Research paper on the dietary therapy of diabetes mellitus

Health & Medicine, Diabetes

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Abstract

Diabetes mellitus is the metabolic diseases that result from an increased level of blood sugar. It is divided into three main categories, Type 1 and 2 diabetes mellitus, and the gestational diabetes. The treatment aims at effectively controlling the level of glucose, as well as lipid content in blood. The treatment may be in the form of a drug, pancreas replacement, herbal drug or dietary therapy. The most effective way of managing diabetes is through dietary therapy, as well as lifestyle management. The use of dietary therapy in the management of diabetes is a safe and a very effective means of improving the metabolic control. This therapy also enables the patient to reduce insulin resistance in the liver as well as in the peripheral tissues. The only challenge that is associated with the therapy is the difficulty of maintaining the diet for a long time. Dietary therapy is also associated with

various contraindications that pose as a challenge to its proper implementation.

Introduction

In patients with diabetes, specialized dietary therapy would be more effective than the usual medication used in the majority of health care facilities in different areas across the globe. Prevention of diabetes starts right from diet and, therefore, its treatment also relies on the diet. This research paper aims at discussing the importance of using dietary therapy in diabetes management, as well as its advantages over the typical drug medication administered to patients with diabetes.

Diabetes mellitus refers to the metabolic diseases that result from an increased level of blood sugar, either as a result of failure to produce insulin by the pancreas or the cells, not responding to the produced insulin (Gardner & Shoback, 2007). The increased glucose level in the blood produces symptoms such as polyuria, which is increase urination frequency, polydipsia or high levels of thirst and polyphagia, which is the increased level of hunger. Diabetes mellitus has three main categories Type 1and 2 diabetes mellitus and the gestational diabetes. (Gardner & Shoback, 2007)

The Type 1 type of diabetes occurs following the failure by the body to produce insulin. This requires that the person receive insulin continuously making this kind of diabetes be referred to as juvenile diabetes or insulin-dependent diabetes mellitus (IDDM). Type 2 form of diabetes is mainly caused by resistance insulin by the cell. The cells are thus unable to use the produced insulin in the right way and may be combined with lack of insulin.

This form of diabetes mellitus was known as adult-onset diabetes or noninsulin-dependent diabetes mellitus (NIDDM). The third form of diabetes, gestational diabetes, happens when a woman is pregnant with no previous incidents of the disease (Gardner & Shoback, 2007).

Diabetes mellitus is one of the most common disorders and has been the leading cause of mortality and morbidity in the United States. The most common type is the Type 2 diabetes mellitus, which has been reported to affect more than 10 million Americans. Diabetes mellitus has also been associated with more than 70% of reported obesity cases. Obesity also increases the risk of developing NIDDM, which increases as body weight increases and depends on the duration of obesity, as well as excess fat distribution to the abdominal and the upper regions of the body. The combination of obesity and diabetes accelerates the mortality rate, hypertension, cardiovascular diseases and other complications that result from diabetes. Obesity increases the resistance of insulin in cells and this result in diabetic conditions that are not easily treated through insulin or hypoglycemic agent administration (Henry & Gumbiner, 1991)

Type 2 diabetes mellitus, which is the most common type of diabetes, is mainly characterized by metabolic disorders such as insulin resistance, decreased functions of the pancreas and β-cell function and increased hepatic glucose output (HGO). All these metabolic disorders contribute in a significant way to the derangement of metabolic processes in people with diabetes mellitus (Feinglos & Bethel, 1998). The uptake of glucose by the skeletal muscles is reduced by more than 70% due to the insulin resistance in most diabetes patients. As diabetes progresses, the level of insulin

resistance becomes worse due to the poor regulation of carbohydrate and lipid metabolism. The severity of insulin resistance is also complicated by other diseases such as obesity. The distribution of body fat is one of the major risk factors of developing diabetes.

Ways of Managing Diabetes

There are various interventions that have been used in the management of diabetes. The treatment aims to effectively control the level of glucose and lipid in blood, blood pressure and minimize the chances of developing diabetes complications (Mishra & Chandrashekhar, 2011). The treatment of diabetes employs anti-diabetes medications such as insulin and helps in keeping blood glucose under control. The other intervention is the replacement of the nonfunctional pancreas with an artificial pancreas. This is usually a combination of a pump to pump insulin and continuously monitor glucose. Herbs and spices have also been applied in the management of blood sugar in diabetic patients. The most effective way of managing diabetes is dietary, as well as lifestyle management. Practices such as low calorie intake reduction have been used to help in the weight reduction and hence reduce the insulin reduction (Feinglos & Bethel, 1998).

