

Nutrition Recommendations and Principles for People With Diabetes Mellitus

Medical nutrition therapy is integral to total diabetes care and management. Although adherence to nutrition and meal planning principles is one of the most challenging aspects of diabetes care, nutrition therapy is an essential component of successful diabetes management.

Achieving nutrition-related goals requires a coordinated team effort that includes the person with diabetes. Because of the complexity of nutrition issues, it is recommended that a registered dietitian, knowledgeable and skilled in implementing current principles and recommendations for diabetes, be a member of the treatment team.

Effective self-management training requires an individualized approach, appropriate for the personal lifestyle and diabetes management goals of the individual with diabetes. Monitoring of glucose and glycated hemoglobin, lipids, blood pressure, and renal status is essential to evaluate nutrition-related outcomes. If goals are not met, changes must be made in the overall diabetes care and management plan.

Nutrition assessment is used to determine what the individual with diabetes is able and willing to do. A major consideration is the likelihood of adherence to nutrition recommendations. To facilitate adherence, sensitivity to cultural, ethnic, and financial considerations is of prime importance.

This paper reflects scientific nutrition and diabetes knowledge as of 1994. However,

there are limited published data for some recommendations and, under these circumstances, recommendations are based on clinical experiences and consensus. This position paper is based on the concurrent technical review paper, which discusses published research and issues that remain unresolved (1).

GOALS OF MEDICAL NUTRITION THERAPY —

Although the overall goal of nutrition therapy is to assist people with diabetes in making changes in nutrition and exercise habits leading to improved metabolic control, there are additional specific goals:

1. Maintenance of as near-normal blood glucose levels as possible by balancing food intake with insulin (either endogenous or exogenous) or oral glucose-lowering medications and activity levels.
2. Achievement of optimal serum lipid levels.
3. Provision of adequate calories for maintaining or attaining reasonable weights for adults, normal growth and development rates in children and adolescents, increased metabolic needs during pregnancy and lactation, or recovery from catabolic illnesses. Reasonable weight is defined as the weight an individual and health care provider acknowledge as achievable and maintainable, both short- and long-term. This may not be the same as the traditionally defined desirable or ideal body weight.

4. Prevention and treatment of the acute complications of insulin-treated diabetes such as hypoglycemia, short-term illnesses, and exercise-related problems, and of the long-term complications of diabetes such as renal disease, autonomic neuropathy, hypertension, and cardiovascular disease.
5. Improvement of overall health through optimal nutrition. *Dietary Guidelines for Americans* (2) and the *Food Guide Pyramid* (3) summarize and illustrate nutritional guidelines and nutrient needs for all healthy Americans, and can be used by people with diabetes and their family members.

NUTRITION THERAPY AND TYPE I DIABETES —

A meal plan based on the individual's usual food intake should be determined and used as a basis for integrating insulin therapy into the usual eating and exercise patterns. It is recommended that individuals using insulin therapy eat at consistent times synchronized with the time-action of the insulin preparation used. Further, individuals need to monitor blood glucose levels and adjust insulin doses for the amount of food usually eaten. Intensified insulin therapy, such as multiple daily injections or use of an insulin pump, allows considerable flexibility in when and what individuals eat. With intensified therapy, insulin regimens should be integrated with lifestyle and adjusted for deviations from usual eating and exercise habits.

NUTRITION THERAPY AND TYPE II DIABETES —

The emphasis for medical nutrition therapy in type II diabetes should be placed on achieving glucose, lipid, and blood pressure goals. Weight loss and hypocaloric diets usually improve short-term glycemic levels and have the potential to increase long-term metabolic control. However, traditional dietary strategies, and even very-low-calorie diets, have usually not been effective in achieving long-term weight loss; therefore, emphasis should be placed in-

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stead on glucose and lipid goals. Although weight loss is desirable, and some individuals are able to lose and maintain weight loss, several additional strategies can be implemented to improve metabolic control. There is no one proven strategy or method that can be uniformly recommended.

