Diabetes Type 1 and 2

DM: Major Recommendations (2008)

Below, you will find a list of Diabetes Mellitus (DM) Type 1 and 2 recommendations, organized by topic. Also view the Executive Summary of Recommendations or print the guideline in PDF format.

Diabetes Mellitus (DM) Major Recommendations

DM: Medical Nutrition Therapy and Diabetes
DM: Assessment of Glycemic Control
DM: Assessment of Importance of Weight Management
DM: Intervention Options
DM: Macronutrients
DM: Carbohydrate and Diabetes
DM: Sucrose and Diabetes
DM: Non-Nutritive Sweeteners and Diabetes
DM: Glycemic Index and Diabetes
DM: Fiber and Diabetes
DM: Protein and Diabetes
DM: Glucose Monitoring and Diabetes
DM: Prevention and Treatment of CVD and Diabetes
DM: Weight Management and Diabetes
DM: Physical Activity and Diabetes
DM: Coordination of Care and Diabetes
DM: Monitor and Evaluate and Diabetes

The recommendations listed below were originally developed for other ADA evidence-based guidelines, but have been integrated into the Diabetes evidence-based nutrition practice guideline.

Adult Weight Management (AWM)

AWM: Classification of Overweight and Obesity
AWM: Comprehensive Weight Management Program
AWM: Determining Energy Needs
AWM: Eating Frequency and Patterns
AWM: Meal Replacements
AWM: Use of Weight Loss Medications
AWM: Multiple Behavior Therapy Strategies
AWM: Weight Management Nutrition Education
AWM: Optimal Length of Weight Management Therapy
AWM: Portion Control
AWM: Realistic Weight Goals

Disorders of Lipid Metabolism (DLM)

DLM: Alcohol Intake
DLM: Antioxidants (Vitamin E, Vitamin C and Beta-Carotene)
DLM: Homocysteine, Folate, Vitamin B6 and B12
DLM: Major Dietary Fat Components
DLM: Omega-3 Food Sources
DLM: Omega-3 Supplements
DLM: Plant Stanols and Sterols
DLM: Referral to a Registered Dietitian for MNT for Disorders of Lipid Metabolism
DLM: Soy Protein
DLM: Trans-Fatty Acid Intake
DLM: Elevated Triglycerides and Macronutrients
DLM: Elevated Triglycerides and EPA/DHA Supplements

Hypertension (HTN)

HTN: Blood Pressure Measurement in Monitoring and Evaluation
HTN: Comprehensive Program for Blood Pressure Management
HTN: Blood Pressure Treatment Goal for Individuals with Diabetes or Renal Disease
HTN: Dietary Approaches to Stop Hypertension (DASH) Dietary Pattern
HTN: Sodium Intake
HTN: Caffeine Intake
HTN: Food/Nutrient and Medication Interaction Assessment

Quick Links

Recommendations Summary

DM: Medical Nutrition Therapy 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- **Recommendation(s)**

  **DM: MNT and Number/Length of Initial Series of Encounters**

  Medical nutrition therapy (MNT) provided by a registered dietitian (RD) is recommended for individuals with type 1 and type 2 diabetes. An initial series of three to four encounters each lasting from 45 to 90 minutes is recommended. This series, beginning at diagnosis of diabetes or at first referral to an RD for MNT for diabetes, should be completed within three to six months. The RD should determine if additional MNT encounters are needed after the initial series based on the nutrition assessment of learning needs and progress towards desired outcomes. Studies based on a range in the number (1-5 individual sessions or a series of 6-12 group sessions) and length (45-90 minutes) report sustained positive outcomes at one year and longer. Studies implementing a variety of nutrition interventions report a reduction in A1C levels, and some studies also report improved lipid profiles, improved weight management, adjustments in medications, and reduction in the risk for onset and progression of comorbidities.

  **Rating: Strong**
  Imperative

- **DM: MNT Long-Term Follow-up Encounters**

  At least one follow-up encounter is recommended annually to reinforce lifestyle changes and to evaluate and monitor outcomes that impact the need for changes in MNT or medication. The RD should determine if additional MNT encounters are needed. Studies involving regular lifestyle intervention sessions (up to 1 per month) report sustained positive outcomes at one year and longer.

  **Rating: Strong**
  Imperative

  - **Risks/Harms of Implementing This Recommendation**
    None.
  - **Conditions of Application**
    None.
  - **Potential Costs Associated with Application**
    Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

  - **Recommendation Narrative**

    - MNT has its greatest impact at diagnosis of diabetes (Monk et al, 1995; Delahanty et al, 1998).
    - Eight studies (Franz et al, 1995; DAFNE Study Group, 2002; Graber et al, 2002; Miller et al, 2002; Goldhaber-Fiebert et al, 2003; Wilson et al, 2003; Lemon et al, 2004; Gaetke et al, 2006), evaluating the effectiveness of diabetes MNT at three to six months, reported reductions in A1C, ranging from 0.25% to 2.9%, depending on the type and duration of diabetes. Individual sessions ranging from one to five or a series of 10 to 12 group sessions were employed.
    - A variety of nutrition therapy interventions, such as a reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios and behavioral strategies were implemented.
    - The number of initial and follow-up sessions varies in all the studies.
    - Studies reporting on effectiveness of MNT from six to twelve months (Lemon et al, 2004; DAFNE Study Group, 2002; Franz et al, 1995; Wolf et al, 2004; Banister et al, 2004; Chima et al, 2005; Bray et al, 2005) report a variety in the number and type of MNT sessions that lead to improved outcomes. Therefore, the RD needs to determine what is appropriate for individual clients.
    - Seven studies (DCCT, 1993; Laitinen et al, 1993; Maislos et al, 2002; Banister et al, 2004; Wolf et al, 2004; Bray et al, 2005; Chima et al, 2005) report sustained improvements in A1C at 12 months and longer. All involved regular sessions with an RD, ranging from monthly to three sessions per year.
    - Seven studies (DCCT, 1993; Franz et al, 1995; Goldhaber-Fiebert et al, 2003; Banister et al, 2004; Lemon et al, 2004; Wolf et al, 2004; Gaetke et al, 2006) report improvements in other outcomes, such as improved lipid profiles, weight management, decreased need for medications and reduced risk for onset and progression of comorbidities.

  - **Recommendation Strength Rationale**

    Conclusion statement was Grade I

  - **Minority Opinions**

    Consensus reached.

- **Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

How effective is MNT provided by Registered Dietitians in the management of persons with type 1 and type 2 diabetes?

- References
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  

- Diabetes Type 1 and 2

**Quick Links**

**Recommendations Summary**

**DM: Assessment and Diabetes 2008**

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

DM: Nutrition Assessment

The RD should assess food intake (focusing on carbohydrate), medication, metabolic control (glycemia, lipids, and blood pressure), anthropometric measurements and physical activity to serve as the basis for implementation of the nutrition prescription, goals and intervention. Individuals who have diabetes should receive MNT tailored by the RD.

Rating: Strong Imperative

Risks/Harms of Implementing This Recommendation

None.

Conditions of Application

None.