Use of Dietary Therapy in Diabetes management

In the case of Type 1 diabetes, the use of dietary therapy helps in the reduction of the solute load that is getting into the kidney. Diets that are low in sodium and high calories providing diets that have high calorie solute ratio are usually recommended. It is also recommended that oral sodium intake be restricted to very low amounts (about 1meq/kg/day) and protein to

2g/kg/day. Since most of the patients are still in their developmental stages, it is more prudent to restrict the amount of solute taken than proteins since protein is needed for growth (Mishra & Chandrashekhar, 2011).

Nutrition intervention has also been recognized in the management of gestational diabetes mellitus. The management of this condition is based on the restriction of calorie and nutrients as a strategy to bring back the levels of blood glucose to normal. Dietary therapy is normally applied to between 30% and 90% of women diagnosed with the gestational diabetes. The main aim of therapy is to balance the dietary needs of a pregnant woman and control of the level of blood sugar (Reader, 2007).

Mechanism of Action

Diets with a reduced calorie have been linked with immediate improvement in the control of the level of blood glucose. This kind of diet also has the capability of controlling metabolism even for a long time. Having a reduced calorie diet improves secretion and action of insulin and reduces the HGO. The reduction of HGO results in the reduction of FPG (fasting plasma glucose) level. These factors have been shown to change quickly after introducing calorie restriction. Loss of weight has been shown to increase the rate of insulin receptor binding both in the adipocytes and monocytes. This is unlike the use of drugs, which focus on addressing the symptoms that result from high glucose level such as insulin resistance, high levels of hepatic glucose output and insulin defects (Feinglos & Bethel, 1998).

Regulating diet with an aim of reducing body fat is the initial step in controlling diabetes mellitus. The level of fasting plasma glucose decrease in

a rapid way in the first 14 days after diet therapy is initiated. The level of fasting plasma glucose falls to levels that may even allow for insulin or oral hypoglycemic agents or both. Having a reduction of 5% in body weight has been linked to significant improvements in the glycemic control. Although low calorie diet has an effective way of managing diabetes, only 15% of diabetic patients have the capability of sustaining normal level of FPG through the use of diet therapy alone (Feinglos & Bethel, 1998).

Reducing calorie intake has also been shown to affect dyslipidemia in a positive way. More than 50 % of patients with diabetes show an abnormal level of plasmid lipoproteins and lipids and reduced levels of high-density lipoprotein (HDL) type of cholesterol. The level of total and low-density lipoprotein (LDL) cholesterol is either high or normal. Having a dietary therapy reduces the level of triglyceride in serum as well as raising the level of HDL cholesterol. The level of triglyceride falls typically gradually in 2 to 4 weeks of having a hypocaloric therapy. This occurs even to women who do not show any improvement in the glycemic control (Feinglos & Bethel, 1998).

Very low-calorie diets (VLCD) that contain from 400 to 800 kilo calories in a day may in a significant way help in reducing hyperlipidemia, weight, hyperglycemia, and hyperinsulinemia in diabetic people especially those who are obese. Maintenance of this diet is normally not easy to maintain over a long period of time. Typically, a diet with low calorie is typically made up of high-protein either in liquid or solid formulation that is administered for 12 to 16 weeks (Hansen, 1988).

A diet made up of low content of fat and cholesterol is usually recommended

for those patients who have type 2 diabetes in order to lower the risk of diseases such as atherosclerosis. A diet that has 30% of total calories or less and protein content of between 10 and 20 % should have the rest of the diet coming from carbohydrates. Diets that have high-carbohydrate content have been shown to increase the level of triglyceride, decrease the level of HDL cholesterol, as well as worsen the glycemic control. These effects, however, are usually offset by increasing the dietary fiber. Diets that are made up of high levels of monounsaturated fat content is usually preferred in the place of high-carbohydrate, low fat diets. This is mainly due to the fact that a diet that is low in calories but has high carbohydrate amount does not favor weight loss over the diets that are high in fat (Feinglos & Bethel, 1998). Most patients have had difficulties getting the carbohydrate level consumption that is needed in maintaining a diet that has a high level of carbohydrate and most of them preferring the food selection that is available on the diets that are high in monounsaturated fats. Patients who take diets high in monounsaturated fat also feel more energetic and active when they take in a diet that is high in high-carbohydrate content (Walker, O'Dea, Nicholson, & Muir, 1995). Provided the patients will achieve a high fat intake while maintaining the same energy intake, it is, therefore, easy to either maintain or lose body weight. However, the control of the amount of energy that is consumed is very hard to achieve especially on high-fat diets. Consumption of diets that are high in carbohydrate or fat has not shown good results in maintaining a reduced body weight (Feinglos & Bethel, 1998).

