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# ROLE OF DIET COUNSELING IN THE MANAGEMENT OF TYPE 2 DIABETES MELLITUS: LATEST APPROACHES AND NUTRITIONAL STRATEGIES

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## ABSTRACT

We demonstrate the evidence-based dietary practices. Diet counseling plays a crucial role in the treatment of type II diabetes mellitus. Along with the supplements of medicine, nutrition treatment has been shown to be successful in lowering the HbA1c levels in diabetic patients. The major primary food nutrients include carbohydrates, proteins, fats, vitamins, and minerals. One of the most suggested diets to control type II diabetes is a low-carbohydrate diet, taking the role of a low-fat diet. Besides that, numerous studies have shown that coffee consumption reduces the risk of it. Unless saturated fatty acids and cholesterol, monounsaturated fatty consumption is the main goal of a healthy diet. Moderate alcohol use is linked to a lower overall morbidity rate in those with type II diabetes but is hazardous if highly consumed. Yet, for many individuals with diabetes, consuming more protein is linked to improved metabolism. People with diabetes illness may be marked by the oxidative stress that is treated by taking vitamin E, which can help lessen the long-term pancreatic beta-cell dysfunction brought on by oxidative stress. Vitamin D treatment can also be shown to improve impaired glucose tolerance. Zinc consumption could also lower the risk of type II diabetes. A magnesium shortage in the diet may increase the chance of developing diabetes.

**KEYWORDS:** Diabetes mellitus, diet, carbohydrates, proteins, fats, vitamins and minerals - zinc; vitamin D; vitamin E; magnesium; cadmium; vitamin C, coffee and tea, alcohol.

## INTRODUCTION

A chronic genetic condition known as diabetes mellitus is characterized by a deficiency of endogenous insulin, which leads to hypoglycemia and the excretion of glucose in the urine.[1] Ancient Egyptians and Indians were the first to recognize diabetes mellitus (DM) as a condition approximately 3000 years ago.

When the diabetes is not properly managed, it can harm several organs, particularly the kidneys, eyes, nerves, and cardiovascular system.[2] According to the study, obesity is the most common cause of type 2 diabetes mellitus, and obesity itself contributes to some degree of insulin resistance. According to World Health Organization research, 347 million people worldwide suffer from diabetes, and it is estimated that 3.4 million individuals have lost their lives as a result of excessive blood sugar. This number is expected to rise by two-thirds between 2008 and 2030.[3] Type 2 diabetes is hard to control, and it's costing the NHS (National Health Services) a lot of money every year. The risk of heart attack, heart failure, and stroke is almost 2.5 times higher for individuals with type 2 diabetes than for those without the disease. Diabetes is linked to a number of risk factors that may be changed, such as dietary variables, obesity, insulin resistance, and physical inactivity.[4] As a supplement to medicine, nutrition treatment has been shown to be successful in lowering HbA1c levels in diabetic patients by up to 2% at three months. It is crucial to remember that over 50% of people with diabetes are ignorant of their illness, which raises their chance of experiencing severe health issues. The Middle Eastern and North African countries have the highest adult age-adjusted prevalence of diabetes worldwide, as per the most recent reports from the International Diabetes Federation (IDF).[5] The optimal ratio of the primary food components—protein, fat, carbohydrates, vitamins and minerals—needs to be suggested. The majority of these authorities advise consuming 50–60% of the total energy as carbohydrates and 30% as fat (with restricted consumption of saturated and trans fats and moderate consumption of poly saturated fats).[6] It can minimize potential harm while delivering nutrients, foods, or diets to those who stand to gain the most. The apparent variance in how people's bodies react after eating is caused by a combination of microbial, lifestyle, demographics, and genetic factors, according to studies examining the heterogeneity of individual post-meal responses.[7] The elements of self-management, such as better nutrition, more exercise, optimal blood sugar regulation, and sensible medication use, are as diverse as the psychological and cognitive elements linked to self-management behaviors.[8] The interplay of genetic, environmental, and behavioral risk factors leads to type 2 diabetes. It