Potential Costs Associated with Application

- Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

Recommendation Narrative

- MNT has its greatest impact at diagnosis of diabetes (Monk et al, 1995; Delahanty et al, 1998).
- Eight studies (Franz et al, 1995; DAFNE Study Group, 2002; Graber et al, 2002; Miller et al, 2002; Goldhaber-Fiebert et al, 2003; Wilson et al, 2003; Lemon et al, 2004; Gaetke et al, 2006), evaluating the effectiveness of diabetes MNT at three to six months, reported reductions in A1C, ranging from 0.25% to 2.9%, depending on the type and duration of diabetes. Individual sessions ranging from one to five or a series of 10 to 12 group sessions were employed.
- A variety of nutrition therapy interventions, such as a reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios and behavioral strategies were implemented.
- The number of initial and follow-up sessions varies in all the studies.
- Studies reporting on effectiveness of MNT from six to twelve months (Lemon et al, 2004; DAFNE Study Group, 2002; Franz et al, 1995; Wolf et al, 2004; Banister et al, 2004; Chima et al, 2005; Bray et al, 2005) report a variety in the number and type of MNT sessions that lead to improved outcomes. Therefore, the RD needs to determine what is appropriate for individual clients.
- Seven studies (DCCT, 1993; Laitinen et al, 1993; Maislos et al, 2002; Banister et al, 2004; Wolf et al, 2004; Bray et al, 2005; Chima et al, 2005) report sustained improvements in A1C at 12 months and longer. All involved regular sessions with an RD, ranging from monthly to three sessions per year.
- Seven studies (DCCT, 1993; Franz et al, 1995; Goldhaber-Fiebert et al, 2003; Banister et al, 2004; Lemon et al, 2004; Wolf et al, 2004; Gaetke et al, 2006) report improvements in other outcomes, such as improved lipid profiles, weight management, decreased need for medications and reduced risk for onset and progression of comorbidities.
- American Diabetes Association Recommendation: Individuals who have pre-diabetes or diabetes should receive individualized MNT; such therapy is best provided by a registered dietitian familiar with the components of diabetes MNT (Grade B).

Recommendation Strength Rationale

Conclusion Statement given Grade I

Minority Opinions

Consensus reached.

Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

References


Wolf AM, Conaway MR, Crowther JO, Hazen KY, Nadler JL, Oneida B, Boybierg VE. Translating Lifestyle Intervention to Practice in Obese Patients with Type 2 Diabetes: Improving Control with Activity and Nutrition (ICAN) study. Diabetes Care, 2004; 27 (7): 1,570-1,576.


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


Quick Links

Recommendations Summary

DM: Assessment of Glycemic Control 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

Recommendation(s)

DM: Assessment of Glycemic Control

The RD should assess glycemic control and focus medical nutrition therapy to achieve and maintain blood glucose levels in the target range (target glucose levels noted in the American Diabetes Association Standards of Medical Care in Diabetes). Studies evaluating the effectiveness of diabetes MNT at three to six months reported reductions in A1C ranging from 0.25% to 2.9%.
Rating: Strong
Imperative

Risks/Harms of Implementing This Recommendation

None.

Conditions of Application

None.

Potential Costs Associated with Application

Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

Recommendation Narrative

- MNT has its greatest impact at diagnosis of diabetes (Monk et al, 1995; Delahanty et al, 1998).
- Eight studies (Franz et al, 1995; DAFNE Study Group, 2002; Graber et al, 2002; Miller et al, 2002; Goldhaber-Fiebert et al, 2003; Wilson et al, 2003; Lemon et al, 2004; Gaetke et al, 2006), evaluating the effectiveness of diabetes MNT at three to six months, reported reductions in A1C, ranging from 0.25% to 2.9%, depending on the type and duration of diabetes. Individual sessions ranging from one to five or a series of 10 to 12 group sessions were employed.
- A variety of nutrition therapy interventions, such as a reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios and behavioral strategies were implemented.
- The number of initial and follow-up sessions varies in all the studies.
- Studies reporting on effectiveness of MNT from six to twelve months (Lemon et al, 2004; DAFNE Study Group, 2002; Franz et al, 1995; Wolf et al, 2004; Banister et al, 2004; Chima et al, 2005; Bray et al, 2005) report a variety in the number and type of MNT sessions that lead to improved outcomes. Therefore, the RD needs to determine what is appropriate for individual clients.
- Seven studies (DCCT, 1993; Laitinen et al, 1993; Maislos et al, 2002; Banister et al, 2004; Wolf et al, 2004; Bray et al, 2005; Chima et al, 2005) report sustained improvements in A1C at 12 months and longer. All involved regular sessions with an RD, ranging from monthly to three sessions per year.
- Seven studies (DCCT, 1993; Franz et al, 1995; Goldhaber-Fiebert et al, 2003; Banister et al, 2004; Lemon et al, 2004; Wolf et al, 2004; Gaetke et al, 2006) report improvements in other outcomes, such as improved lipid profiles, weight management, decreased need for medications and reduced risk for onset and progression of comorbidities.

American Diabetes Association Recommendation: Target A1C is as close to normal as possible without significant hypoglycemia (Grade B).

Recommendation Strength Rationale

- Conclusion Statement was Grade I

Minority Opinions

Consensus reached.

Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- How effective is MNT provided by Registered Dietitians in the management of persons with type 1 and type 2 diabetes?

References


Wolf AM, Conaway MR, Crowther JO, Hazen KY, Nadler JL, Oneida B, Bovbjerg VE. Translating Lifestyle Intervention to Practice in Obese Patients with Type 2 Diabetes: Improving Control with Activity and Nutrition (ICAN) study. Diabetes Care, 2004; 27 (7): 1,570-1,576.


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


Quick Links

Recommendations Summary

DM: Assess Relative Importance of Weight Management 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

 Recommendation(s)

DM: Assess Relative Importance of Weight Management

The RD should assess the relative importance of weight management for persons with diabetes who are overweight or obese. While modest weight loss has been shown to improve insulin resistance in overweight and obese insulin-resistant individuals, research on sustained weight loss interventions lasting 1 year or longer reported inconsistent effects on A1C.

Rating: Strong

Conditional

- Risks/Harms of Implementing This Recommendation

  None.

- Conditions of Application
Recommendations apply to persons with diabetes who are overweight or obese.

