With this edition of *On The Cutting Edge*, we sought to bring together the roles of the revised and updated *DGA*, family meals and diabetes prevention. Our hard-working authors present six articles covering a wide-spectrum on these topics, including discussions on everything from diabetes in pregnancy, to the management of type 2 diabetes (T2DM) in children, and the use of oral medications for preventing diabetes.

The first article by Antonia Scotto Pinckney, RD, RN, CDE, presents a thorough overview of the *DGA* and their evidence basis, pointing out the unique features of the 2010 version, including its emphasis on children and families, and the prevention of chronic disease through healthy lifestyle choices. Antonia’s article is an excellent summary on the new *DGA* and provides a practical review of information that many of us use on a daily basis in our patient education sessions.

Our second article by Alicia Lindell, BS, and Liz Quintana, EdD, RD, CDE, addresses diabetes in pregnancy and the need for ongoing post-partum diabetes screening. Alicia provides an excellent case study on gestational diabetes, and how the new *DGA* guidelines can help diabetes educators working with this population.

Next, Melissa Halas-Liang, MS, RD, CDE, presents information on the role of...
family meals in diabetes prevention. Melissa provides readers with many practical tips for helping parents model healthy food and lifestyle behaviors, which is an important piece to promoting lifelong healthy habits among children and teens.

Marla Solomon, RD, CDE, offers an article discussing the problem of T2DM among children and teens. She also shares the story of two community-based T2DM prevention programs that targeted African American youth in the Chicago area.

Nancy Kure, RD, LD, CDE, and Kristi Holden, MSPE, describe how the recommendations on physical activity are presented in the DGA. Through a comprehensive review of the literature, they describe the role of physical activity in diabetes prevention through the lifecycle. They also share their experience of how they were able to incorporate physical activity education into one rural community’s hospital-based, recognized diabetes education program.

To close this issue, Joel Thome, PharmD, contributes an article reviewing the use and efficacy of antihyperglycemic agents in preventing patients at high risk for diabetes, such as those diagnosed with pre-diabetes, from progression to full-blown T2DM.

The goal of (OTCE) is to provide DCE members with up-to-date, practical information that will be useful to educators across the spectrum—from private-practice serving small communities, to those working with endocrinologists in metropolitan areas. It is our hope that you will find this issue useful in understanding how to incorporate the DGA recommendations regarding healthy food choices and physical activity into everyday practice. And finally, we hope that the information gleaned from this issue of OTCE will be kept in the “educational toolbox” to aid in our ongoing efforts to prevent obesity and T2DM.

I want to express mountains of gratitude to this issue’s theme team: Liz Quintana, EdD, RD, LD, CDE, OTCE Editor; Alyce Thomas, RD, OTCE Associate Editor, Melissa Olfert, DrPH, MS, RD, and Nancy Kure, RD, LD, CDE. Both Liz and Alyce provided me with excellent guidance through the course of this effort and I am grateful for their patience, and for this experience. I also want to thank all of our authors and reviewers for their hard work and dedication to DCE and OTCE. Without you, we could not produce this valuable publication.


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**STRATEGIC PRIORITY AREAS**

**GOAL 1:** Sustain and grow a high level of satisfaction and retention among members.

- Use electronic technology to engage new and existing members.
- Promote and support member professional development.
- Maintain a high value of membership.

**GOAL 2:** Advance DCE’s unique position as the authority in nutrition and diabetes prevention, education and management.

- Promote and maintain new DCE image.
- Develop domestic and global alliance and stakeholder relationships.
- Promote and support evidence-based practice and research.

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**MISSION**

DCE members are the most valued authorities on nutrition and diabetes prevention, education, and management.

**VISION**

DCE members lead the future of nutrition and diabetes prevention, education, and management.
The 2010 Dietary Guidelines for Americans: Scientific Basis and Summary Implications for Diabetes Educators

Antonia Scotto Pinckney, RD, RN, CDE, CDN
Nutrition Program Coordinator
New York Hospital
Fresh Meadows, New York

Brief History and Review

The 2010 Dietary Guidelines Advisory Committee (DGAC) released its report in June of last year (1). The report presented the findings of a panel of experts after nearly 2 years of scientific review. The recommendations were presented to the Secretaries of the U.S. Departments of Agriculture and Health and Human Services as the basis for the Dietary Guidelines for Americans (DGA), which were released on January 30, 2011. Both the DGAC report and the 2011 DGA are available to the public online (1). The consumer materials that reflect the guidelines will be released at a later date. This article explains the formulation of the 2010 DGA, based on the DGAC recommendations, and summarizes the main points.

The federal government uses the DGA as the foundation for many nutrition-related endeavors. For example, the DGA are used by the National School Lunch and Elderly Nutrition Programs for menu planning and by the Special Supplemental Program for Women, Infants, and Children (WIC) for designing benefit structures and nutrition education programs. WIC food packages must be aligned with the DGA and infant feeding practice guidelines of the American Academy of Pediatrics (2). The DGA also provide the foundation for the Healthy People 2020 national health promotion and disease prevention objectives related to nutrition (3).

The most recent reassessment of the science behind the newly updated DGA identified one glaring reality, which served as the basic framework: the number of deaths and disabilities related to poor diet and physical inactivity is steadily increasing.

Unique Features of the 2010 DGA

The 2010 DGA differ from previous guidelines in several important ways. This is the first time the DGA has incorporated data from the Nutrition Evidence Library (NEL), a systematic web-based method used to conduct, grade, and draw conclusions from peer-reviewed published research. The Web site www.nutritionevidencelibrary.com presents detailed explanation of the NEL.