was evident in 1936 that type 1 and type 2 diabetes mellitus were different. The metabolic syndrome was first identified in 1988 as a component of type 2 diabetes. Insulin resistance, relative insulin shortage, and hyperglycemia are the hallmarks of type 2 diabetes, the most prevalent kind of the disease (formerly known as non-insulin dependent diabetes mellitus).[9] High-fiber legumes and cereals digest more slowly and cause a lower rise in blood sugar than would be predicted for a given carbohydrate content.[10] It is often difficult for diabetes to choose the appropriate diet, including its quantity and quality. According to the study, men consumed a lot more rice, pork, and fried food than women's did. However, it has been claimed that a patient's food choices and dietary habits are greatly influenced by their level of understanding of the prescribed diabetic diet.[11] India has the second highest cases of diabetes in the world after China. Complications of type 2 diabetes mellitus can be costly due to its chronic nature and multi-organ involvement. Hypoglycemic control is the main treatment goal in diabetes management.[12] Dietary management may be more successful for patients with strong dietary skills such as understanding how various foods affect the hypoglycemic index (GI) and hypoglycemic load (GL) and being able to create flexible, customized meal plans based on daily caloric requirements.[13] Noncommunicable diseases are becoming a significant health issue and are thought to be responsible for 44% of all fatalities; DM accounting for 2% of these deaths. because of weak health information and a lack of study.[14] According to reports, diabetes mellitus has the highest rates of morbidity and mortality. The purpose of this review was to talk about evidence-based practices.[15]

## MACRONUTRIENTS

The quality of the different macro-nutrients, the objectives of the dietary treatment plan, and the lifestyle of the individual can affect the optimal macro-nutrient distribution for the control of diabetes.[16]

## CARBOHYDRATES

The criteria used to define low- and very-low-carbohydrate foods differ depending on the study. Generally, a daily calorie intake of less than around 35% is classified as low carbohydrate, less than 25% as extremely low, and less than 10% as autogenic.

Postprandial blood glucose levels are mostly influenced by carbohydrates. One of the most often suggested diets to control type 2 diabetes is now a low-carbohydrate diet, taking the role of a low-fat diet. Reducing the amount of carbohydrates consumed has been the main focus of numerous diet intervention studies since they are processed into glucose.[17]

Participants on a low-GI diet had a significantly lower HbA1C than those on a high-GI diet, according to meta-analysis of CRTs with interventions lasting more than 4 weeks among adults with diabetes. Educating a person with diabetes to use GI and GL as tools is usually encouraged by numerous organizations to improve hypoglycemic management.[18] Foods high in carbohydrates that support stable but low blood glucose levels may help manage the metabolic aspects of diabetes and associated consequences. Slow-release carbohydrate diets enhance fibrinogen, which may be a viable treatment for type 2 diabetes, and reduce insulin and glucose responses throughout the day.[19]

**PROTEINS**

Protein consumption in the diet for people with diabetes is comparable to that of the general population and typically does not exceed 20% of total energy intake.

The glucose generated from consumption does not raise plasma glucose concentration, but it does raise serum insulin responses. Insulin resistance and insufficiency may be the root causes of abnormalities in protein metabolism.[20] Legumes are excellent and moderately priced sources of protein and fiber. In casserole recipes, lentils (or) other legumes can be used in place of ground beef.[21]

In 2013, a meta-analysis of trials with duration of 4–24 weeks was performed, which found that high protein eating programs (25–32% of total calories versus 15-20%) led to improvements in weight reduction of 2 kg and A1C of 0.05%.[22] It is also necessary to address the possibility of renal problems. When protein is used as an energy source, the renal solute load increases; yet, for many diabetic individuals, consuming protein may be linked to improved metabolism.[23] Finally, since proteins seem to increase the insulin response in people with type 2 diabetes, even if they have no effect on blood glucose control. It is not advised to use them in hypoglycemia situations.[24] Fried food is bad for those with diabetes. DM sufferers should be urged to eat wheat bread, lean meat, game meat (bush meat), green leafy vegetables, and garden eggs.[25] It has been discovered that human responses follow a linear connection. When barley kernels were ground to the floor, the corresponding whole grain bread showed similarly high glucose and insulin responses to the white bread reference product.[26]