- **Potential Costs Associated with Application**

  Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

- **Recommendation Narrative**

  - In randomized clinical trials, approximately half report improvement in A1C values with weight loss; whereas, approximately half report no improvement in A1C values despite fairly similar weight losses.
  - Eleven studies with more than 1 diet arm (Hollander et al, 1998; Manning et al, 1998; Hanefeld et al, 2002; Miles et al, 2002; Kelley et al, 2003; Redmon et al, 2003; Brinkworth et al, 2004; Metz et al, 2004; Li et al, 2005; Berne et al, 2005; Redmon et al, 2005) reported weight loss and A1C values at 12 months.
  - Six studies in diet arms reported no improvement in A1C (Hollander et al, 1998; Manning et al, 1998; Redmon et al, 2003; Brinkworth et al, 2004; Wolf et al, 2004; Li et al, 2005; Redmon et al, 2005) despite weight loss (range: -0.8 to -4.4 kg) in all but one study which reported no weight loss (Manning et al, 1998).
  - Five studies in diet arms reported improvement in A1C ranging from -0.2% to -0.6% (Hanefeld et al, 2002; Miles et al, 2002; Kelley et al, 2003; Mertz et al, 2004; Berne et al, 2005) with fairly similar weight losses (range: -1.3 to -5.1 kg).
  - Studies using weight loss medications (orlistat and lifestyle, sibutramine) report consistent improvement in A1C. Six studies with an orlistat arm (Hollander et al, 1998; Hanefeld et al, 2002; Miles et al, 2002; Kelley et al, 2003; Derosa et al, 2004; Berne et al, 2005) reported improvements in A1C values (range: -0.3% to -1.1%) with orlistat and lifestyle intervention with weight loss (range: -3.9 to -6.2 kg).
  - Four studies (McNulty et al, 2003; Redmon et al, 2003; Derosa et al, 2004; Sanchez-Reyes et al, 2004; Redmon et al, 2005) reported improvements in A1C values (range: -0.3% to -6.0%) with sibutramine with weight loss (range: -4.1 to -8.0 kg).
  - Ten studies reported significant improvements in at least one lipid value, generally in triglycerides and HDL cholesterol from weight loss either by diet alone or with weight loss medications (Hollander et al, 1998; Hanefeld et al, 2002; Miles et al, 2002; Paisley et al, 2002; Ash et al, 2003; Kelley et al, 2003; McNulty et al, 2003; Metz et al, 2004; Berne et al, 2005).
  - Six studies reported improvement in blood pressure with weight loss (Miles et al, 2002; Redmon et al, 2003; Brinkworth et al, 2004; Derosa et al, 2004; Metz et al, 2004; Li et al, 2005; Redmon et al, 2005); however, one study using sibutramine reported increases in blood pressure (McNulty et al, 2003) and one study using sibutramine reported no change in blood pressure (Derosa et al, 2004).
  - American Diabetes Association Recommendation: In overweight and obese insulin-resistant individuals, modest weight loss has been shown to improve insulin resistance. Thus, weight loss is recommended for all such individuals who have or are at risk for diabetes (Grade A).

- **Recommendation Strength Rationale**

  - Conclusion Statement given Grade II

  Consensus reached.

- **Minority Opinions**

- **Supporting Evidence**

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  **What is the long-term effect (1 year or greater) of weight management on metabolic outcomes in persons with type 1 and type 2 diabetes?**

- **References**


  Hanefeld M, Sachse G. The effects of orlistat on body weight and glycaemic control in overweight patients with type 2 diabetes: a randomized, placebo-controlled trial. Diabetes, Obesity and Metabolism 2002; 4:413-423.


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


- **Diabetes Type 1 and 2**
- **Diabetes (DM) Guideline (2008)**

**Quick Links**

**Recommendations Summary**

**DM: Intervention Options 2008**

*Click here* to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the **Supporting Evidence Section** below.

- **Recommendation(s)**
- **DM: Intervention Options**
The RD should implement MNT selecting from a variety of interventions (reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios, physical activity and behavioral strategies). Nutrition education and counseling should be sensitive to the personal needs, willingness to change, and ability to make changes of the individual with diabetes. Studies reporting on effectiveness of MNT report a variety in the number and type of MNT sessions that lead to improved outcomes.

**Rating: Strong**

**Imperative**

- **Risks/Harms of Implementing This Recommendation**
  None.

- **Conditions of Application**
  None.

- **Potential Costs Associated with Application**
  Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

**Recommendation Narrative**

- MNT has its greatest impact at diagnosis of diabetes (Monk et al, 1995; Delahanty et al, 1998).
- Eight studies (Franz et al, 1995; DAFNE Study Group, 2002; Graber et al, 2002; Miller et al, 2002; Goldhaber-Fiebert et al, 2003; Wilson et al, 2003; Lemon et al, 2004; Gaetke et al, 2006), evaluating the effectiveness of diabetes MNT at three to six months, reported reductions in A1C, ranging from 0.25% to 2.9%, depending on the type and duration of diabetes. Individual sessions ranging from one to five or a series of 10 to 12 group sessions were employed.
- A variety of nutrition therapy interventions, such as a reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios and behavioral strategies were implemented.
- The number of initial and follow-up sessions varies in all the studies.
- Studies reporting on effectiveness of MNT from six to twelve months (Lemon et al, 2004; DAFNE Study Group, 2002; Franz et al, 1995; Wolf et al, 2004; Banister et al, 2004; Chima et al, 2005; Bray et al, 2005) report a variety in the number and type of MNT sessions that lead to improved outcomes.
- Therefore, the RD needs to determine what is appropriate for individual clients.
- Seven studies (DCCT, 1993; Laitinen et al, 1993; Maislos et al, 2002; Banister et al, 2004; Wolf et al, 2004; Bray et al, 2005; Chima et al, 2005) report sustained improvements in A1C at 12 months and longer. All involved regular sessions with an RD, ranging from monthly to three sessions per year.
- Seven studies (DCCT, 1993; Franz et al, 1995; Goldhaber-Fiebert et al, 2003; Banister et al, 2004; Lemon et al, 2004; Wolf et al, 2004; Gaetke et al, 2006) report improvements in other outcomes, such as improved lipid profiles, weight management, decreased need for medications and reduced risk for onset and progression of comorbidities.
- American Diabetes Association Recommendation: Nutrition counseling should be sensitive to the personal needs, willingness to change, and ability to make changes of the individual with pre-diabetes or diabetes (Grade E).

**Recommendation Strength Rationale**

- Conclusion Statement was given Grade I

**Minority Opinions**

Consensus reached.

**Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

**How effective is MNT provided by Registered Dietitians in the management of persons with type 1 and type 2 diabetes?**

- **References**
  - DAFNE Study Group. Training in flexible, intensive insulin management to enable dietary freedom in people with


Wolf AM, Conaway MR, Crowther JO, Hazen KY, Nadler JL, Oneida B, Bovbjerg VE. Translating Lifestyle Intervention to Practice in Obese Patients with Type 2 Diabetes: Improving Control with Activity and Nutrition (ICAN) study. Diabetes Care, 2004; 27 (7): 1,570-1,576.

References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


Quick Links

Recommendations Summary

DM: Macronutrients 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

Recommendation(s)

DM: Macronutrient Percentages

The RD should encourage consumption of macronutrients based on the Dietary Reference Intakes (DRI) for healthy adults. Research does not support any ideal percentage of energy from macronutrients for persons with diabetes.

Rating: Strong

Imperative

Risks/Harms of Implementing This Recommendation

Although total carbohydrate content of meals and snacks is the first priority, macronutrient content and total energy intake cannot be ignored as excessive energy intake may lead to weight gain, even if glycemic control is maintained. Diets too low in carbohydrate eliminate many foods that are important sources of vitamins, minerals, fiber and energy. Diets too low in protein and energy can lead to hypoalbuminemia, and both intake and albumin levels need to be monitored in persons with diabetic nephropathy who are restricting protein intake and may have a diminished appetite.

**Conditions of Application**

- In persons with diabetic nephropathy, hypoalbuminemia and weight must be monitored.

