

Role of Nutrition in the Management of Diabetes Mellitus

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ABSTRACT

A healthful eating pattern, regular physical activity, and often pharmacotherapy are key components of diabetes management. For many individuals with diabetes, the most challenging part of the treatment plan is determining what to eat. It is the position of the American Diabetes Association (ADA) that there is not a "one-size-fits-all" eating pattern for individuals with diabetes. The ADA also recognizes the integral role of nutrition therapy in overall diabetes management and has historically recommended that each person with diabetes be actively engaged in self-management, education, and treatment planning with his or her health care provider, which includes the collaborative development of an individualized eating plan. Therefore, it is important that all members of the health care team be knowledgeable about diabetes nutrition therapy and supports its implementation.

Keywords: Diabetes, Supplements, Nutrition, ADA, DMICC

History

Diabetes nutrition recommendations have been no exception to cycles. Throughout recorded history, they have swung between greater or lesser amounts of food and macronutrients as percentages of calories [1, 2]. As we continually update our scientific bases and as we integrate more and more precise treatment modalities (self-monitoring of blood glucose, intensive management, pumps), changes will continue to occur, both in recommendations and in their practical application (meal planning methods). Will the cycles continue in the new millennium, or will some event/discovery/scientific breakthrough occur to stop the cyclic nature of the process? From the beginning of the Egyptian New Kingdom Period (about 1550 B.C.) to the early 17th century, the few references available indicated that foods prescribed for individuals with diabetes were high in carbohydrate but more than likely low in calories. From the early 1800s to the early

1900s, recommendations for carbohydrates could have been high or low; however, the first adequate documentation is that for Allen's "starvation" diet (low in carbohydrate and high in fat when food was "allowed"). With the discovery of insulin in the early 1920s, the cycle again shifted as the recommended percentage of calories from carbohydrate gradually increased, but this time usually with adequate calories. In the early 1950s, the American Diabetes Association (ADA), The American Dietetic Association, and the U.S. Public Health Service joined forces to make nationally applicable recommendations. The carbohydrate percentages continued to increase, reaching a peak in 1986. In 1994, there were no recommendations for percentages of calories as carbohydrate or for total fat. Instead these macronutrients were to be based on nutrition assessment and individualized treatment goals.

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Introduction

Diabetes is a chronic disease in which food is not properly absorbed in the body to be used as energy. This results in high levels of sugar in the blood. During

the normal process of digestion, food is consumed and broken down into small sugar particles called glucose. The glucose enters the blood stream and is moved into the body's cells, where it can be used as energy. Insulin is a hormone that is produced by the pancreas. People with diabetes have too little insulin production, their body is unable to use insulin properly (insulin resistance), or both. This does not allow glucose to be moved into the body's cells, which results high levels of glucose in the bloodstream. There are four major conditions associated with high blood glucose levels: prediabetes, type 1 diabetes, type 2 diabetes, and gestational diabetes[3,4]. Nutrition is often said to be the cornerstone of diabetes care [5]. The nutritional management of Diabetes can affect long term health and quality of life. The goal for nutritional management is Optimal metabolic control through a balance between food intake, physical activity, and if Necessary, medication to avoid complications [6]. All people with diabetes should receive individual advice on nutrition from a registered dietitian(RD) [7]. the registered dietitian can apply the nutrition guidelines while considering current Intake, individual energy needs, life stage, lifestyle, and any medical conditions of the individual with diabetes. In type 2 diabetes, nutritional goals aim for improved glycemic and lipid levels and weight loss when required. In type 1 diabetes, the goal of nutritional intervention is improved glycemic Control through coordination of food, especially carbohydrates, doses of insulin, and physical activity.

Management of Nutritional Goals for Diabetes Mellitus

A major goal for diabetes care is to improve glycemic control by balancing food intake with endogenous and/or exogenous insulin levels. For people with type 1 diabetes, insulin doses need to be adjusted to balance with nutritionally adequate food intake and physical activity. For individuals with type 2 diabetes, impaired glucose tolerance or impaired fasting glucose, attention to food portions and weight management combined with physical activity may help improve glycemic control. Nutrition and all forms of diabetes management should be individualized [8]. The Nutritional management of diabetes follows the principles of "Canada's Food Guide to Healthy Eating"[8] and remains one of the cornerstones of effective therapy. Nutritional management seeks to improve or maintain the following:

- The quality of life for people with diabetes and their families through management techniques that include the entire family unit in decision-making, while enhancing the individual's personal sense of control and well-being.
- The physiological health of individuals with diabetes, by establishing and maintaining blood glucose and lipid levels as near-normal as possible, and by using vigilance in preventing and/or treating diabetes-related complications and any concomitant conditions.
- The nutritional status of people with diabetes, by recognizing that their micro and macronutrient requirements are similar to those of the general population[8,9].

