

CHAPTER 3

NUTRITIONAL MANAGEMENT OF DIABETES MELLITUS

Author:

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3.1 General Principles

Overall goals of medical nutrition therapy (MNT) are to improve or maintain quality of life, nutritional status and physiological health, and to prevent and treat the acute and long-term complications of diabetes and the associated comorbid conditions. Effective MNT:

- Involves family members, enhances the individual's sense of control and well being.
- Is adapted to the individual's life stage, lifestyle, culture, pharmacological management of DM and concomitant medical conditions.
- Maintains blood glucose and lipid levels as near normal as possible.
- Provides adequate calories for maintenance/achievement of a reasonable weight for adults, and normal growth and development for children and adolescents.
- Is based on Canada's Guidelines for Healthy Eating: http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/food_guide_guidelines_e.html, Canada's Food Guide to Healthy Eating: http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/food_guide_rainbow_e.html
- Should be coordinated by a registered dietitian in collaboration with client and other members of health care team.

3.2 Nutrition Assessment

A nutrition assessment involves a thorough evaluation of the following:

- Usual eating pattern - kinds and amounts of food and beverages consumed, and times of eating including meal and snack distribution throughout the day, current energy and macronutrient intake, and micronutrient intake
- Weight history, Body Mass Index (BMI), target weight, and estimated energy requirements,
- Waist circumference
- Food, nutrition, and diabetes knowledge
- History of diets followed in the past and success attained
- Food preparation and handling skills, food preparation facilities
- Food allergies, intolerances, and preferences
- Cultural, ethnic, and financial considerations
- Current method of coordinating eating and glycemic control
- Review of results of SMBG (Self monitoring blood glucose)
- Client readiness for change

3.3 Planning Nutritional Management

Composition

Energy

Type 1 DM

- Energy sufficient to support growth or maintenance of a healthy body weight.
- Meals and snacks should be consumed at consistent times throughout the day and should be synchronized with the action of insulin to prevent episodes of hypoglycemia and hyperglycemia

Type 2 DM

- Weight management has high priority as 80% of persons with type 2 diabetes are overweight. Weight loss of 5-10% of initial weight brings significant improvement in glycemic control.
- Waist circumference (WC) of >102cm (40inches) for men, and >88cm (35inches) for women is an independent and practical indicator of abdominal obesity which is associated with insulin resistance, hyperinsulinemia, hypertension, and lipid abnormalities. A reduction in waist circumference for an overweight client (BMI >25) increases insulin sensitivity and improves the lipid profile.
- Estimated energy requirement is calculated taking into account activity level. Increased regular physical activity is advantageous for energy balance and independent effect on glycemic control. (Refer to Chapter 15 Diabetes Mellitus and Exercise.)
- Obese people frequently under report food intake or eat less during reporting days.
- Gradual weight loss advised with reasonable, achievable short term goal such as 5 kg in 3 months.
- Maintenance of weight loss and avoidance of weight gain more important than quick temporary weight reduction.
- Adjustments in hypoglycemic medication may be required as weight loss progresses.
- Currently, one in five Canadians are on a weight reducing diet. Several popular diets restrict carbohydrate intake. The long-term effects of very low carbohydrate diets in people with diabetes has yet to be ascertained. Clients who follow low carbohydrate diets for weight loss should be made aware of this. Based on current guidelines, healthy eating practices should include an adequate carbohydrate intake. Precaution with use of insulin secretagogue is emphasized as the dose may need to be reduced to avoid hypoglycemia when carbohydrates are restricted.
- Continued weight gain despite MNT, for clients requiring insulin secretagogues or insulin, may suggest overcompensation with food. Repeated episodes of hypoglycemia, or fear of hypoglycemia may result in overeating. Discuss proper methods for prevention and treatment of hypoglycemia. Adjustments in medication may be warranted to enable weight loss.

Carbohydrate

- 50 – 60 % of daily energy intake from high fibre cereals, breads, and other grain products, legumes, vegetables, fruit dairy products and limited amounts of added sugars are recommended.
- Actual intakes of fruit, vegetables and calcium-rich foods are often less than the amounts recommended in Canada's Food Guide.
- The total amount of CHO per meal and snack is calculated. Excessively high CHO intake at any one eating episode is to be avoided. For persons practicing intensive diabetes management, variations in CHO loads per eating episode may be possible without compromising glycemic control. Otherwise consistency in the amount of CHO consumed per meal or snack is advised.
- High-glycemic-index (GI) foods are replaced with low-glycemic-index foods in mixed meals to slow glucose absorption from the gut and thus, reduce BG excursions, and optimize glycemic control in both Type 1 DM and Type 2 DM.
- Increasing the use of low-glycemic-index foods helps to optimize glycemic control in children and adults with type 1 diabetes by reducing A1C and the number of hypoglycemic episodes.
- Serving sizes of CHO containing foods on the market are highly variable – up to 5 fold greater than a standard or reference portion. Persons with diabetes are advised how to evaluate and control portion sizes.