**Potential Costs Associated with Application**

- Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

**Recommendation Narrative**

- Two studies in subjects with Type I diabetes based the adjustment of mealtime insulin to match planned carbohydrate intake (DCCT, 1993; DAFNE Study Group, 2002) and three studies based on day-to-day consistency in carbohydrate intake resulted in improved glycemic control (Wolever et al, 1999; Boden et al, 2005; Nielsen, Jonsson, and Nilsson, 2005).
- Of four studies evaluating differing percentages of carbohydrate, the evidence was inconclusive (Garg et al, 1994; Komiyama et al, 2002; Gerhard et al, 2004; Nielsen, Jonsson, and Ivarsson, 2005).
- The amount of protein consumed at meals has minimal influence on glycemic response, on lipids, on hormones and metabolites, and shows no long-term effect on insulin requirements.
- However, three studies (Luscombe et al, 2002; Parker et al, 2002; Gannon et al, 2003) based on higher protein diets (30% of energy from protein) lasting five to twelve weeks showed no significant difference in longer-term insulin response; one study (Gannon et al, 2003) showed a significant decrease in A1C.
- As the percentage of energy from protein is increased and the percentage of energy from fat remains constant, the percentage of energy from carbohydrate is decreased, and therefore it is difficult to determine whether higher protein intakes or lower carbohydrate intakes result in significant effects on metabolic outcomes.
- American Diabetes Association Recommendation: A dietary pattern that includes carbohydrate from fruits, vegetables, whole grains, legumes, and low-fat milk is encouraged for good health (Grade B).
- American Diabetes Association Recommendation: For individuals with diabetes and normal renal function, there is insufficient evidence to suggest that usual protein intake (15-20% of energy) should be modified (Grade E).

**Recommendation Strength Rationale**

- Conclusion Statement for Carbohydrate was given Grade I
- Conclusion Statement for Protein was given Grade II

**Minority Opinions**

Consensus reached.

**Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

What is the relationship between carbohydrate intake and metabolic outcomes in persons with type 1 and type 2 diabetes?

What is the relationship between protein intake and metabolic outcomes in persons with type 1 and type 2 diabetes?

**References**


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


Quick Links

DM: Carbohydrate 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

**Recommendation(s)**

**DM: Carbohydrate Intake Consistency**

In persons receiving either MNT alone, glucose-lowering medications or fixed insulin doses, meal and snack carbohydrate intake should be kept consistent on a day-to-day basis. Consistency in carbohydrate intake results in improved glycemic control.

**Rating: Strong**

**Conditional**

**DM: Carbohydrate Intake and Insulin Dose Adjustment**

In persons with type 1 or type 2 diabetes who adjust their mealtime insulin doses or who are on insulin pump therapy, insulin doses should be adjusted to match carbohydrate intake (insulin-to-carbohydrate ratio). This can be accomplished by comprehensive nutrition education and counseling on interpretation of blood glucose patterns, nutrition-related medication management and collaboration with the healthcare team. Adjusting insulin dose based on planned carbohydrate intake improves glycemic control and quality of life without any adverse effects.

**Rating: Strong**

**Conditional**
**Risks/Harms of Implementing This Recommendation**

- Although total carbohydrate content of meals and snacks is the first priority, macronutrient content and total energy intake cannot be ignored as excessive energy intake may lead to weight gain, even if glycemic control is maintained.
- Diets too low in carbohydrate eliminate many foods that are important sources of vitamins, minerals, fiber and energy.

**Conditions of Application**

- The scope of practice of the RD and standards of professional performance defines the role of the RD in medication adjustment.

**Potential Costs Associated with Application**

- Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

**Recommendation Narrative**

- Two studies in subjects with Type I diabetes based the adjustment of mealtime insulin to match planned carbohydrate intake (DCCT, 1993; DAFNE Study Group, 2002) and three studies based on day-to-day consistency in carbohydrate intake resulted in improved glycemic control (Wolever et al, 1999; Boden et al, 2005; Nielsen, Jonsson, and Nilsson, 2005).
- Of four studies evaluating differing percentages of carbohydrate, the evidence was inconclusive (Garg et al, 1994; Komiyama et al, 2002; Gerhard et al, 2004; Nielsen, Jonsson, and Ivansson, 2005).

**Recommendation Strength Rationale**

- Conclusion Statement was given Grade I

**Minority Opinions**

Consensus reached.

**Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

What is the relationship between carbohydrate intake and metabolic outcomes in persons with type 1 and type 2 diabetes?

**References**


**Recommendation(s)**

**DM: Sucrose Intake**

If persons with diabetes choose to eat foods containing sucrose, the sucrose-containing foods should be substituted for other carbohydrate foods. Sucrose intakes of 10 to 35 percent of total energy intake do not have a negative effect on glycemic or lipid responses when substituted for isocaloric amounts of starch.

**Rating: Strong**

**Conditional**

- **Risks/Harms of Implementing This Recommendation**
  - Excessive substitution of sucrose for starches could potentially contribute to inadequate intake of foods contributing other essential nutrients. If sucrose-containing foods are habitually added to usual intake, excessive energy intake is a concern.

- **Conditions of Application**
  - None.

- **Potential Costs Associated with Application**
  - Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

- **Recommendation Narrative**
  - Sucrose intakes of 10 percent to 35 percent of total energy intake do not have a negative effect on glycemic or lipid responses in persons with either type 1 or type 2 diabetes when sucrose is substituted for isocaloric amounts of starch.

- **Recommendation Strength Rationale**
  - Conclusion statement was given Grade I

- **Minority Opinions**
  - Consensus reached.

- **Supporting Evidence**

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  **What is the relationship between sucrose and metabolic outcomes in persons with type 1 and type 2 diabetes?**

  - **References**


Nadeau J, Koski KG, Strychar I, Yale JF. Teaching subjects with type 2 diabetes how to incorporate sugar choices into their daily meal plan promotes dietary compliance and does not deteriorate metabolic profile. Diabetes Care 2001; 24:222-227.


Quick Links

Recommendations Summary

DM: Non-nutritive Sweeteners and Diabetes 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

DM: Non-nutritive Sweeteners

If persons with diabetes choose to consume products containing FDA-approved non-nutritive sweeteners, at levels that do not exceed the ADIs, the RD should advise that some of these products may contain energy and carbohydrate from other sources that needs to be accounted for. Research on non-nutritive sweeteners reports no effect on changes in glycemic response.

Rating: Fair
Conditional

Risks/Harms of Implementing This Recommendation

Nonnutritive sweeteners are safe when consumed within the daily intake levels established by the Food and Drug Administration (FDA).

Conditions of Application

This recommendation applies to individuals with diabetes who choose to consume non-nutritive sweeteners.

Potential Costs Associated with Application

Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

Recommendation Narrative

In a limited number of studies, non-nutritive sweeteners had no effect on changes in blood lipid profiles
and glycemic response in adults with diabetes (Cooper et al, 1988; Mezitis et al, 1996; Grotz et al, 2003; Reyna et al, 2003; Mackenzie et al, 2006). No studies in children were identified.

In a limited number of studies conducted outside the United States, children and adults with diabetes were found to have higher intakes of non-nutritive sweeteners as compared to controls, which did not exceed the Acceptable Daily Intake (ADI) in most instances (Garnier-Sagne et al, 2001; Cullen et al, 2004). The exception was Swedish children's intakes of acesulfame-K and saccharin, which was greater than the ADI when "worst case" estimates were used (Ilback et al, 2003). Further studies are needed in both children and adults, specifically in the United States.

American Diabetes Association Recommendation: Sugar alcohols and nonnutritive sweeteners are safe when consumed within the daily intake levels established by the Food and Drug Administration (Grade A).

**Recommendation Strength Rationale**

**Conclusion Statements were given Grade III**

**Minority Opinions**

Consensus reached.

**Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

1. Can non-nutritive sweeteners (saccharin, aspartame, acesulfame-K, sucralose, neotame) be used to manage diabetes and glycemic response in people with diabetes?
2. What is the intake of non-nutritive sweeteners (saccharin, aspartame, acesulfame-K, sucralose, neotame) in persons with diabetes, and is this within the Acceptable Daily Intake (ADI) of non-nutritive sweeteners?