Also, for the first time the DGA address the overweight and obesity crisis affecting this country, taking into consideration that most Americans are either living with a condition related to poor diet or physical inactivity or are at risk for developing one.

OTCE Spring 2011
Acknowledgments

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To the following people for assisting with the development of this issue of On the Cutting Edge:

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Two new chapters from the DGAC report were used to develop the DGA. The first, “The Total Diet: Combining Nutrients and Consuming Food,” focuses on using scientific evidence to develop an optimal pattern of eating. This chapter examines the evidence of how dietary components contribute excess energy and inadequate nutrients, and how nutrient-dense foods can provide those nutrients that tend to be in short supply in the American diet. It also briefly reviews several well-researched eating patterns, such as the Mediterranean-style and Dietary Approaches to Stop Hypertension (DASH)-style.

The second new chapter, “Translating and Integrating the Evidence: A Call to Action,” introduces the theory that the current environment does not adequately support Americans’ ability to meet the DGA. It further emphasizes that both environmental and social changes are necessary for successful implementation.

The 2010 DGA places greater emphasis on children based on the understanding that most diet and lifestyle problems start in childhood. It concludes that targeting youth is the single best strategy for combating and reversing the nation’s obesity epidemic.

Major DGA Recommendations Pertaining to Diabetes Care, Education and Prevention

The new DGA emphasize two major points: (1) maintain calorie balance over time to achieve and sustain a healthy weight, and (2) focus on consuming nutrient-dense foods and beverages. These two major points have led to four major recommendations. Each is summarized here with possible implications for registered dietitians (RDs) involved in diabetes care, education and management.

1. Balance calories to manage weight

The primary finding used to develop the guidelines is the urgent need to reduce the incidence and prevalence of overweight and obesity in the U.S. population. Recommendations are based on stages throughout the lifecycle.

It is recommended that efforts to prevent childhood obesity should begin as early as possible: in utero or even before conception. Increasing evidence indicates that maternal obesity before conception and excess maternal weight gain during pregnancy are risk factors for childhood obesity. One-fifth of American women are obese at the beginning of their pregnancies. Many more gain unhealthy amounts of weight during pregnancy, and have difficulty losing it after delivery.

Ideally, women of or approaching childbearing age should be screened for their risk of obesity. Screening of adolescent girls should include not only a weight-for-height assessment, but also their pattern of weight gain during adolescence, obesity-related genetic risks (e.g., type 2 diabetes [T2DM]), and lifestyle factors, such as physical activity level.

Continued weight monitoring and nutrition counseling during pregnancy is merited. Early intervention could reduce the incidence of gestational diabetes (and other adverse maternal/fetal outcomes), maternal and childhood obesity and other related comorbidities in subsequent generations. For this reason, building nutrition intervention into standard obstetric care would be cost-effective.

The DGA provide very specific dietary and behavioral modifications to achieve energy balance during childhood. Controlling the obesity epidemic (and hence the incidence of T2DM) at this stage in the lifecycle will involve education regarding energy-dense foods, sugar sweetened beverages, portion control, regular breakfast consumption, reduced computer/TV time and increased physical activity. Grain-based desserts, pizza, and high-calorie beverages (soda/energy/sports drinks) are the top three sources of calories for children today. Placing emphasis on reducing these high-calorie foods is important, especially for children with diabetes. The most recent body mass index ranges and definitions of overweight and obesity for children are also included in chapter 2 of the DGA.

The DGAC report suggested combating the pattern of childhood obesity by (1) teaching cooking and shopping skills in schools, as previously taught in home economics classes, and (2) modifying the living environment such as adding sidewalks, bicycle trails, zoning changes and not allowing fast food establishments to be located close to schools. These specific recommendations were not included in the DGA, but are generalized in the last chapter.

2. Foods and food components to increase

Chapter 4 places a special emphasis on increasing plant foods. Very few Americans consume the recommended amounts of fruits, vegetables, and whole grains. Including a higher proportion of these foods accomplishes multiple objectives: lowering energy density and saturated fat and sodium intake, while increasing micronutrient, fiber and monounsaturated fat intake.
The DGA explain how a range of eating patterns can be used to attain these above-mentioned goals from vegan to omnivore. Educators know the importance of respecting cultural and personal preferences and appreciate that this is key to long-term behavioral change. Individualization of eating patterns will require more flexibility, creativity and knowledge on the part of educators.

Unique to this edition of the DGA is the inclusion of sections on dried beans and peas (legumes), whole grains and juice. Legumes are not widely consumed foods in America, yet they are nutrient-dense, low-calorie and low-cost. Dried beans and peas should be considered both a vegetable and a protein food, and are discussed again in chapter 5 (“Building Healthy Eating Patterns”). Because many Americans are confused by the use of “whole grains” on food packaging, the DGA clearly defines whole grains, refined grains and enriched grains. Juice consumption is also discussed, with emphasis on limited consumption of 100% fruit- and sugar-sweetened beverages, especially among children.

Although monitoring carbohydrate intake is a key strategy for achieving glucose control, emphasizing carbohydrate quality as well as total quantity, including high-fiber plant foods can help achieve good postprandial blood glucose control (4). The reduction in saturated fat intake as a result of this eating pattern may be beneficial in promoting an improved lipid profile and a lower LDL-cholesterol level.