An initial strategy is improvement in food choices, as illustrated by *Dietary Guidelines for Americans* and the *Food Guide Pyramid*. A nutritionally adequate meal plan with a reduction of total fat, especially saturated fats, can be employed. Spacing meals (spreading nutrient intake throughout the day) is another strategy that can be adopted. Mild to moderate weight loss (5–10 kg [10–20 pounds]) has been shown to improve diabetes control, even if desirable body weight is not achieved. Weight loss is best attempted by a moderate decrease in calories and an increase in caloric expenditure. Moderate caloric restriction (250–500 calories less than average daily intake) is recommended.

Regular exercise and learning new behaviors and attitudes can help facilitate long-term lifestyle changes. Monitoring blood glucose levels, glycated hemoglobin, lipids, and blood pressure is essential. However, if metabolic control has not improved after employment of better nutrition and regular exercise, an oral glucose-lowering medication or insulin may be needed.

Many individuals with refractory obesity may have limited success with the above strategies. Newer pharmacological agents, i.e., the serotonergic appetite suppressants, as well as gastric reduction surgery (for people with a body mass index $>35 \text{ kg/m}^2$), may prove to be potentially beneficial to this group. Studies on the long-term efficacy and safety of these methods are, however, unavailable.

PROTEIN — There is limited scientific data upon which to establish firm nutritional recommendations for protein intake for individuals with diabetes. At the

present time, there is insufficient evidence to support protein intakes either higher or lower than average protein intake for the general population. For people with diabetes, this translates into ~10–20% of the daily caloric intake from protein. Dietary protein should be derived from both animal and vegetable sources.

With the onset of nephropathy, lower intakes of protein should be considered. A protein intake similar to the adult Recommended Dietary Allowance ($0.8 \text{ g}\cdot\text{kg body wt}^{-1}\cdot\text{day}^{-1}$), ~10% of daily calories, is sufficiently restrictive and is recommended for individuals with evidence of nephropathy.

TOTAL FAT — If dietary protein contributes 10–20% of the total caloric content of the diet, then 80–90% of calories remain to be distributed between dietary fat and carbohydrate. Less than 10% of these calories should be from saturated fats and up to 10% calories from polyunsaturated fats, leaving 60–70% of the total calories from monounsaturated fats and carbohydrates. The distribution of calories from fat and carbohydrate can vary and be individualized based on the nutrition assessment and treatment goals.

The recommended percentage of calories from fat is dependent on desired glucose, lipid, and weight outcomes. For individuals who have normal lipid levels and maintain a reasonable weight (and for normal growth and development in children and adolescents) the *Dietary Guidelines for Americans* recommendations of 30% or less of the calories from total fat and $<10\%$ of calories from saturated fat can be implemented.

If obesity and weight loss are the primary issues, a reduction in dietary fat intake is an efficient way to reduce caloric intake and weight, particularly when combined with exercise.

If elevated low-density lipoprotein (LDL) cholesterol is the primary problem, the National Cholesterol Education Program Step II diet guidelines, in which $<7\%$ of total calories are from sat-

urated fat, $\leq 30\%$ of the calories are from total fat, and dietary cholesterol is $<200 \text{ mg/day}$, should be implemented.

If elevated triglycerides and very low density lipoprotein cholesterol are the primary problems, one approach that may be beneficial, other than weight loss and increased physical activity, is a moderate increase in monounsaturated fat intake, with $<10\%$ of calories each from saturated and polyunsaturated fats, monounsaturated fats up to 20% of calories, and a more moderate intake of carbohydrate. However, in obese individuals, the increase in fat intake may perpetuate or aggravate the obesity. In addition, patients with triglyceride levels $>1,000 \text{ mg/dl}$ may require reduction of all types of dietary fat to reduce levels of plasma dietary fat in the form of chylomicrons.

Monitoring glycemic and lipid status and body weight, on any diet, is essential to assess the effectiveness of the nutrition recommendations.