**References**

- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


**Quick Links**

**Recommendations Summary**

**DM: Glycemic Index and Diabetes 2008**

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

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DM: Glycemic Index

If the use of glycemic index is proposed as a method of meal planning, the RD should advise on the conflicting evidence of effectiveness of this strategy. Studies comparing high versus low GI diets report mixed effects on A1C.

Rating: Fair
Conditional

- Risks/Harms of Implementing This Recommendation
  None.

- Conditions of Application
  None.

- Potential Costs Associated with Application
  Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

- Recommendation Narrative
  Fifteen short-term studies ranging from two to 12 weeks and one longer term (one year) studies report mixed effects on A1C levels (Wolever et al, 1991, 1992, 1994, and 1999; Fontvieille et al, 1992; Frost et al, 1994; Jarvis et al, 1999; Buyken et al, 2001; Gilbertson et al, 2001 and 2003; Helbronn et al, 2002; Kabir et al, 2002; Brand-Miller et al, 2003; Rizkalla et al, 2004; Burani et al, 2006). These studies are complicated by differing definitions of "high GI" and "low GI" diets or quartiles, as well as possible confounding dietary factors.

- Recommendation Strength Rationale
  Conclusion statement given Grade II.

- Minority Opinions
  Consensus reached.

- Supporting Evidence
  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  **What is the relationship between glycemic index and metabolic outcomes in persons with type 1 and type 2 diabetes?**

  - References
    Kabir M, Oppert JM, Vidal H, Bruzzo F, Fiquet C, Wursch P, Slama G, Rizkalla SW. Four-week low-glycemic index
breakfast with a modest amount of soluble fibers in type 2 diabetic men. Metabolism 2002; 51:819-826.


Diabetes Type 1 and 2

Quick Links

Recommendations Summary

DM: Protein and Diabetes 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

Recommendation(s)

DM: Protein Intake and Normal Renal Function

In persons with type 1 or type 2 diabetes with normal renal function, the RD should advise that usual protein intake of approximately 15 to 20% of daily energy intake does not need to be changed. Although protein has an acute effect on insulin secretion, usual protein intake in long-term studies has minimal effects on glucose, lipids, and insulin concentrations.

Rating: Fair
Conditional

DM: Protein Intake and Nephropathy

In persons with diabetic nephropathy, a protein intake of one gram or less per kg body weight per day is recommended. Diets with less than one gram protein per kg body weight per day have been shown to improve albuminuria in persons with nephropathy; however, they have not been shown to have significant effects on glomerular filtration rates (GFR).

Rating: Fair
Conditional

DM: Protein Intake and Late Stage Nephropathy

For persons with late stage diabetic nephropathy (Chronic Kidney Disease [CKD] Stages 3-5), hypoalbuminemia (an indicator of malnutrition) and energy intake must be monitored and changes in protein and energy intake made to correct deficits. A protein intake of approximately 0.7 grams per kg body weight per day has been associated with hypoalbuminemia, whereas a protein intake of approximately 0.9 grams per kg body weight per day has not.

Rating: Fair
Conditional

Risks/Harms of Implementing This Recommendation

- Diets too low in protein and energy intakes can lead to hypoalbuminemia (malnutrition) and unintentional weight loss. This needs to be monitored in persons with diabetic nephropathy who are restricting protein intake and may have a diminished appetite.

Conditions of Application

- In persons with diabetic nephropathy, hypoalbuminemia and weight must be monitored.

Potential Costs Associated with Application

- Protein intake of approximately 0.6 g/kg/d or lower often requires purchase and use of low-protein foods. This can contribute to the cost of food.
- Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

Recommendation Narrative

- The amount of protein consumed at meals has minimal influence on glycemic response, on lipids, on hormones and metabolites, and shows no long-term effect on insulin requirements.
- However, three studies (Luscombe et al, 2002; Parker et al, 2002; Gannon et al, 2003) based on higher protein diets (30% of energy from protein) lasting five to twelve weeks showed no significant difference in longer-term insulin response; one study (Gannon et al, 2003) showed a significant decrease in A1C.
- As the percentage of energy from protein is increased and the percentage of energy from fat remains constant, the percentage of energy from carbohydrate is decreased, and therefore it is difficult to determine whether higher protein intakes or lower carbohydrate intakes result in significant effects on metabolic outcomes.
- Six positive-quality randomized controlled trials based on lower protein diets in the management of diabetic nephropathy report inconclusive findings; in all six studies this may be a result of poor compliance.

- In the two studies that were able to compare protein levels greater than 1.0 g/kg/day with protein intakes of 0.8 g/kg/day or lower, the lower protein diets significantly improved albuminuria but had no significant effects on glomerular filtration rate (Hansen et al, 1999, Meloni et al, 2002).
- The other four studies found no significant difference between groups in either albumin excretion rate or glomerular filtration rate.
- In two studies, hypoalbuminemia was associated with an actual protein intake of ~0.7 g/kg/d (Meloni et al, 2002), but not at a protein intake of ~0.9 g/kg/day (Meloni et al, 2004).

American Diabetes Association Recommendation: For individuals with diabetes and normal renal function, there is insufficient evidence to suggest that usual protein intake (15-20% of energy) should be modified (Grade E).

- **Recommendation Strength Rationale**

  - Conclusion Statements were given Grade II

- **Minority Opinions**

  Consensus reached.

- **Supporting Evidence**

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What is the evidence that protein restriction (with or without amino acid or ketoacid supplementation) is an effective treatment of patients with diabetic nephropathy?

  What is the relationship between protein intake and metabolic outcomes in persons with type 1 and type 2 diabetes?

**References**


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

Recommendations Summary

DM: Blood Glucose Monitoring

For individuals on nutrition therapy alone or nutrition therapy in combination with glucose-lowering medications, self-monitoring of blood glucose (SMBG) is recommended. Frequency and timing is dependent on diabetes management goals and therapies (i.e. MNT, diabetes medications and physical activity). When SMBG is incorporated into diabetes education programs and the information from SMBG is used to make changes in diabetes management, SMBG is associated with improved glycemic control.

Rating: Fair
Conditional

DM: Frequency of Blood Glucose Monitoring

For persons with type 1 or type 2 diabetes on insulin therapy, at least three to eight blood glucose tests per day are recommended to determine the adequacy of the insulin dose(s) and guide adjustments in insulin dose(s), food intake and physical activity. Some insulin regimens require more testing to establish the best integrated therapy (insulin, food, and activity). Once established, some insulin regimens will require less frequent self-monitoring of blood glucose (SMBG). Intervention studies that include self-management training and adjustment of insulin doses based on SMBG result in improved glycemic control.

Rating: Strong
Conditional

DM: Possible Need for Continuous Glucose Monitoring or More Frequent SMBG

Persons experiencing unexplained elevations in A1C or unexplained hypoglycemia and hyperglycemia may benefit from use of continuous glucose monitoring (CGM) or more frequent SMBG. It is essential that persons with diabetes receive education as to how to calibrate CGM and how to interpret CGM results. Studies have proven the accuracy of CGM and most show that using the trend/pattern data from CGM can result in less glucose variability and improved glucose control.

Rating: Fair
Conditional

Risks/Harms of Implementing This Recommendation

SMBG:
- Frequent glucose self-monitoring may cause pain and discomfort
- Individuals should know of proper disposal of hazardous waste

Conditions of Application

SMBG:
- Persons must receive education and training in order to use the SMBG devices and data correctly.