3. Foods and food components to reduce
One of the most startling findings from the DGAC report, presented in chapter 3, is that 35% of America's energy intake comes from solid fats and added sugar. Foods with high levels of saturated fat and sugar (referred to as SoFAS in the report) usually contain high levels of refined grains and sodium. The high consumption levels of these nutrient-poor foods are linked to high rates of weight gain, hypertension, cardiovascular disease (CVD) and T2DM.

Diabetes increases the risk for developing CVD, which accounts for the greatest component of health care costs in people with diabetes (5). The excess SoFAS all contribute to an adverse lipid profile, while excess sodium intake is associated with hypertension. Cardioprotective interventions, such as SoFAS intake reduction, are fundamental for the diabetes population. A careful diet history can be used to identify an individual’s primary sources of SoFAS. The report cites research that states the most commonly consumed forms of SoFAS are grain-based desserts for most adults and children, and soda/ sports drinks and pizza for adolescents. Foods prepared away from home contribute to this pattern as well.

The DGAC recommended restricting sodium to no more than 1,500 mg. This recommended decrease for the general population from 2,300 mg is because of the high rates of hypertension, stroke and CVD. The DGAC recognized that gradual reduction is necessary to gain consumer acceptance because this new level will require most people to reduce their sodium intake by more than half. The final version of the DGA recommends a 1,500 mg/day sodium level for adults older than 51 years of age, African Americans, people with chronic kidney disease, and those with diabetes, but maintains the level at 2,300 mg for the rest of the population. This change recommended for approximately half the population will require efforts beyond that of the individual consumer. In addition to closely working with clients to identify and replace the most prominent sources of sodium in their diets, registered dietitians (RDs) and certified diabetes educators (CDEs) will need to partner with industry to reduce the sodium content of foods in the marketplace.

4. Building healthy eating patterns
A healthy eating pattern is defined by the DGA as “an array of options that can accommodate cultural, ethnic, traditional and personal preferences, and food cost and availability.” Adopting new eating patterns, just as any other lifestyle change made by a person with diabetes, requires additional glucose monitoring, at least until a pattern is recognized and adequate control is achieved. The DGA described the research evidence that supports the use of the DASH, vegetarian, and Mediterranean-style diets, and clearly defines those dietary patterns. The DGA also refer readers to the U.S. Department of Agriculture’s food patterns, which many diabetes educators will also likely find useful in developing meal plans for patients who require very specific recommendations.

Helping Americans Make Healthy Choices
The DGA final chapter begins with a discussion on barriers to change, including personal/individual, environmental and sociocultural barriers. Just as with all other areas of diabetes self-management skills, having access to healthy food options and participating in physical activity are key ingredients for success.
The Department of Health and Human Services released Physical Activity Guidelines for Americans in 2008 (6) which pertain to people of all ages, pregnant women and those with disabilities, and is summarized in the DGA. This information is reviewed by Nancy Kure, RD, LD, CDE, and Kristi Holden, MSPE, in this issue of OTCE.

These four categories of recommendations are in concert with those of the American Diabetes Association. Other categories call for achieving energy balance; reducing risk through lifestyle changes; and consuming a high-quality diet rich in fruits, vegetables and legumes and limited in saturated fat, trans fat and refined grains (5).

The ADA
The American Dietetic Association (ADA) supports the DGA’s "healthy balance" approach to weight management, which focuses on consuming nutrient-dense foods and beverages and engaging in regular physical activity to create an eating pattern that is right for each individual. ADA also supports the DGA's call for "options that can accommodate cultural, ethnic, traditional and personal preferences and food cost and availability" in developing practical advice from scientific findings (7).

Conclusion: A Call to Action
We are all ultimately responsible for our own food and lifestyle choices, but the DGA posits that we must all have the opportunity to make those choices, and many Americans lack this opportunity. As RDs, we must ensure that all our patients have access to healthy food options before we can ask them to eat healthier foods. A multipronged approach is urgently needed to halt and begin to reverse the alarmingly high rates of obesity, cardiovascular disease and diabetes. The DGAC report calls for a unified effort of practitioners, educators, industry leaders, civic planners, communities, and policy makers to facilitate the efforts of individuals and families. RDs and CDEs are uniquely qualified to assume a partnership role in helping Americans make these changes and improve the nation's health. This can be accomplished by guiding clients through the transition to healthy lifestyle habits and leading the way by helping society incorporate these changes.

References
Abstract
Gestational Diabetes Mellitus (GDM) is a serious complication of pregnancy. Obesity increases the risk for GDM, and the increasing rate of obesity in the nation has led to more cases of GDM. The condition not only affects the mother, but can cause poor outcome in the infant. The 2010 Dietary Guidelines for Americans provide recommendations for pregnant women and current research further expounds on recommendations and guidelines that should be implemented in managing women with GDM. A registered dietitian certified diabetes educator (RD and CDE) shares a case study of a first-time visit with a GDM patient.

Introduction
Gestational Diabetes Mellitus (GDM) is defined as glucose intolerance that is first recognized during pregnancy and develops in approximately 7% of all pregnancies (1,2). To identify more women with GDM and to reduce the health risks to the mother and fetus, the American Diabetes Association (ADbA) has adopted new guidelines for testing pregnant women for gestational diabetes. The International Association of Diabetes and Pregnancy Study Groups, which includes the ADbA, has adopted new guidelines for testing pregnant women for gestational diabetes. The International Association of Diabetes and Pregnancy Study Groups, which includes the ADbA, has adopted new guidelines for testing pregnant women for gestational diabetes.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Plasma Glucose Threshold (mg/dL)*</th>
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<tbody>
<tr>
<td>Fasting Plasma Glucose</td>
<td>≥92</td>
</tr>
<tr>
<td>1 hour</td>
<td>≥180</td>
</tr>
<tr>
<td>2 hours</td>
<td>≥153</td>
</tr>
</tbody>
</table>

*At 24-28 weeks of gestation, a 75-g oral glucose tolerance test with plasma glucose is performed after an overnight fast of at least 8 hours.

