of developing the type 2 diabetes. In this disease, the body makes enough insulin but the cells in the body have become resistant to the salutary action of insulin. Science proposes that being overweight stresses the insides of individual cells. Specifically, overeating stresses the membranous network inside of cells called endoplasmic reticulum (ER). When the ER has more nutrients to process than it can handle, it sends out an alarm signal telling the cell to dampen down the insulin receptors on the cell surface. This translates to insulin resistance and to persistently high concentrations of the sugar glucose in the blood.[9]

Exercise

Exercise has so many benefits, but the biggest one is that it makes it easier to control the blood glucose (blood sugar) level. People with type 2 diabetes have too much glucose in their blood, either because their body doesn't produce enough insulin to process it, or because their body doesn't use insulin properly (insulin resistant). In either case, exercise can reduce the glucose in your blood. Muscles can use glucose without insulin when patient is exercising. In other words, it doesn't matter if patient is insulin resistant or if he don't have enough insulin. When he exercise, his muscles get the glucose they need, and in turn, his blood glucose level goes down. Exercise can also help people with type 2 diabetes to avoid long-term complications, especially heart problems. People with diabetes are susceptible to developing blocked arteries (arteriosclerosis), which can lead to a heart attack. Exercise helps in keeping the heart healthy and strong. Exercise helps to maintain good cholesterol and that helps in avoiding arteriosclerosis. Additionally, there are all the traditional benefits of exercise:[10]

- Lower blood pressure
- Better control of weight
- Increased level of good cholesterol (HDL)
- Leaner, stronger muscles
- Stronger bones
- More energy
- Improved mood
- Better sleep
- Stress management

The different yogaasana used under special techniques for DM either stretch, compress, or twist the abdominal area, so that you may bring your awareness to the pancreatic area, focus and then defocus to give very deep rest to pancreas. Breathing exercises like Pranayama will help in reducing the stress thus manages Type 2 Diabetes mellitus.

Diet

Food can either promote diabetes or help prevent it, depending on how it affects the body's ability to process glucose. People should avoid foods that increase blood sugar and those that raise cholesterol, such as processed foods, foods high in saturated fats or with trans fats, and foods with added sugars and syrups. Processed foods as well as items high in fat or sugar not only can disrupt the balance between glucose and insulin, resulting in inflammation, but can also contribute to risk factors such as being overweight. Uncertainties abound even though the complex interrelationships between nutrients and foods in our diet and risk of developing of diabetes and hyperglycemia have been examined by many investigators. Research have indicated that diets with high saturated fat content and low fiber content may increase the risk of insulin resistance and lead to development of type 2 diabetes.[11]

Because many persons with type 2 diabetes are overweight and insulin resistant, medical nutrition therapy should emphasize lifestyle changes that result in reduced energy intake and increased energy expenditure through physical activity. Therefore, reducing body weight by eating few calories and taking regular exercise. Also, increased physical activity can lead to improved glycaemia, decreasing insulin resistance, and reduced cardiovascular risk factors. A change in dietary regimen has a greater potential to improve type 2 diabetes, therefore, the following guidelines will serve a useful purpose.

- Reduce saturated fat and maintaining a reduced plasma low density lipoprotein cholesterol levels.
- Eating low glycaemic index foods such as soya beans, apple, grapefruits, peas(groundnuts), increase intake of vegetables, fruits, legumes and whole grain cereal also have low glycaemic indices.
- Keep salt intake low.

- Fried food is not good for diabetes patients. Wheat bread, lean meat, game meat (bush meat), green, leafy vegetables, garden egg, all these should be encouraged for DM patients.[12]

It has been suggested that this change in dietary pattern is responsible for the occurrence of various diseases, such as atherosclerosis, diabetes and hyperlipidaemia. One proposed physiological basis underlying such suggestions is a traditionally held tenet that simple carbohydrates are more readily available for immediate absorption by the gut than are more complex carbohydrates and that they therefore produce a greater and faster rise in postprandial plasma glucose and insulin responses than do the supposedly more gradually digested and absorbed complex carbohydrate. Consequently, diets restricted in simple carbohydrates have been recommended in disease states in which control of plasma glucose and insulin is felt to be important.

Diabetes is a life style related condition due to an imbalance in handling a glucose load and is not a disease. It is one of the several life style related chronic conditions and one inescapable conclusion is that the public health importance of diabetes prevention is indisputable. To reduce the burden of this devastating disease, prevention programs must target not only the affected individuals but also families, workplaces, schools, and communities.

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