High levels of LDL have been cited as the major risk factor in the

development of coronary heart disease. This relationship is also true in patients with diabetes. Diets that are used in the management of diabetes need to have a low amount of cholesterol and saturated fatty acids. It is, however, important to know the right replacement for the fatty acids that are saturated in the diet. In case the patient is overweight, there is no need to replace the saturated fatty acids with any other form of diet and this would thus promote weight reduction. The options that are available for replacing the saturated fatty acids include using polyunsaturated fatty acids and carbohydrates. Studies have shown an equal level of LDL cholesterol reduction when any of the replacing nutrients is used. It has thus been recommended that both the public and diabetic patients use carbohydrate content while replacing the saturated fatty acids (Grundy, 1991).

Using diet in the control of diabetes has a significant contribution to the improvement of glycemic control. It is, however, hard to attain and sustain the normal level of FPG using diet alone. It is thus important to combine medication with diet therapy. More than 20% of diabetes patients experience failures using sulfonylurea therapy mainly due to the failure to comply with dietary recommendations. The adverse effects that result from other medications such as lactic acidosis, weight gain and hypoglycemia are rarely witnessed when using dietary therapy (Feinglos & Bethel, 1998).

It is hard to recommend a general diet for anyone with diabetes especially in the cases that are coupled with obesity. In adverse cases of diabetes that have insulin secretion deficiency, the type of diet that would be recommended is different from that of early diabetes in an obese patient. The ideal dietary therapy is thus dependent on the fact whether the diabetic

case is associated with obesity and the type of medication being taken by the patient.

There are, however, issues that are raised concerning the adverse effects of using carbohydrates that raise the levels of plasma glucose, VLDL and HDL. It is thus argued that unsaturated fatty acids would be preferred to replace the saturated fatty acids. For this purpose, the polyunsaturated fatty acids have been preferred to monounsaturated fatty acids. There has been various studies that have doubted the fact that polyunsaturated fatty acids have a higher potent for lowering the amount of cholesterol more than monounsaturated fatty acids. Moreover, there are doubts that a high intake of polyunsaturated fatty acids lowers the level of HDL cholesterol and whether such high amounts of polyunsaturated fatty acids are safe (Grundy, 1991)

Limitation of dietary therapy

One of the major situations that raise questions about the use of dietary therapy such as the VLCD therapy is when the patient has an impaired renal function that is compromised. The diet given to such patients should help in maintaining kidney function and at the same time prevent kidney disease from progressing. However, studies have also indicated successful use of the therapy without further compromising the function of the renal system. Other studies have indicated an improvement in the clinical proteinuria as well as creatinine after VLCD therapy in patients with Type 2 diabetes. Thus, the benefits that are enjoyed when VLCD therapy is used in various situations may sometimes outweigh the risks. Other controversies over the

contraindication in using VLCD therapy include situations such as cardiovascular and gallbladder diseases. Use of dietary therapy in patients with cardiovascular condition may result in the development of coronary artery disease. It is also debated that use of dietary therapy may increase the chances of having gallbladder diseases (Henry & Gumbiner, 1991).

In addition, VLCD therapy has been linked to the development of long ventricular arrhythmias and Q-Tc intervals as well as in causing 58 deaths. Recently, the VLCD therapy has been enhanced using high-quality proteins, trace elements, vitamin supplements, minerals, and essential fatty acids. Administering the modified VLCD therapy under a strict medical supervision for a limited duration, the diet has not been linked with any kind of abnormalities of the heart or even death. However, adverse effects such as fatigue, dizziness, diarrhea, cold intolerance, constipation, gallstone development, acute gout, nausea, and weakness have been reported (Feinglos & Bethel, 1998).

Although studies have shown beneficial improvement in the use of low-protein diets in patients who have diabetic nephropathy, there is no consistency in the benefits of using a diet that is low in protein. This kind of diet may even increase the risk of suffering from malnutrition in most patients due to the high protein catabolism rate, muscle wasting and the negative nitrogen balance (Feinglos & Bethel, 1998).

In conclusion, use of dietary therapy in the management of diabetes is a safe and a very effective means to improving metabolic control. This therapy also enables the patient to reduce insulin resistance in the liver as well as in the peripheral tissues. Combining dietary therapy and conventional medication

has better outcomes than using medication alone. The only challenge that is associated with the therapy is the difficulty of maintaining the diet for a long time. This therapy does not have a given time when it can stop, and stopping it may result in the patient losing the benefits that had already being gained.

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