Although many factors contribute to the onset of GDM, one of the major factors is obesity. Obese women are already predisposed to altered glucose and lipid metabolism, which puts them at a higher risk for developing GDM. The association between obesity and the risk for GDM is exponential; the greater the obesity, the higher the risk for GDM (3).

Whether associated with obesity or other causes, GDM affects not only the mother but also the health of her infant. The most common and significant neonatal complication associated with GDM is macrosomia: an oversized infant with a birthweight of more than 4000 g (>9 lb). Seen in 20% of pregnancies complicated by GDM, macrosomic infants have significantly greater fat mass (4,5). Fat accumulation in the infant is related to the blood glucose levels of the mother. As the mother’s blood glucose level increases, fetal fat accumulation also increases (6).

Exposure to maternal diabetes also affects the infant later in life. Infants born to women with previous GDM are at increased risk for obesity and altered glucose metabolism (6). Exposure to maternal diabetes in utero puts these infants at an increased risk for obesity and also for cardiovascular disease and metabolic syndrome later in life (7).

Women who have been diagnosed with GDM are now considered at risk for heart attack or stroke, according to the 2011 update of the American Heart Association’s cardiovascular disease prevention guidelines for women (8).

Although GDM is a complication of pregnancy and usually resolves immediately after delivery, up to one-third of women with GDM will test positive to impaired glucose metabolism or diabetes within 6 to 12 weeks after delivery. Another 15% to 50% of these women will develop type 2 diabetes (T2DM) within the next 10 years (9,10). In addition,
women with previous GDM are 30% to 84% more likely to develop the condition with any subsequent pregnancy (11).

2010 Dietary Guidelines and Pregnancy

The 2010 Dietary Guidelines for Americans (DGA) are aimed at promoting health and preventing risks of chronic disease, such as T2DM (12). Because excessive weight gain and obesity increase the risk for GDM, and GDM increases the risk for T2DM, these new guidelines will have direct implications in GDM management.

The new DGA includes several recommendations concerning pregnant women. One recommendation is the avoidance of excessive weight gain, which is associated with suboptimal outcomes in the mother and infant.

These outcomes include postpartum weight retention, increased risk of cesarean delivery, large-for-gestational age infants, and obesity later in life. To prevent these undesirable health outcomes, the DGA Advisory Committee recommended that women achieve a healthy weight before conception. Pregnant women should engage in sound dietary practices and physical activity that will lead to gestational weight gains within the recommended guidelines and help to prevent postpartum weight retention. The new DGA also recommend breastfeeding because of its association with maternal postpartum weight loss (12).

Evidence-Based Guidelines for GDM

In addition to the DGA, current research provides more insight on the management of GDM. These guidelines include gestational weight gain, dietary interventions, and postpartum assessments.

The Institute of Medicine has instituted guidelines for appropriate gestational weight gain (Table 2). Weight gain in excess of these guidelines is associated with poor outcomes. Excessive maternal weight gain increases the risk for neonatal hypoglycemia, macrosomia, low Apgar score, seizures, and polycythemia, and may also increase the infant’s risk for obesity later in life (13).

Certain dietary interventions can help in the management of GDM. Women with GDM are encouraged to practice carbohydrate counting and/or use carbohydrate-controlled meal plans. The amount of carbohydrates consumed to allow for fetal growth and brain development should be at least 175 g (14). In addition to controlling for the amount of carbohydrates, the type and distribution also influence blood glucose levels. By decreasing processed carbohydrates and increasing fiber-rich foods, a woman can improve her glycemic control.

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Recommended weight gain (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>28-40</td>
</tr>
<tr>
<td>18.5-24.96</td>
<td>25-35</td>
</tr>
<tr>
<td>25-29.9</td>
<td>15-25</td>
</tr>
<tr>
<td>&gt;30</td>
<td>11-20</td>
</tr>
</tbody>
</table>

BMI=Body Mass Index
If a woman is obese, a 30% caloric restriction can also help improve glycemic control (14).

Women need continuous postpartum monitoring to detect signs of insulin resistance and possible onset of T2DM. Follow-up screening should be performed at 6 weeks after delivery, followed by annual screening of women with impaired fasting glucose or impaired glucose tolerance (14).

GDM Case Study: Stacy’s Story
What do registered dietitians discuss with their GDM patients? Sarah Edwards, RD, CDE, West Virginia University Hospitals Diabetes Education Center shares her visit with Stacy (name has been changed).

Stacy is 30 years old, white, 5’7” tall, weighs 257.5 lbs and was diagnosed with GDM at 26 weeks’ gestation. This is her fourth pregnancy. Although her obstetrical history included two miscarriages, this was her first time diagnosed with GDM. Her family history included both mother and maternal grandmother with T2DM. She is taking a prenatal multivitamin-mineral supplement. She was given a glucose meter upon diagnosis by her physician’s staff.