CGM:
- Persons must receive more comprehensive education and training in order to use the CGM devices and data correctly.
- In order to have accurate glucose readings, individuals using CGM must be able to correctly calibrate the monitors as indicated by the specific device. Calibration must be done when glucose levels are stable (e.g., it should not be done when a person is eating or exercising). Users must also understand the difference in interstitial fluid tests compared to single point measurement of blood tests and lag time. This is especially critical when glucose levels are dropping. To accurately detect and treat hypoglycemia, capillary blood tests should be used.
- Currently, the Food and Drug Administration has approved CGM for diagnostic use (e.g., tracking trends in glucose levels), not for making treatment decisions. Treatment decisions should be confirmed using a capillary blood glucose test.
- CGM devices have alarms to alert the user of hypoglycemia. The intent of the alarm is to enable the user to detect when blood glucose levels are dropping and must be verified by single point measurements of
blood glucose to confirm hypoglycemia. If hypoglycemia is verified, treatment must be provided. False negative alarms and alarm delays due to lag time are a concern.

- Reimbursement for medical supplies may be a barrier.
- The scope of practice of the RD and the standards of professional performance defines the role of the RD in glucose self-monitoring education.

**Potential Costs Associated with Application**

- There are costs involved in the purchasing of blood glucose monitors and supplies. Insurance reimbursement varies from state-to-state. Medicare provides some reimbursement.
- Although costs vary, educational sessions on how to use the data from self-monitoring of blood glucose are essential.
- Elevated blood glucose levels (sub-optimal control) or hypoglycemic episodes can lead to costly health complications. The cost of education and supplies is less than that of treating complications.
- Both the initial and ongoing costs for CGM are high. Limited coverage is available and reimbursement decisions are usually made case-by-case.

**Recommendation Narrative**

- In subjects with diabetes, studies have shown that self-monitoring of blood glucose (SMBG) values correlate with A1C values (Brewer et al, 1998; Bonora et al, 2001; Hoffman et al, 2002; Fiallo-Scharer et al, 2005).
- Prospective intervention studies in subjects with type 1 diabetes that included self-management training and adjustment of insulin doses based on SMBG showed significant improvement in glycemic control compared to study control group (DAFNE Study Group, 2002; DCCT, 1993).
- More frequent SMBG (3 to 8 times daily) was also associated with better glycemic control regardless of diabetes type or therapy (Karter et al, 2001).
- SMBG, compared to non-SMBG, is associated with greater improvement in A1C when it is a part of a structured education program where subjects use the information to make changes in their management program (Allen et al, 1990; Franciosi et al, 2001; Schwedes et al, 2002; Davidson et al, 2005; Sarol et al 2005).
- Seven studies (4 RCTs, 2 time series, 1 nonrandomized trial) report improvements in hyper- and hypoglycemic ranges (Schiaffini et al, 2002; Schaepelynck-Belicar et al, 2003; Bode et al, 2004; Garg et al, 2004; Tanenberg et al, 2004; Weintrob et al, 2004; Garg et al, 2006).
- Data derived from CGM can be used to modify food or insulin therapy that will improve metabolic outcomes; however, it is currently unclear if use of information from CGM will improve metabolic outcomes significantly more than use of information derived from SMBG: two RCTs (Chico et al, 2003; Tanenberg et al, 2004) found that both methods significantly improved A1C; one RCT (Ludvigsson et al, 2003) found that only CGM significantly improved A1C; and one RCT (Garg et al, 2006) found that only CGM significantly reduced hyperglycemia.
- In a data-gathering study (Fiallo-Scharer et al, 2005), both methods gave similar mean glucose profiles and associations with A1C.
- Two RCTs (Chico et al, 2003; Ludvigsson et al, 2003) found no significant differences between methods in improving hypoglycemia; however two other RCTs (Tanenberg et al, 2004; Garg et al, 2006) found that CGM reduced duration of hypoglycemia vs. SMBG.
- Five studies (1 observational, 2 cross-sectional, and 2 case series) present pattern information from the wearing of CGM devices (Boland et al, 2001; Alemzadeh et al, 2003; Manuel-y-Keenoy et al, 2004; Bode et al, 2005; Streja et al, 2005).

**Recommendation Strength Rationale**

- Conclusion Statements given Grades I and II

**Minority Opinions**

Consensus reached.

**Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- What is the relationship between self-monitoring of blood glucose and metabolic outcomes in persons with type 1 diabetes?
- What is the relationship between self-monitoring of blood glucose and metabolic outcomes in persons with type 2 diabetes?
- What is the relationship between continuous glucose monitoring and metabolic outcomes in persons with type 1 and type 2 diabetes?

**References**


Chico A, Vidal-Rios P, Subira M, Novials A. The continuous glucose monitoring system is useful for detecting unrecognized hypoglycemias in patients with type 1 and type 2 diabetes but is not better than frequent capillary glucose measurements for improving metabolic control. Diabetes Care. 2003;26:1153-1157.


Streja D. Can continuous glucose monitoring provide objective documentation of hypoglycemia unawareness?. Endocrine Practice 2005;11(2):83-90.


Allen BT, DeLong ER, Feussner JR. Impact of glucose self-monitoring on non-insulin-treated patients with type II diabetes mellitus. Randomized controlled trial comparing blood and urine testing. Diabetes Care, 1990; 13:


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


Quick Links

Recommendations Summary

DM: Prevention and Treatment of CVD 2008

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http://www.anedal.org
Recommendation(s)

DM: CVD and Cardioprotective Nutrition Therapy

Cardioprotective nutrition interventions for the prevention and treatment of cardiovascular disease (CVD) should be implemented in the initial series of encounters. Diabetes is associated with an increased risk for CVD and glycemic control may improve the lipid profile.

Rating: Strong
Imperative

DM: CVD and Cardioprotective Nutrition Interventions

Cardioprotective nutrition interventions for prevention and treatment of CVD include reduction in saturated and trans fats and dietary cholesterol, and interventions to improve blood pressure. Studies in persons with diabetes utilizing these interventions report a reduction in cardiovascular risk and improved cardiovascular outcomes.

Rating: Strong
Imperative

- Risks/Harms of Implementing This Recommendation
  None.

- Conditions of Application
  None.

- Potential Costs Associated with Application
  Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

- Recommendation Narrative
  - Diabetes is associated with increased risk of complications related to CVD (Mayer-Davis et al, 1999; Mukamal et al, 2001; Orchard et al, 2001; Selvin et al, 2004; Faulkner et al, 2006).
  - Nutrition interventions lasting 1 year or more, such as Mediterranean dietary patterns (Ciccarone et al, 2003; Diakoumopoulou et al, 2005) and multifactorial interventions, reduced A1C, blood pressure and body weight and improved serum lipid profile (DCCT, 1993; Turner et al, 1998; Dhindsa et al, 2003; Gaede et al, 2003; Gill et al, 2003), all of which reduce the risk for the development of cardiovascular disease.
  - Three studies (Yu-Poth et al, 1999; Krook et al, 2003; Perassolo et al, 2004) showed improvements in lipid profiles from cardioprotective nutrition interventions.
  - Eight studies (Storm et al, 1997; Lovejoy et al, 2002; Gerhard et al, 2004; Neyestani et al, 2004; Mostad et al, 2004; Rodriguez-Villar et al, 2004; Tapsell et al, 2004; West et al, 2005) reported benefits from specific fatty acids and low-fat diets.
  - Two studies (Didangelons et al, 2004; Osende et al, 2004) implementing MNT and drug therapies reported lower A1C levels and improvement in vascular risk factors.
  - Two studies (Karantonis et al, 2006; Mantzoros et al, 2006) implementing MNT and drug therapies reported lower A1C levels and improvement in vascular risk factors.
  - Two studies (Houlihan et al, 2002; Vedovato et al, 2004) reported benefits on blood pressure from low-sodium diets.