SATURATED FAT AND CHOLESTEROL

— A reduction in saturated fat and cholesterol consumption is an important goal to reduce the risk of cardiovascular disease (CVD). Diabetes is a strong independent risk factor for CVD, over and above the adverse effects of an elevated serum cholesterol. Therefore, $<10\%$ of the daily calories should be from saturated fats, and dietary cholesterol should be limited to 300 mg or less daily. However, even these recommendations must be incorporated with consideration of an individual's cultural and ethnic background.

Polyunsaturated fats of the omega-3 series are provided naturally in fish and other seafood, and the intake of these foods need not be curtailed in people with diabetes mellitus.

CARBOHYDRATE AND SWEETENERS

— The percentage of calories from carbohydrate will also vary, and is individualized based on the patient's eating habits and glucose and lipid

goals. For most of this century, the most widely held belief about the dietary treatment of diabetes has been that "simple" sugars should be avoided and replaced with complex carbohydrates. This belief appears to be based on the assumption that sugars are more rapidly digested and absorbed than are starches and thereby aggravate hyperglycemia to a greater degree. There is, however, very little scientific evidence that supports this assumption. Fruits and milk have been shown to have a lower glycemic response than most starches, and sucrose produces a glycemic response similar to that of bread, rice, and potatoes. Although various starches do have different glycemic responses, from a clinical perspective first priority should be given to the total amount of carbohydrate consumed rather than the source of the carbohydrate.

Sucrose

Scientific evidence has shown that the use of sucrose as part of the meal plan does not impair blood glucose control in individuals with type I or type II diabetes. Sucrose and sucrose-containing foods must be substituted for other carbohydrates and foods and not simply added to the meal plan. In making such substitutions, the nutrient content of concentrated sweets and sucrose-containing foods, as well as the presence of other nutrients frequently ingested with sucrose such as fat, must be considered.

Fructose

Dietary fructose produces a smaller rise in plasma glucose than isocaloric amounts of sucrose and most starchy carbohydrates. In that regard, fructose may offer an advantage as a sweetening agent in the diabetic diet. However, because of potential adverse effects of large amounts of fructose (i.e., double the usual intake [20% of calories]) on serum cholesterol and LDL cholesterol, fructose may have no overall advantage as a sweetening agent in the diabetic diet. Although peo-

ple with dyslipidemia should avoid consuming large amounts of fructose, there is no reason to recommend that people avoid consumption of fruits and vegetables, in which fructose occurs naturally, or moderate consumption of fructose-sweetened foods.

Other Nutritive Sweeteners

Nutritive sweeteners other than sucrose and fructose include corn sweeteners such as corn syrup, fruit juice or fruit juice concentrate, honey, molasses, dextrose, and maltose. There is no evidence that these sweeteners have any significant advantage or disadvantage over sucrose in terms of improvement in caloric content or glycemic response.

Sorbitol, mannitol, and xylitol are common sugar alcohols (polyols) that produce a lower glycemic response than sucrose and other carbohydrates. Starch hydrolysates are formed by the partial hydrolysis and hydrogenation of edible starches, thus becoming polyols. The exact caloric value of the polyols is difficult to determine. There appear to be no significant advantages of the polyols over other nutritive sweeteners. Excessive amounts of polyols may, however, have a laxative effect.

Nonnutritive Sweeteners

Saccharin, aspartame, and acesulfame K are approved for use by the Food and Drug Administration (FDA) in the United States. The FDA also determines an acceptable daily intake for approved food additives, including nonnutritive sweeteners. Nonnutritive sweeteners approved by the FDA are safe to consume by all people with diabetes.

FIBER — Dietary fiber may be beneficial in treating or preventing several gastrointestinal disorders, including colon cancer, and large amounts of soluble fiber have a beneficial effect on serum lipids. There is no reason to believe that people with diabetes would be more or less ame-

nable to these effects than those without diabetes. Although selected soluble fibers are capable of delaying glucose absorption from the small intestine, the effect of dietary fiber on glycemic control is probably insignificant. Therefore, fiber intake recommendations for people with diabetes are the same as for the general population. Daily consumption of a diet containing 20–35 g dietary fiber from a wide variety of food sources is recommended.