Stacy tracked her blood glucose on her own before meeting with the RD. Although the ADbA does not recommend a daily monitoring schedule, research shows that in GDM, postprandial glucose concentrations are associated with a lower incidence of complications than preprandial concentrations (15). A frequent monitoring schedule enabled the health care providers and Stacy to assess the effectiveness of her meal and physical activity plan.

The determination of calorie needs is controversial. Energy recommendations must take into account sufficient calories without causing excessive weight gain or hyperglycemia. At this time, there is no formula supported by research to determine energy needs in overweight and obese pregnant women. Stacy led a sedentary lifestyle. Her desired weight was 135 lb. In estimating Stacy’s caloric needs, the following formula was used (13):

\[
EER = 354 - (6.91 \times \text{age}) + \text{Physical Activity} \times [9.36 \times \text{wt (desired)} + 726 \times \text{Ht}] +340 \text{ for second trimester, or } +452 \text{ for third trimester}
\]

Stacy has gained 8 lb since becoming pregnant. Her weight gain goal for the pregnancy is 11 to 20 lbs (Table 2). The third trimester caloric needs were estimated at 2620 kcal. Based on her BMI, appetite, preferred food intake and physical activity, Stacy was encouraged to consume 2000 kcal/day (16). The foods sources of calories—fat, carbohydrates, and protein—were discussed in detail.

During the RD visit, Stacy’s meal plan was established. The meal plan included 240 grams carbohydrates, or 16 choices (15 g carbohydrates per choice).

- Breakfast: 30-45 g
- Morning Snack: 30 g
- Lunch: 60 g
- Afternoon snack: 15-30 g
- Dinner: 60 g
- Bedtime: 30 g

Stacy’s post-breakfast glucose readings were above the target range, suggesting probable insulin resistance in the morning. She agreed to eat 30 to 45 g of carbohydrates for breakfast, and a mid-morning snack with 30 g carbohydrates. She was encouraged to have her fruit during the afternoon, rather than in the morning. Her fasting blood glucose remained WNL. The food log did not include fruit or milk products. Discussions with Stacy focused on how best to improve her nutrient intake, such as incorporating some fruit, yogurt, cottage cheese, and milk into her meal plan. She was encouraged to avoid added sugars, to use nonnutritive sweeteners in moderation, to eat salmon twice a week as a good source of omega-3 fatty acids, and to avoid fish that may contain higher amounts of mercury.

<table>
<thead>
<tr>
<th>Glucose Measure</th>
<th>Blood Glucose (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preprandial</td>
<td>≤95</td>
</tr>
<tr>
<td>1-hour postprandial</td>
<td>≤140</td>
</tr>
<tr>
<td>2-hour postprandial</td>
<td>≤120</td>
</tr>
</tbody>
</table>

Table 4. Stacy’s Blood Glucose Log

<table>
<thead>
<tr>
<th>Glucose Measures</th>
<th>Blood Glucose (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Blood Glucose</td>
<td>WNL</td>
</tr>
<tr>
<td>2-hour post breakfast</td>
<td>89-150 (several 130s-140s)</td>
</tr>
<tr>
<td>2-hour Post-Dinner</td>
<td>94-136 (one &gt;120)</td>
</tr>
</tbody>
</table>

WNL=Within normal limits

Approximately 68% of Stacy’s results were within normal limits (WNL). Table 4 shows typical entries in Stacy’s blood glucose log after starting her meal and physical activity plan.
(e.g., shark, swordfish, king mackerel, and tilefish). The session concluded with a discussion on ways to avoid food borne illnesses, such as listeriosis. Stacy’s weight was regularly monitored and her food intake was adjusted to keep her weight gain to about 0.5 lb/week. Her pregnancy and delivery progressed without complications. She delivered a 7 lb, 9 oz boy with blood glucose WNL. The sidebar on page 8 includes tips on successful management of GDM (17).

**Conclusion**

With the increasing obesity epidemic, more cases of GDM are appearing across the nation. Current research and the 2010 DGA provide registered dietitians and diabetes educators with the information necessary to counsel women. This advice includes how to manage blood glucose levels and to make lifestyle changes, such as increasing physical activity and monitoring gestational weight gain. How well blood glucose is managed during GDM will affect the woman’s own risk for T2DM, as well as her infant’s risk of developing diabetes.

**References**

Abstract
The increased incidence of childhood obesity has led to a corresponding rise of type 2 diabetes (T2DM) in children. Although medical management of the disease is important, providers need to be aware of the psychosocial and environmental aspects that affect diabetes self-management. These include family history, beliefs about health and disease, cultural and ethnic backgrounds, and practitioners’ backgrounds. T2DM management is presently based on experience with adults; however, new studies will provide more current and age-appropriate therapy suggestions.

The number of children diagnosed with adult chronic diseases has increased. This is especially apparent among ethnic minority populations where diabetes among children is increasing and has become a major public health concern (1). The Chicago Childhood Diabetes Registry observed that an overwhelming percentage of children with T2DM were also overweight. Insulin resistance, which is often associated with obesity, was found to be the common denominator (2).

In 2001, a 5-year SEARCH for Diabetes in Youth study found that 15,000 youth had type 1 diabetes (T1DM), with another 3,700 cases of T2DM primarily in minority populations. Asian/Pacific Islanders and American Indian youth had greater risk of T2DM than T1DM, Latino and African Americans had similar cases with both types of diabetes, while white youth had a greater incidence of T1DM than T2DM. The two major findings from the SEARCH study were as follows: (1) 84% of adolescents with T2DM had a first-degree relative with diabetes, and (2) the highest percentage of T2DM cases were among African American adolescents (2).