- **Sugars:** Up to 10% of daily energy from added sugars (fructose, sucrose, high-fructose corn syrup) can be incorporated into a healthy eating pattern without impairing glycemic control and lipid profiles.
- **Fibre:** Total daily fibre intake of at least 25-35 g/day from a variety of sources as recommended by Canada's Food Guide to Healthy Eating. For children a suggested guide is 5g + 1g per year of age. Sources slow glucose absorption and lowers LDL. Foods with soluble fiber typically have low GI. Clients need ideas for incorporating fibre into the meal plan.

Protein

- Recommended intake should be at least 0.86g/kg/day.
- Protein restriction below the usual 15 to 20% of energy intake is not recommended for most people with diabetes.
- If clinical nephropathy (Stage 3 or 4) is present, consider protein restricted diet (below 0.86 g/kg/day).
- Sources of vegetable protein may be a desirable alternate to animal protein as they contain more soluble fibre and less saturated fat and cholesterol than animal proteins and may help in decreasing serum cholesterol.

Fat

- Total fat \leq 30 % of daily energy requirements.
- Saturated and trans fatty acids \leq 10 % of energy, <10% from polyunsaturated fatty acids (PUFAs) and the remainder of fat from monounsaturated sources (MUFAs).
- Higher than 30% of energy as fat intake may be justified if fat sources are primarily MUFAs and PUFAs, and low in trans-FA.
- Fish rich in omega-3 fatty acids recommended at least once weekly.

Alcohol

- Light to moderate amounts of alcohol ingested with food containing carbohydrate generally do not affect blood glucose or blood pressure. Alcohol intake should be restricted to light or moderate amount of alcohol intake defined as 5-15g ethanol/day which represents 1 to 2 standard drinks/day or < 14 drinks/week for men, and < 9 drinks/week for women. A standard drink is defined as 12oz (340mL) beer, 5oz (145mL) wine, or 1.5oz (45mL) distilled spirits.
- Individuals taking insulin should be advised to eat a CHO containing food when drinking alcohol to help avoid hypoglycemia.
- Abstinence from alcohol is advised during pregnancy and lactation.
- Individuals with medical conditions such as severe hypertriglyceridemia, pancreatitis, advanced neuropathy, liver disease, and a history alcohol abuse should avoid alcohol.
- Chronic excessive intakes (>3-4 standard drinks/day) raise blood pressure in both men and women.
- Alcohol is a concentrated source of energy (7kcal/g of ethanol) and may contribute to weight gain.

Meal Planning Food Selection

- Eating patterns vary from person to person and in some cases intraindividually. Identification of an acceptable usual meal and snack routine with the client is an initial step to providing dietary advice and coordinating food management with hypoglycemic medication schedules. Distribution of carbohydrate in several frequent small meals or snacks may contribute to improved glycemic control.
- Effective meal planning is taught in the context of the client's culture and preferred food choices. The use of culturally tailored nutrition education material enables clients to learn to incorporate appropriate portions of culturally preferred foods.
- In some cases such as food intolerances, allergies, or inadequate intake, specific vitamin or mineral supplements may be advised.

- Nutrition education approaches are shifting from simply limiting intake of unhealthy foods to emphasizing foods that have health-promoting properties such as omega-3 fatty acid rich fish, soy products, fruits and vegetables.

3.4 Life Stages

Infants, Children and Teenagers

- Adequate nutrition to support growth and development is recommended. Regular heights and weight should be plotted on pediatric growth charts to ensure normal growth along a growth curve.
- Avoidance of hypoglycemia is the primary goal for infants and children.
- Macronutrient and micronutrient intake is the same as for children without diabetes; fat restriction ($\leq 30\%$ of total energy) is contraindicated in children under 2 years.
- Infants and toddlers should be encouraged to adopt normal infant/toddler feeding practices emphasizing consistency with timing of meals and snacks and avoidance of concentrated carbohydrate foods.
- Meal plans focusing on stable amounts of carbohydrate are acceptable for the school aged child.
- Older children and teenagers may benefit from Multiple Daily Injections (MDI) of insulin or Continuous Subcutaneous Insulin Infusion (CSII) to increase flexibility in lifestyle including the amount of carbohydrate consumed at each meal/snack time and timing of meals.

Children with Type 2 Diabetes Mellitus

- Children with Type 2 DM should receive care in conjunction or consultation with an interdisciplinary pediatric diabetes team.
- Adult management principles apply equally to this population, including consideration of the sociocultural environment associated with obesity.
- Intensive lifestyle intervention in obese youth with Type 2 DM should be the first line of therapy unless there is severe metabolic decompensation at which time, both lifestyle and pharmacological interventions are initiated simultaneously.