SODIUM — People differ greatly in their sensitivity to sodium and its effect on blood pressure. Because it is impractical to assess individual sodium sensitivity, intake recommendations for people with diabetes are the same as for the general population. Some health authorities recommend no more than 3,000 mg/day of sodium for the general population, while other authorities recommend no more than 2,400 mg/day. For people with mild to moderate hypertension, 2,400 mg or less per day of sodium is recommended.

ALCOHOL — The same precautions regarding the use of alcohol that apply to the general public also apply to people with diabetes. Under normal circumstances, however, blood glucose levels will not be affected by moderate use of alcohol when diabetes is well controlled. For people using insulin, ≤ 2 alcoholic beverages (1 alcoholic beverage = 12 oz beer, 5 oz wine, or 1 1/2 oz distilled spirits) can be ingested with and in addition to the usual meal plan.

Special considerations for further modification of alcohol intake include the following. Abstinence from alcohol should be advised for people with a history of alcohol abuse or during pregnancy. Alcohol may increase the risk for hypoglycemia in people treated with insulin or sulfonylureas. If alcohol is consumed by such people, it should only be ingested with a meal. Reduction of or abstinence from alcohol intake may be advisable for people with diabetes with other medical problems such as pancre-

Table 1—Historical perspective of nutrition recommendations

Year	Distribution of Calories		
	%Carbohydrate	%Protein	%Fat
Before 1921		Starvation diets	
1921	20	10	70
1950	40	20	40
1971	45	20	35
1986	up to 60	12–20	<30
1994	*	10–20	*, †

*Based on nutritional assessment and treatment goals. †Less than 10% of calories from saturated fats.

atitis, dyslipidemia, or neuropathy. When calories from alcohol need to be calculated as part of the total caloric intake, alcohol is best substituted for fat exchanges or fat calories (1 alcoholic beverage = 2 fat exchanges).

MICRONUTRIENTS: VITAMINS AND MINERALS —

When dietary intake is adequate, there is generally no need for additional vitamin and mineral supplementation for the majority of people with diabetes. Although there are theoretical reasons to supplement with antioxidants, there is little confirmatory evidence at present that such therapy has any benefits.

The only known circumstance in which chromium replacement has any beneficial effect on glycemic control is for people who are chromium deficient as a result of long-term chromium-deficient parenteral nutrition. However, it appears that most people with diabetes are not chromium deficient and, therefore, chromium supplementation has no known benefit.

Similarly, although magnesium deficiency may play a role in insulin resistance, carbohydrate intolerance, and hypertension, the available data suggest that routine evaluation of serum magnesium levels is recommended only in patients at high risk for magnesium deficiency. Levels of magnesium should be repleted only if hypomagnesium can be demonstrated.

Potassium loss may be sufficient to warrant dietary supplementation in patients taking diuretics. Hyperkalemia sufficient to warrant dietary potassium restriction may occur in patients with renal insufficiency or hyporeninemic hypoaldosteronism or in patients taking angiotensin-converting enzyme inhibitors.

PREGNANCY — Nutrition recommendations for women with preexisting and gestational diabetes mellitus should be based on a nutrition assessment. Monitoring blood glucose levels, urine ketones, appetite, and weight gain can be a guide to developing and evaluating an ap-

propriate individualized meal plan and to making adjustments to the meal plan throughout pregnancy to ensure desired outcomes.

SUMMARY — A historical perspective of nutrition recommendations is provided in Table 1. Today there is no ONE “diabetic” or “ADA” diet. The recommended diet can only be defined as a dietary prescription based on nutrition assessment and treatment goals.

Medical nutrition therapy for people with diabetes should be individualized, with consideration given to usual eating habits and other lifestyle factors. Nutrition recommendations are then developed to meet treatment goals and desired outcomes. Monitoring metabolic parameters including blood glucose, glycated hemoglobin, lipids, blood pressure, and body weight, as well as quality of life, is crucial to ensure successful outcomes.

References

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