Overweight and obesity are the major reasons for the increased number of cases of T2DM (3). The National Health and Nutrition Examination Survey (NHANES) found that 16% to 17% of children had body mass indexes (BMI) greater than or equal to the 95th percentile for age and sex. This high rate of unhealthy body weight is a public health issue and a quality of life concern for children, their families and their communities. This article will address the current treatment of a child diagnosed with T2DM as well as the psychosocial barriers a practitioner needs to consider with treatment.

Managing Children With T2DM
Because children will present with different symptoms when diagnosed with diabetes, it is important to individualize the care to each child’s needs.

Nutrition. The nutritional needs of children and teens with diabetes are the same as their peers without diabetes. Because excess body weight is a major factor for T2DM, many children with T2DM will be placed on a weight management program with a focus on general nutrition/portion size.

Exercise. Exercise is associated with a decrease in insulin resistance and is a key component in diabetes management. Family involvement will improve the child’s compliance in becoming physically active as opposed to the usual sedentary activities, such as electronic games and television programs.

Medication. Metformin and/or insulin are two medications that have been widely used in children with T2DM. Glimepiride is also approved for pediatric use but is associated with weight gain and eventual loss of beta cell function (4). However, some children may be able to control their diabetes in the early stages with a nutrition and exercise program alone, which encourages weight reduction. With subsequent weight loss, insulin resistance usually improves, which may allow a decrease or cessation of insulin therapy and/or a change to an oral medication (5).

Several studies are currently evaluating medications for children and teens with T2DM. The Type 2 Study for Children and Teenagers, which focuses on children and teens...
between 10 and 17 years of age, is being conducted to assess the use of liraglutide, a glucagon-like peptide-1 drug, for this population. The study is expected to conclude in September 2011 (6). Another program to identify and evaluate medication and behavioral therapy is the Treatment Options for T2DM in Adolescents and Youth (TODAY) study (7). With subsequent weight changes, children with T2DM, unlike those with T1DM, must be evaluated sooner for organ complications, and may need to begin lipid and hypertensive medications at the time of diagnosis.

**Self-Monitoring of Blood Glucose.**
It is suggested that blood glucose be self-monitored at certain times to determine if the medical plan is appropriate for the patient’s treatment goals. Obtaining hemoglobin A1C values will determine the child’s overall control and determine whether further monitoring is needed. When T2DM is diagnosed during youth, this potentiates a longer term exposure to hyperglycemia, which can lead to diabetic complications.

**Psychosocial and Environmental Aspects.** Although self-management tools are important, it is essential that healthcare professionals understand the psychosocial aspects of diabetes. According to Mulvaney et al (8), parenting techniques, negative environments, and observation of people living with diabetes influence diabetes management outcomes. Other areas of concern include a lack of behavioral change, a lack of motivation, and a high-risk lifestyle (8).

Another important psychosocial aspect of diabetes management is the influence of cultural beliefs and behaviors. Most children with T2DM often have a family member living with the disease. One person with diabetes may exemplify living a healthy life, while another may not adhere to any diabetes lifestyle or medication regimens and exhibit numerous long-term complications. Questionable adherence to the diabetes regimen and inadequate knowledge can affect a child’s success in living with diabetes. According to White et al (9), a family member’s lack of understanding about diabetes in general may be a deterrent to success with a child’s diabetes self-management. A qualitative interview with 18 primarily Latino and African American young adults with diabetes found that many were self-managing their diabetes at an earlier developmental stage than is recommended. At the end of this study, participants appreciated the interaction with peers who had experienced the same issues (9). Many indicated a desire to have received such support in their younger years. In another study that focused on diabetes prevention among 11- to 14-year-old Latino girls, the same message was delivered about the importance of youth peer groups (10). Good role models and positive input are important for children with diabetes.

Practitioners need to be aware of the knowledge, language and literacy level of the parents and to use appropriate resources, such as growth charts. These charts provide important guidance for the healthcare team and patients’ families. Physicians can be proactive about weight concerns, and/or impaired fasting glucose levels in children, based on information provided by the growth chart. It is not surprising that growth charts are increasingly used in pediatric offices. Unfortunately, many parents do not understand the implications of growth chart data, which warrants careful explanation and discussion between the healthcare team and parents. If not implemented correctly, this lack of education may influence a parent’s perception of their child’s weight and the resulting risk for chronic diseases (11). In some cultures, a “chubby” or “plump” child is perceived as a healthy child.

There is an abundance of patient educational tools and algorithms for the healthcare professional caring for non-minority children. However, information providing culturally specific help for minority children with weight concerns and T2DM is limited. This same limitation is found in the number of weight loss programs aimed toward the pediatric population. Refer to the sidebar on page 13 for a discussion on diabetes prevention programs for children with T2DM.

Another clinical barrier is the availability of physicians who can influence the management outcomes in many children with T2DM. Because of the shortage of pediatric endocrinologists, the pediatrician becomes an important first line of defense. Unfortunately, many pediatricians’ experience with diabetes is limited. In a study of 550 pediatricians, only 15.3% felt prepared to deal with diabetes management needs and follow-up appointments. About 62% reported referring their patients to diabetes education programs and medical nutrition therapy, but only one in nine considered an exercise program prescription (12). Early detection of children with T2DM is often difficult because of the lack of public awareness regarding the risks, the signs and symptoms, and the progression of this disease.
At the University of Chicago, one team has focused on diabetes prevention programs within the high-risk, inner-city African American community for the past 11 years.