**FATS**

Reducing fats, cholesterol, and saturated fat consumption is the main goal of a healthy diet. The benefits of MUFAs, such as those found in olive oils and other vegetable oils, such as omega-3 fatty acids (w-3 PUFA), on hypertriglyceridemia and cardiovascular events make them recommended. But we must keep in mind that eating fried fish is not advised because of its greater calorie content.[27] By binding to PPARs, GPR40,GPR40 and GPR120, Omega-3 PUFAs directly impact beta cell activity by boosting insulin secretion, inhibiting the generation of inflammatory cytokines and eicosanoid from AA, and inducing the production of adipokines from adipose tissue. The precise effects of these PUFAs on glucose metabolism are still unknown.[28] A gram of any type of fat or oil has 9 calories, while a gram of carbohydrates only has 4 calories. Avoid foods like white or wheat bread, most cold cereals, watermelon, pineapple, baking potatoes, and sugar that contain more than 2–4 grams of fat per serving.[29] Lowering fasting glucose by replacing carbohydrates with fat is far more controversial. In a recent meta-analysis, Wanders et al. discovered that while poly-saturated fat decreased fasting insulin, it had no effect on normal subjects.[30] Saturated fat consumption was not linked to type 2 diabetes, according to a meta-analysis that looked into the relationships between trans and the risk for chronic illnesses. On the other hand, ruminant-derived trans-palmitoleic acid (trans-16:1, n-7) was linked to a 42% lower risk for type 2 diabetes.[31]

**Coffee and Tea**

Numerous studies have shown that coffee consumption reduces the risk of type 2 diabetes. Coffee use during pregnancy has also been associated with a relatively low birth weight and a significant risk of miscarriage.[32] In a large Dutch cohort (n = 117111), coffee drinking was identified to have a very substantial inverse relationship with the prevalence of diabetes. Similarly, the outcomes of some large-scale observational studies are rather well organized and consistent.[33] In a variety of populations in the United States, Europe, and Japan, coffee drinking has been linked to better glucose tolerance and a decreased risk of type 2 diabetes mellitus.[34] Green tea contains a type 2 intergalactic called 7WA, which may enhance glucose-stimulated insulin release via the cyclic adenine mono-phosphate-A kt (camp-A kt) pathway. Furthermore, the AMPK pathway may be activated by green tea polyphony, particularly EGCG, to enhance the closure of the insulin stress signal pathway brought on by IRS-1 activation.[35] Studies over the past 20 years have suggested that drinking herbal tea

with hypoglycemic activity may benefit people with type 2 diabetes more than drinking regular tea.[36]

**ALCOHOL**

It is recommended that those with type 2 diabetes who drink alcohol do so in moderation. Healthcare professionals should counsel the patients about the warning indications, symptoms, and self-care of reactive hypoglycemia following alcohol. Especially when using hypoglycemic medications, monitoring glucose levels after alcohol consumption should be encouraged.[37] Diabetes and alcohol use are correlated in a U-shaped way. The levels of alcohol use that were most protective against diabetes, according to a meta-analysis, were 22 g/d for men and 50 g/d for women. However, alcohol started to become hazardous at higher consumption levels.[38] Moderate alcohol use is also linked to a lower risk of coronary heart disease and a lower overall mortality rate in those with type 2 diabetes. The type of alcohol beverage has no bearing on its health benefits. An increase in insulin sensitivity is the most reliable mechanism for alcohols.[39]

**Vitamins and Minerals**

Prescription antioxidant vitamins have drawn interest from people with diabetes since the illness may be marked by increased oxidative stress. Large quantities of dietary antioxidants, including beta-carotene, vitamin C, vitamin E, selenium, and other carotids, have not generally been demonstrated to guard against cardiovascular disease, diabetes.[40] In people with type 2 diabetes, vitamin E can help lessen the long-term pancreatic beta-cell dysfunction brought on by oxidative stress.[41] In individuals with type 2 diabetes, vitamin D treatment has also been shown to ameliorate insulin resistance, boost pancreatic insulin release, and improve impaired glucose tolerance.[42] While higher serum (or) plasma zinc levels were linked to a 64% greater risk of T2 DM, zinc consumption could lower the risk of T2 DM by 13%. Zinc deficiency promotes inflammation in type 2 diabetes by having a negative correlation with IL-6.[43] A co-factor for the insulin cascades downstream effects is magnesium. Growing insulin tolerance is a result of decreased intracellular magnesium, which also effects tyro-sine kinase and inhibits insulin activity within the cell. A magnesium shortage in the diet may increase the chance of developing diabetes.[44] Yogurt eating on a regular basis appears to have a direct impact on energy distribution and satiation, lowering of fat, which is closely linked to insulin resistance and the risk of DM2.[45] One heavy metal that is frequently found in the air, water, and soil is cadmium. Humans, animals, and plants all

absorb higher levels of cadmium from water. It has been suggested that cadmium may accelerate the induction of disruption of pancreatic beta cells in diabetes and inhibit insulin-induced translocation of glucose transporter-4 (GLUT 4).[46] It was discovered that vitamin C dramatically reduced the high levels of low density lipoprotein, triglycerides, cholesterol, and glucose in people with type 2 diabetes.[47]

## LITERATURE REVIEW

[33]Salas-salvado et al. have conducted a study on the role of diet in the prevention of type 2 diabetes mellitus and have concluded that in order to prevent diabetes in the general population and postpone its emergence in vulnerable individuals, a healthy lifestyle is essential. Maintaining an optimal body weight, exercising, and eating healthy food are crucial life choices.