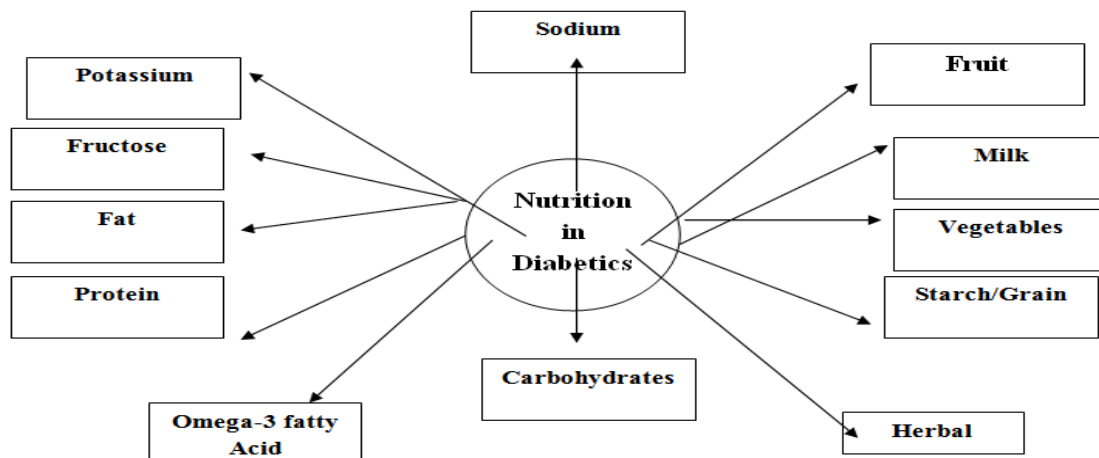


Fig. 1: Nutrition in diabetes

Goals of Nutrition Therapy

To promote and support healthful eating patterns, emphasizing a variety of nutrient dense foods in appropriate portion sizes, in order to improve overall health and specifically to:

- Attain individualized glycemic, blood pressure, and lipid goals. General recommended goals from the ADA for these markers are as follows*
- A1C, 7%.
- Blood pressure, 140/80 mmHg.
- LDL cholesterol, 100 mg/dL; triglycerides, 150 mg/dL; HDL cholesterol .40 mg/dL for men; HDL cholesterol .50 mg/dL for women.

- Achieve and maintain body weight goals.
- Delay or prevent complications of diabetes. *A1C, blood pressure, and cholesterol goals may need to be adjusted for the individual based on age, duration of diabetes, health history, and other present health conditions. Further recommendations for individualization of goals can be found in the ADA Standards of Medical Care in Diabetes [10, 11].

Table 1: Target Monitoring

Blood Glucose (mmol/l)	Pre-meal: between 4 – 7 (tight control below 5.5 mmol/l) 2 hrs after meal: less than 10 (tight control below 7.5 mmol/l)
HbA1c (%) (Average blood glucose)	Less than 6.5% is tight control 6.5-7.0% is good 7.0-7.5% is OK Above 7.5% is poor control
Blood Pressure (mmHg)	Below 130/80 is good Between 140/80 and 160/90 denotes need of Lifestyle changes/medication. Above 160/90 lifestyle change and medication : Needed
Total Cholesterol (mmol/l)	Less than 4.0
HDL (mmol/l) (good cholesterol)	Men: 1.0 or above Women: 1.2 or above
LDL (mmol/l) (bad cholesterol)	Less than 2.0
Triglycerides (mmol/l)	Less than 1.7 excellent Less than 2.3 good
ACR (mg/mmol) (albumin: creatinine ratio)	Men: Less than 2.5 Women: Less than 3.5

Table 2: Recommendations for the Nutritional Management in Diabetes Mellitus

Macronutrient Composition		
Fat	Percentage	• The total fat intake <35% of total daily caloric intake • Saturated fat < 7% of total caloric intake. • Polyunsaturated and monounsaturated fats should comprise the rest of the fat intake • Cholesterol limited to <300 mg/day or <200 mg/day with LDL-Cholesterol >100 mg/dl.
	Recommended	Mono and polyunsaturated fats (e.g., olive oil, canola oil, nuts/seeds, avocado and fish, Particularly those high in omega-3 fatty acids). 4 oz