- Recommendation Strength Rationale
  Conclusion Statements were given Grade I

- Minority Opinions
  Consensus reached.
Are there specific nutrition interventions (for at least 1 year) in the prevention of cardiovascular disease in people with diabetes?

References


Mostad Il, Ovigstad E, Bjerve KS, Grell VE. Effects of a 3-day low-fat diet on metabolic control, insulin sensitivity, lipids, and adipocyte hormones in Norwegian subjects with hypertriacylglycerolaemia and type 2 diabetes. Scand J


improved outcomes.

### Recommendation Narrative

- In randomized clinical trials, approximately half report improvement in A1C values with weight loss; whereas, approximately half report no improvement in A1C values despite fairly similar weight losses.
- Eleven studies with more than 1 diet arm (Hollander et al, 1998; Manning et al, 1998; Hanefeld et al, 2002; Miles et al, 2002; Kelley et al, 2003; Redmon et al, 2003; Brinkworth et al, 2004; Metz et al, 2004; Wolf et al, 2004; Li et al, 2005; Berne et al, 2005; Redmon et al, 2005) reported weight loss and A1C values at 12 months.
- Six studies in diet arms reported no improvement in A1C (Hollander et al, 1998; Manning et al, 1998; Redmon et al, 2003; Brinkworth et al, 2004; Wolf et al, 2004; Li et al, 2005; Redmon et al, 2005) despite weight loss (range: -0.8 to -4.4 kg) in all but one study which reported no weight loss (Manning et al, 1998).
- Five studies in diet arms reported improvement in A1C ranging from -0.2% to -0.6% (Hanefeld et al, 2002; Miles et al, 2002; Kelley et al, 2003; Mertz et al, 2004; Berne et al, 2005) with fairly similar weight losses (range: -1.3 to -5.1 kg).
- Studies using weight loss medications (orlistat and lifestyle, sibutramine) report consistent improvement in A1C. Six studies with an orlistat arm (Hollander et al, 1998; Hanefeld et al, 2002; Miles et al, 2002; Kelley et al, 2003; Derosa et al, 2004; Berne et al, 2005) reported improvements in A1C values (range: -0.3% to -1.1%) with orlistat and lifestyle intervention with weight loss (range: -3.9 to -6.2 kg).
- Four studies (McNulty et al, 2003; Redmon et al, 2003; Derosa et al, 2004; Sanchez-Reyes et al, 2004; Redmon et al, 2005) reported improvements in A1C values (range: -0.3% to -6.0%) with sibutramine with weight loss (range: -4.1 to -8.0 kg).
- Ten studies reported significant improvements in at least one lipid value, generally in triglycerides and HDL cholesterol from weight loss either by diet alone or with weight loss medications (Hollander et al, 1998; Hanefeld et al, 2002; Miles et al, 2002; Paisey et al, 2002; Ash et al, 2003; Kelley et al, 2003; McNulty et al, 2003; Metz et al, 2004; Berne et al, 2005; Li et al, 2005).
- Six studies reported improvement in blood pressure with weight loss (Miles et al, 2002; Redmon et al, 2003; Brinkworth et al, 2004; Derosa et al, 2004; Metz et al, 2004; Li et al, 2005; Redmon et al, 2005); however, one study using sibutramine reported increases in blood pressure (McNulty et al, 2003) and one study using sibutramine reported no change in blood pressure (Derosa et al, 2004).

### Recommendation Strength Rationale

- Conclusion statement is Grade II.

### Minority Opinions

Consensus reached.

### Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

What is the long-term effect (1 year or greater) of weight management on metabolic outcomes in persons with type 1 and type 2 diabetes?

#### References

**Recommendations Summary**

**DM: Physical Activity 2008**

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- **Recommendation(s)**
  - **DM: Type 2 Diabetes and Physical Activity**

In persons with type 2 diabetes, 90 to 150 minutes of accumulated moderate-intensity aerobic physical activity per week as well as resistance/strength training three times per week is recommended. Both aerobic and resistance training improve glycemic control, independent of weight loss. Physical activity also improves insulin sensitivity and decreases risk for cardiovascular disease and all-cause mortality.

**Rating:** Strong

**Conditional**

- **DM: Type 1 Diabetes and Physical Activity**
Individuals with type 1 diabetes should be encouraged to engage in regular physical activity. Although exercise is not reported to improve glycemic control in persons with type 1 diabetes, individuals may receive the same benefits from exercise as the general public—decreased risk for cardiovascular disease and improved sense of well-being.

**Rating: Fair**

**Conditional**

**DM: Physical Activity and Insulin/Insulin Secretagogue Use**

The RD should instruct individuals on insulin or insulin secretagogues on the safety guidelines to prevent hypoglycemia (frequent blood glucose monitoring and possible adjustment in insulin dose or carbohydrate intake). Research indicates that the incidence of hypoglycemia during exercise may depend on baseline glucose levels.

**Rating: Fair**

**Conditional**

- **Risks/Harms of Implementing This Recommendation**
  - Before beginning a program of physical activity more vigorous than brisk walking, people with diabetes should be assessed for conditions that might be associated with an increased risk of cardiovascular disease. Of concern are uncontrolled hypertension, severe autonomic or peripheral neuropathy, and preproliferative or proliferative retinopathy or macular edema.
  - In previously sedentary individuals whose 10-year risk of a coronary event is likely to be equal to or greater than 10 percent, a graded exercise test with electrocardiogram (ECG) monitoring is recommended. In individuals taking insulin or insulin secretagogues, physical activity can cause hypoglycemia if medication dose or carbohydrate intake is not adjusted. Carbohydrate should be ingested if preexercise levels are less than 100 mg/dl.

- **Conditions of Application**
  - This recommendation applies to persons with type 1 or type 2 diabetes, and persons with type 1 or type 2 diabetes on insulin or insulin secretagogues.

- **Potential Costs Associated with Application**
  - In previously sedentary individuals, a graded exercise test with electrocardiogram (ECG) monitoring is recommended before undertaking aerobic physical activity with intensity exceeding the demands of every day living (more intense than brisk walking), and this is a potential cost.

- **Recommendation Narrative**
  - In persons with type 1 diabetes, the incidence of hypoglycemia during exercise depends on baseline glucose levels, and exercise often results in overnight hypoglycemia (Tsalikian et al, 2005; Tansey et al, 2006).
  - Glycemic control generally does not improve in response to ongoing participation in physical activity alone (Roberts et al, 2002; Sarnblad et al, 2005).
  - One study reported possible gender differences in A1C (Waden et al, 2005).
  - American Diabetes Recommendation: To improve glycemic control, assist with weight maintenance, and reduce risk of CVD, at least 150 minutes/week of moderate-intensity aerobic physical activity (50-70% of maximum heart rate) and/or at least 90 minutes/week of vigorous aerobic exercise (>70% of maximum heart rate) is recommended. The physical activity should be distributed over at least 3 days/week and with no more than two consecutive days without physical activity (Grade A).
  - American Diabetes Recommendation: In the absence of contraindications, people with type 2 diabetes should be encouraged to perform resistance exercise three times a week, targeting all major muscle groups, progressing to three sets of 8-10 repetitions at a weight that cannot be lifted more than 8-10 times (Grade A).