[48]Arora Sk et al. have conducted a study on the case for low-carbohydrate diets in diabetes management, nutrition, and metabolism and concluded that, at least in a short time, a low-carbohydrate diet is more effective than a standard low-fat diet at improving insulin sensitivity, hypoglycemic control, and diabetes dyslipidemia by lowering triglycerides, raising HDL cholesterol, and changing LDL into a less atherogenic form.

[49]Goptal et al. have conducted a study on dietary approaches in management of diabetes: current prospective in India and have said that in India, a variety of nutrition practices are used, where the diabetes cannot be treated in a customized manner. The best results are from nutrition therapy for diabetes and can be obtained by adjusting insulin dosages and matching meal content to blood glucose level.

[50]Rodringuez-Villar et al. have conducted a study on the comparison of high-carbohydrate and high-mono-saturated-fat, olive oil-rich foods with Type 2 diabetes mellitus and concluded that a MUFA diet has a positive impact on the lipid profile and is better accepted by patients, making it a useful substitute for high-CH diets in diabetes nutrition therapy.

[51]Tay J., Luscombe-Marsh ND et al. have undergone a study on the comparison of low and high carbohydrate diets for type 2 diabetes management: a randomized trial and concluded that the LC diet, which was low in saturated fat and rich in unsaturated fat, has significantly improved blood glucose stability, the lipid profile, and the need for diabetic medication, indicating that it is a useful approach for managing type 2 diabetes.

[52]Toi PL, et al. have conducted a study on the preventive role of diet in interventions and dietary factors in type 2 diabetes mellitus: an umbrella review and have said that the risk of type 2 diabetes mellitus can be reduced by healthy dietary patterns like Mediterranean, DASH, and hypoglycemic index diets, diet interventions like low calorie and low fat diets, and less intake of red and processed meat and sugar-sweetened beverages.

[53]Nielson Jv. et al. has conducted a study on the low-carbohydrate diet in type 2 diabetes. stable improvement of body weight and hypoglycemic control during 22 months Follow-up. and had said that patients with type 2 diabetes who are obsessed with and get advice on a 20% carbohydrate diet with moderate calorie restriction experience long-term changes in hypoglycemic control.

[54]Forouhi NG, et al. have conducted a study on the dietary and nutritional approaches for prevention and management of type 2 diabetes mellitus and said that controlling weight remains a key component of managing diabetes.

## CONCLUSION

In conclusion, this review has discussed the importance of nutrition in managing type 2 diabetes mellitus. Type 2 DM is hard to control, and it's costing the national health services. the optimal ratio of the primary food components such as proteins, fats, carbohydrates, vitamins, and minerals. Postprandial blood glucose levels are mostly influenced by carbohydrates. Slow-release carbohydrate diets enhance fibrinolysis, which may be a viable treatment for type 2 diabetes. Reducing cholesterol and saturated fat consumption is the main goal of a healthy diet. Eating fried fish is not advised because of its greater calorie content. Binding to PPARS, GPR40, and GPR120, omega-3 PUFS directly impact beta cell activity by boosting insulin secretion. Especially when using hypoglycemic medications and monitoring glucose levels after alcohol consumption. Diabetes and alcohol use are correlated in a U-shaped way. The glucose generated from consumed protein does not raise plasma glucose concentration, but it does raise serum insulin responses. Legumes are excellent and moderately priced sources of protein and fiber. When the protein is used as an energy source, the renal solute load increases; consuming more protein may be linked to improving metabolism. Yogurt eating on a regular basis appears to have a direct impact on energy distribution and lowering fat, which is closely linked to insulin resistance and the risk of diabetes mellitus 2. Low-carbohydrate diet in diabetes management. In India, a variety of nutritional practices are used, where the diabetes cannot be treated in a customized manner.

Type 2 diabetes can be reduced by healthy patterns like Mediterranean, DASH, hypoglycemic index diets, diet interventions like a low-calorie and low-fat diet, and less intake of red meat and sugar-sweetened beverages.

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