REACH-IN!/REACH-OUT! Chicago Children’s Diabetes Prevention Program was a culturally sensitive, family-oriented nutrition and physical activity community-based intervention program that was developed to decrease obesity and the risk of T2DM. Each child enrolled in the program was required to have an adult present during the sessions. Adult and children’s group discussions were used to generate information and support goal setting. It was very rewarding to observe each family unit working together to achieve the same health goal. While the control group was led by a registered dietitian, the experimental group involved a community lay health educator who guided the group through all lessons and served as a moderator rather than an instructor. This person encouraged discussion so that all who attended felt part of the process.

During the sessions, families laughed at their past food habits, which focused around grandma’s favorite recipes, while they learned skills to make their family favorites heart-healthy. Whenever a picnic-type holiday approached, the “meat story” always surfaced, such as barbecues with four types of meat. They learned to select only one serving. Preparing mashed potatoes without that “added stick of butter” was always a great example of how to reduce calories and fat and still enjoy a family favorite.

Another important aspect to the success of the program was attendance, which benefited from phone call reminders before each class. Several parents would tell the instructors that if their child did not remind them, they probably would have forgotten to attend, although a list of dates was provided at the first class session. In one phone call conversation, a parent informed the caller that his grandfather was in the hospital. The instructor suggested that he visit the relative before coming to class. This parent needed to be reminded that the needs of their two obese children were no less important than those of the ailing grandparent, and the instructor was delighted to see the family attend the session. This parent appreciated the guidance and help with time management.

The difficult part of this study was the recruitment. Many African American families in this area of Chicago consist of single parents juggling their own school and employment schedules, as well as the needs of their children. The possibility that their child may develop T2DM was the last thought on their minds, especially if there were no overt symptoms. Being “big boned” is often culturally acceptable, so health risks associated with obesity were often not of great concern.

Another community-based study, POWER-UP, was an after-school nutrition and physical activity program led by school teachers. During the 14 weekly programs, the activities used to educate the students included a physical activity, such as dancing; preparing heart healthy recipes; or a recreational activity, such as playing a Nutrition Jeopardy game. A highlight of the program, according to the teachers and parents, was a special “Nutrition Expert” badge that was worn by each student during the class and at home. This simple item helped to promote and support the students’ self-empowerment.

Although parents were encouraged to attend discussion sessions during the children’s pick-up times, few participated. Families did complete home assignments, which addressed the weekly classroom topics. Asking the “Nutrition Experts” to bring the assignments back to the next class was a good way to keep the child involved.

After the program was completed, the staff implemented healthy changes at school and became more conscientious and positive role models. Some the changes included choosing water as a beverage, using new exercise equipment, creating an outdoor greenhouse, and conducting a series of parent wellness presentations.

Other insights shared by some of these program participants included:

- A new grandmother, who had missed many sessions, began to bring her granddaughter to class after she was diagnosed with diabetes. She also asked more purposeful questions.
- A mother stood up in front of the group at the last class session and stated, “I cannot expect my daughter to make changes if I don’t.”
- A mother, newly diagnosed with T2DM, stated that her daughter is now her role model.
- One child in the after-school program told his grandmother that water is the best choice for drinking.

These community-based studies demonstrate the need to have good role models from the community rather than relying solely on health professionals. They also support the use of convenient, familiar surroundings, with a strong child/adult participation component.
current management is guided by the protocols for treating adults with T2DM (13).

Conclusion
T2DM has increased with the rise in childhood obesity. This is most evident in minority populations. Therefore, it is important that registered dietitians (RDs) are knowledgeable about various cultural and food traditions. RDs should try to understand a patient’s values and health beliefs, and encourage open discussions among family members on health and wellness.

Summary
With the epidemic of childhood obesity and the increased incidence of T2DM in children, practitioners need to be aware of each child and his or her environment, which includes the people and health professionals who support them. A family’s knowledge and history can have a major effect on the child’s success with diabetes management. The child is not alone, but is part of the medical system and community. Because T2DM in children is a fairly new concern, one will need to develop a patient/provider relationship that engages both the child and the family to optimize outcomes.

References

CPE CREDIT ANSWER KEY
See the CPE credit self-assessment questionnaire on page 28.

1. C
2. A
3. D
4. A
5. C
6. C
7. B
8. D
9. D
10. D
11. B
12. C
13. C
Abstract
Increasing family mealtime and cooking at home is a frontline objective of the Dietary Guidelines for Americans (DGA). Parents have a tremendous influence as role models on their children’s food choices, and the environment they create at home has substantial effects on the health of their children. This review reflects the DGA, counseling tips for those who want to create a healthy food environment for their families and the importance of family meals.

Home Environment and Parent Choices
Family eating habits and the home environment influence the risk of childhood obesity (1). One cross-sectional study assessed the associations between the family food environment and a range of obesity-promoting dietary behaviors in 560 families with 5- to 6-year-old children (2). It showed that a number of aspects in the home environment were associated with circumstances related to being overweight, such as an increased index of energy intake, an increased consumption of sweet snacks and high-energy drinks, and a decreased intake of vegetables. The degree of confidence in adequacy of children’s diets expressed by the parents was directly correlated with the amount of unhealthy foods in their children’s diet. This study demonstrates the importance of enlisting parent’s cooperation or partnering with parents in the nutrition education process and assisting them into becoming role models for healthful eating (2).