		of oily fish (e.g., salmon, herring, trout, Sardines, fresh tuna) 2 times/week, as a source of omega-3 fatty acids.
	Not Recommended	Foods high in saturated fat, including beef, pork, lamb and high-fat dairy products (e.g., cream cheese, whole milk or yogurt) Foods high in trans-fats (e.g., fast foods, commercially baked goods, some margarines) Foods high in dietary cholesterol such as egg yolks, and organ meats.
Proteins	grams/day	Protein intake should not be less than 1.2 gm/kg of adjusted body weight Adjusted Body Weight = IBW (Ideal Body Weight) + 0.25 (Current Weight - IBW). This amount generally Accounts for 20-30% of total caloric intake. There are no reliable scientific findings to Support a protein intake that exceeds 2 gm/kg of adjusted body weight.
	Recommended	Fish, skinless poultry, nonfat or low-fat dairy, nuts, seeds, and legumes.
	Not Recommended	High saturated fat protein sources in excess (e.g., beef, pork, lamb and high-fat dairy products), as they may be associated with increased cardiovascular risk.
	Patients with renal issue	Although reducing total calories may result in a reduction of the absolute total amount of protein intake, patients with signs of kidney disease (i.e., one or more of the following: Proteinuria, GFR < 60 ml/min) should consult a nephrologists before increasing total or Percentage protein in their diet. Protein intake for these patients should be modified, but not lowered to a level that may jeopardize their overall health or increase their risk for malnutrition or hypoalbuminemia
Carbohydrates	Percentage	Intake should be adjusted to meet the cultural and food preferences of the individual. The total daily intake of carbohydrate should be at least 130 gm/day and ideally 40-45% of the total caloric intake
	Consideration of Glycemic Index/Glycemic Load	The glycemic index/glycemic load is an important factor that patients should apply in their Daily selection of carbohydrates foods. Foods with a low glycemic index should be selected (e.g., whole grains, legumes, fruits, green salad with olive oil-based dressing, and most vegetables)
	Recommended	Vegetables and fruits, legumes, whole and minimally processed grains.
	Not Recommended	Sugar, refined carbohydrates or processed grains and starchy foods especially sugary beverages, most pastas, white bread, white rice, low-fiber cereal and white potatoes should be consumed in limited quantities.
	Fiber	Approximately 14gm of fiber /1000 cal (20-35 gm) per day is recommended. If tolerated, ~50 gm/day is effective in improving postprandial hyperglycemia and should be encouraged. Fiber from unprocessed food, such as vegetables, fruits, seeds, nuts, and legumes is preferable but, if needed, fiber supplements such as psyllium, resistant starch and β -glucan can be added.
Micronutrient Composition		
	Sodium	Daily consumption should be < 2300 mg (about 1 tsp of salt) per day. (1A) Further reduction to 1500 mg is recommended in people > 50 yr of age including those with chronic kidney disease. Slow acclimatization to lower sodium intakes is advisable
	Potassium	Daily consumption should be a minimum of 4,700 mg unless potassium excretion is impaired Potassium helps offset high sodium intake by triggering more sodium excretion by the kidneys. Potassium-rich foods include fruits and vegetables like bananas,

		mushrooms, spinach, and almonds
Others		
	Fructose	Fructose consumed as “free fructose” (i.e., naturally occurring in foods such as fruit) may result in better glycemic control compared with is caloric intake of sucrose or starch B, and free fructose is not likely to have detrimental effects on triglycerides as long as intake is not excessive (12% energy).
	Omega-3 fatty Acid	Evidence does not support recommending omega-3 (EPA and DHA) supplements for people with diabetes for the prevention or treatment of cardiovascular events.
	Saturated fat, dietary cholesterol, and trans fat	The amount of dietary saturated fat, cholesterol, and trans fat recommended for people with diabetes is the same as that recommended for the general population
	Herbal Supplements	Routine supplementation with antioxidants, such as vitamins E and C and carotene, is not advised because of lack of evidence of efficacy and concern related to long-term safety. There is insufficient evidence to support the routine use of micronutrients such as chromium, magnesium, and vitamin D to improve glycemic control in people with Diabetes. There is insufficient evidence to support the use of cinnamon or other herbs/ supplements for the treatment of diabetes.
	Eating Patterns	A variety of eating patterns (combinations of different foods or food groups) are acceptable for the management of diabetes. Personal preferences (e.g., tradition, culture, religion, health beliefs and goals, economics) and metabolic goals should be considered when recommending one eating pattern over another

Future Directions- Trans- disciplinary Research

The committee working on this project made a preliminary report at the ADA's 60th Annual Meeting and Scientific Sessions in San Antonio, Texas, in June. Stay tuned for updates [12]. In the future; it may be possible to administer insulin through nasal sprays or in the form of a pill or patch. Devices that can “read” blood glucose levels without having to prick a finger to get a blood sample are also being developed. Until the cure for diabetes is found or until the artificial pancreas, with its internal and continual blood glucose sensor and insulin monitor, becomes a feasible alternative, there will be a need for nutrition recommendations and meal planning methods for people with diabetes and for people at risk for diabetes. But what track will this take? Will we follow the narrow confines of previous cycles, or will the cycle be broken? I firmly believe that in this new millennium we will break the cycle, and we will do it by focusing on the process of medical nutrition therapy to help people meet their individual goals, rather than on general, “one size fits all” recommendations [13]. The Diabetes Mellitus Interagency Coordinating Committee (DMICC), authorized by public Law 93-354, fosters collaborations between federal agencies that conduct or support diabetes-related activities and provides a forum for members to share information ideas to synergize federal efforts to combat diabetes. DMIC meetings held several times a

year, help members identify emerging issues and opportunities and develop ways related to management of nutrition in diabetics. The DMICC continues to improve the dissemination of information about diabetes and enhance coordination of federal efforts to advance diabetic research and improve the health of people with or at risk for diabetes. Future meetings will focus on new opportunities for collaboration, forging new partnerships, and strategic planning to ensure effective deployment of federal resources to better understand, prevent, and treat diabetes in the world [14].

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