- **Recommendation Strength Rationale**

- **Minority Opinions**

- **Conclusion statements received Grades I and II**

- **Consensus Opinions**

- **Supporting Evidence**
  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - What is the effect of physical activity (for at least 3 months) combined with MNT on metabolic outcomes in persons with type 2 diabetes?
  - What is the effect of physical activity combined with Medical Nutrition Therapy (MNT) on metabolic outcomes in persons with type 1 diabetes?
• References


• References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


• Diabetes Type 1 and 2
• Diabetes (DM) Guideline (2008)
Recommendations Summary

DM: Coordination of Care and Diabetes 2008

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- **Recommendation(s)**
- **DM: Coordination of Care**

The RD should implement MNT and coordinate care with an interdisciplinary team. An interdisciplinary team approach is necessary to integrate MNT for patients with diabetes into overall management.

**Rating: Consensus**

**Imperative**

- **Risks/Harms of Implementing This Recommendation**

  None.

- **Conditions of Application**

  None.

- **Potential Costs Associated with Application**

  Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

**Recommendation Narrative**

- MNT has its greatest impact at diagnosis of diabetes (Monk et al, 1995; Delahanty et al, 1998).
- Eight studies (Franz et al, 1995; DAFNE Study Group, 2002; Graber et al, 2002; Miller et al, 2002; Goldhaber-Fiebert et al, 2003; Wilson et al, 2003; Lemon et al, 2004; Gaetke et al, 2006), evaluating the effectiveness of diabetes MNT at three to six months, reported reductions in A1C, ranging from 0.25% to 2.9%, depending on the type and duration of diabetes. Individual sessions ranging from one to five or a series of 10 to 12 group sessions were employed.
- A variety of nutrition therapy interventions, such as a reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios and behavioral strategies were implemented.
- The number of initial and follow-up sessions varies in all the studies.
- Studies reporting on effectiveness of MNT from six to twelve months (Lemon et al, 2004; DAFNE Study Group, 2002; Franz et al, 1995; Wolf et al, 2004; Banister et al, 2004; Bray et al, 2005) report a variety in the number and type of MNT sessions that lead to improved outcomes. Therefore, the RD needs to determine what is appropriate for individual clients.
- Seven studies (DCCT, 1993; Laitinen et al, 1993; Maislos et al, 2002; Banister et al, 2004; Wolf et al, 2004; Bray et al, 2005; Chima et al, 2005) report sustained improvements in A1C at 12 months and longer. All involved regular sessions with an RD, ranging from monthly to three sessions per year.
- Seven studies (DCCT, 1993; Franz et al, 1995; Goldhaber-Fiebert et al, 2003; Banister et al, 2004; Lemon et al, 2004; Wolf et al, 2004; Gaetke et al, 2006) report improvements in other outcomes, such as improved lipid profiles, weight management, decreased need for medications and reduced risk for onset and progression of comorbidities.
- American Diabetes Association Recommendation: An interdisciplinary team approach is necessary to integrate MNT for patients with diabetes into overall management (Grade E).
- American Diabetes Association Recommendation: Establishing an interdisciplinary team, implementation of MNT, and timely diabetes-specific discharge planning improves the care of patients with diabetes during and after hospitalizations (Grade E).

**Recommendation Strength Rationale**

Conclusion Statement was given Grade I

**Minority Opinions**

Consensus reached.

**Supporting Evidence**

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

How effective is MNT provided by Registered Dietitians in the management of persons with type 1 and type 2 diabetes? © 2016 Academy of Nutrition and Dietetics (A.N.D.), Evidence Analysis Library. Printed on: 01/17/16 - from: http://www.andeal.org
References


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process


Quick Links

Recommendations Summary

DM: Monitor & Evaluate and Diabetes 2008

Recommendation(s)

DM: Monitoring and Evaluation

The RD should monitor and evaluate food intake, medication, metabolic control (glycemia, lipids, and blood pressure), anthropometric measurements and physical activity. Research reports sustained improvements in A1C at 12 months and longer with long-term follow-up encounters with an RD.

Rating: Strong

Imperative

DM: Evaluation of Glycemic Control

The RD should primarily use blood glucose monitoring results in evaluating the achievement of goals and effectiveness of MNT. Glucose monitoring results can be used to determine whether adjustments in foods and meals will be sufficient to achieve blood glucose goals or if medication additions or adjustments need to be combined with MNT.

Rating: Consensus

Imperative

Risks/Harms of Implementing This Recommendation

None.

Conditions of Application

None.

Potential Costs Associated with Application

Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes.

Recommendation Narrative

- MNT has its greatest impact at diagnosis of diabetes (Monk et al, 1995; Delahanty et al, 1998).
- Eight studies (Franz et al, 1995; DAFNE Study Group, 2002; Graber et al, 2002; Miller et al, 2002; Goldhaber-Fiebert et al, 2003; Wilson et al, 2003; Lemon et al, 2004; Gaetke et al, 2006), evaluating the effectiveness of diabetes MNT at three to six months, reported reductions in A1C, ranging from 0.25% to 2.9%, depending on the type and duration of diabetes. Individual sessions ranging from one to five or a series of 10 to 12 group sessions were employed.
- A variety of nutrition therapy interventions, such as a reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios and behavioral strategies were implemented.
- The number of initial and follow-up sessions varies in all the studies.
- Studies reporting on effectiveness of MNT from six to twelve months (Lemon et al, 2004; DAFNE Study Group, 2002; Franz et al, 1995; Wolf et al, 2004; Banister et al, 2004; Chima et al, 2005; Bray et al, 2005) report a variety in the number and type of MNT sessions that lead to improved outcomes.
- Therefore, the RD needs to determine what is appropriate for individual clients.
- Seven studies (DCCT, 1993; Laitinen et al, 1993; Maislos et al, 2002; Banister et al, 2004; Wolf et al, 2004; Bray et al, 2005; Chima et al, 2005) report sustained improvements in A1C at 12 months and longer. All involved regular sessions with an RD, ranging from monthly to three sessions per year.
- Seven studies (DCCT, 1993; Franz et al, 1995; Goldhaber-Fiebert et al, 2003; Banister et al, 2004; Lemon et al, 2004; Wolf et al, 2004; Gaetke et al, 2006) report improvements in other outcomes, such as improved lipid profiles, weight management, decreased need for medications and reduced risk for onset and progression of comorbidities.

American Diabetes Association Recommendation: Plasma glucose monitoring can be used to determine whether adjustments in foods and meals will be sufficient to achieve blood glucose goals or if medication(s) needs to be combined with MNT (Grade E).

Recommendation Strength Rationale

Conclusion Statement for MNT given Grade I

Minority Opinions

Consensus reached.

Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

How effective is MNT provided by Registered Dietitians in the management of persons with type 1 and type 2 diabetes?

References


Wolf AM, Conaway MR, Crowther IJ, Hazen KY, Nadler JL, Oneida B, Boybjerg VE. Translating Lifestyle Intervention to Practice in Obese Patients with Type 2 Diabetes: Improving Control with Activity and Nutrition (ICAN) study. Diabetes Care, 2004; 27 (7): 1,570-1,576.


References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process