Pregnancy

- Goal is to achieve normoglycemia while consuming a nutritionally adequate diet. Preconception counseling recommended.
- Normal weight gain for pregnancy is recommended. Monitor weight gain. Weight reducing diets should be avoided to prevent ketosis.
- Multivitamin with 0.4 mg to 1.0 mg/day folic acid prior to conception and during early weeks of pregnancy.
- Food choices divided into 6 small meals through the day to reduce peak glycemic excursions, and prevent hypoglycemia. An evening snack is often necessary to reduce nocturnal hypoglycemia and fasting ketosis in women requiring insulin during pregnancy.
- Promote breastfeeding and ensure energy requirements for breastfeeding are met.
- Postnatal MNT facilitates attainment of a healthy body weight and a healthy lifestyle to reduce risk of development or to manage Type 2 DM.

Elderly

- Social situation and co-existing medical conditions must be taken into account in nutrition care planning.
- Causes of involuntary weight loss or weight gain should be evaluated (e.g. loss of appetite, poor dentition, depression, physical disability). Appropriate referral should be made to enable client to address psychosocial or physical barriers to self-management.

- A daily multivitamin mineral supplement may be warranted in elderly with poor nutritional intake, or with drug-nutrient interactions.

3.5 Co-existing Medical Conditions

Hypertension

As per usual adult guidelines for diabetes management with the following exceptions and additional considerations:

- Sodium restriction to 2-4 g/day
- Limit alcohol intake.
- Incorporate the 'DASH Diet' (Dietary Approaches to Stop Hypertension) on an individualized basis, considering medication regime. The DASH diet is rich in minerals such as magnesium, potassium, and calcium, fibre, low in fat, cholesterol, and sodium

Dyslipidemia

As per usual adult guidelines for diabetes management with the following exceptions and additional considerations:

- Restriction of energy from saturated fat to $\leq 7\%$ of energy and cholesterol to ≤ 200 mg/day
- Omega-3 PUFA rich fish are encouraged at least once a week.
- Consider soluble fibre sources and soy products as alternative food choices.

Nephropathy

Nutritional recommendations depend on the degree of nephropathy and concurrent treatments:

- Overt nephropathy in adults: Limit protein intake to 0.86g/kg/day. In children: limit protein intake to recommended nutrient intake for age and gender.
- Priorities for MNT is to achieve the best possible glycemic and blood pressure control to help delay progression of nephropathy.
- In the presence of anemia, emphasize heme-iron (lean red meat) choices of protein while maintaining a 0.86g/kg/day restricted intake. Otherwise, substitute some animal protein with high quality non-meat protein sources.
- Individualize sodium, potassium and phosphorus restriction based on results of lab tests.

Neuropathy

Gastropathy refers to various disorders of upper gastrointestinal motility which delays absorption of carbohydrates and slows gastric emptying thus, predisposing postprandial hypoglycemia.

- Bloating, and nausea are common symptoms that may reduce food intake and further increase risk of hypoglycemia.
- Dietary strategies include: Chewing food thoroughly; having small frequent low-fat meals; increasing intake of foods of higher liquid consistency; eating solids as tolerated; maintaining a low fibre diet to discourage the development of bezoars. Nutritional supplements and multivitamin/minerals may be necessary to meet nutrient requirements.

3.6 Nutrition Counseling Strategy

- Client centered and meeting client's preferred learning style and stage of change.
- Maintain ongoing contact with patient and review nutrition habits periodically, especially in times of major lifestyle changes.

References

1. American Diabetes Association. Nutrition principles and recommendations in Diabetes. *Diabetes Care*: 27 -S36-46, 2004
2. Canadian Food Information Council and the National Institute of Nutrition. *Tracking Nutrition Trends V*; May 2004.
3. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. *Can J Diabetes* 2003;27(suppl 2):S27-31.
4. Daneman D, Frank M, Perlman K. *When a Child has Diabetes*. Toronto, Key Porter Book Limited, 2002.
5. Health Canada, Nutrition Policy and Promotion. *Canadian Guidelines for Body Weight Classification in Adults*. 2003
6. Jenkins DJA, Kendall CWC, Augustin LSA, Vuksan V. Food frequency and carbohydrate metabolism. *Canadian Journal of Diabetes Care* 1999;23:(Suppl 2): S71-6.
7. Wolever T, Barbeau M-C, Charron S, Harrigan K, Leung S, Madrick B, Taillefer T, Seto C. Guidelines for the nutritional management of diabetes mellitus in the new millennium: a position statement by the Canadian Diabetes Association. *Canadian Journal of Diabetes Care* 1999;23(3):56-69.
8. Young L, Nestle M. Variation in perception of a 'medium' food portion: implications for dietary guidance. *J Am Diet Assoc* 1998;98:458-9.