The DGA encourage “all adults—parents, educators, caregivers, teachers, policy makers, health care providers, and all other adults who work with and care about children and families—to serve as role models in some capacity and to share the responsibility for helping the next generation prevent obesity by promoting healthy lifestyles at all ages” (3).

According to the United States Department of Agriculture (USDA), we all “must now take responsibility and play a leadership role in creating gradual and steady change to help current and future generations live healthy and productive lives.”

To do so, it is beneficial for nutrition educators to communicate consistent messages. The USDA has developed core nutrition messages that can be used in conjunction with the DGA to help create healthier families and prevent overweight/obesity and T2DM (4).

These messages include:
1) Role modeling is important because children learn by watching their parents and teachers.
2) Cooking and eating together, and talking with each other makes mealtime a memorable time.
3) Let children serve themselves at mealtime. Teach them to take small amounts at first. Tell them they may have more food if they are still hungry.
4) Sometimes accepting new foods takes time and repeated attempts. Give them a taste at first and be patient with them.
5) Patience works better than pressure. Offer new foods and let them choose how much to eat. Children are more likely to enjoy a food when they choose to eat it.

Parenting Choices Make a Difference: Start Early
It is essential to introduce a variety of healthy nutrient-dense foods to children at an early age to increase the likelihood of including them in their diets later in life (5). Yet many children today are eating artificially flavored fruit snacks in place of real fruit, processed and sugary cereals in school breakfast programs, and doughnuts accompanied by chocolate milk in after-school programs. Numerous epidemiologic studies have demonstrated that the healthiest Americans eat diets rich in fruits and vegetables and low in processed foods (6,7). We know that replacing high energy density foods (high calories per weight of food) with foods of lower energy density...
(lower calories per weight of food), such as fruits and vegetables, can be an important part of a weight and disease management strategy. The DGA provide suggestions for numerical goals for fat and saturated fat, but stress that the goals should be met through dietary choices made over several days, not through a single meal or type of food (3). Choosing more fresh fruits, more whole foods and fewer packaged meals can help lower saturated fat consumption. The important role of nutrition educators is to encourage parents to create a healthy home food environment by using a balanced approach to meals with more whole foods and fewer additives and unhealthful ingredients (Table 1).

Some strategies to help families create a healthy food environment include the following:

- Decide on a location for meals. Avoid eating “on the run,” in the car, or while watching television.
- Provide children with nutrient-dense, high-fiber foods at meals and snacks and healthy beverages, such as water and 100% fruit juice. Offer appropriate portion sizes but allow them to decide how much to eat.
- Purchase smaller portion sizes of treats and keep them out of sight.
- Avoid excessive food restriction, bribing or using food as a reward.
- Encourage children to eat breakfast on a daily basis to help lower their risk of becoming overweight or obese.

The way Americans eat has changed considerably over time, as reflected in selected measures of the US food retail and food service environments as regulated by the USDA (Table 2) (3). Changes in the U.S. food environment have made it extremely difficult to eat adequate amounts of fresh produce and other wholesome foods. Selected data compiled in the 2010 DGA report shown in Table 2 indicate that eating a home-cooked meal has become a thing of the past for most American families (3). To make health a priority, family mealtime must be made a priority.

### Family Meals

The family meal is an important component in creating a healthy food environment and protecting against childhood obesity in various socio-economic populations. In Japan, one study found that eating family meals was associated with a lower rate of obesity as well as developing healthy lifestyle habits including balanced meals and adequate sleep (11).

Experts believe that most children develop lifelong eating habits by age 6 years, and studies show that diet quality tends to decrease between the ages of 2 and 3 years, and again between ages 4 and 6 years (5,12). Even preschool-aged children eat more when larger portions of highly palatable foods are offered. Parenting food choices, eating habits and the family food environment help shape a child’s eating habits and food preferences. Therefore, providing the appropriate amount of nutritious foods at meal time and having healthy snacks on hand should be encouraged (13,14).

---

### Table 1. Suggestions for Food Choices (3)

<table>
<thead>
<tr>
<th>Eat More of These</th>
<th>Eat Less of These</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh, colorful fruits</td>
<td>Processed and pre-packaged foods</td>
</tr>
<tr>
<td>Fresh, colorful vegetables</td>
<td>White breads, refined pasta, &amp; crackers</td>
</tr>
<tr>
<td>Whole grain breads, pasta, &amp; crackers</td>
<td>Chips &amp; other snack foods</td>
</tr>
<tr>
<td>Beans and legumes</td>
<td>Cookies &amp; other desserts</td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td>Candy</td>
</tr>
<tr>
<td>Low-fat and non-fat dairy products</td>
<td>Trans- &amp; saturated fats</td>
</tr>
<tr>
<td>Lean meats and fish</td>
<td>Fatty red meats</td>
</tr>
<tr>
<td>Healthy oils</td>
<td>Processed meats</td>
</tr>
<tr>
<td>“No added salt” foods</td>
<td>High sodium foods</td>
</tr>
<tr>
<td>“No added sugar” foods</td>
<td>Added sugars</td>
</tr>
</tbody>
</table>

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### Encourage Parents to Choose More Produce

What can educators and families do to help prevent obesity and T2DM in children?

Scientists, physicians, and registered dietitians believe that in addition to more physical activity each day, children need diets that contain more nutrients; less fat, including saturated fat; and fewer calories. In a setting of widespread calorie-dense foods, fruits and vegetables are good choices for providing valuable nutrients at a calorie bargain. The high fiber and water contents of plant foods make them satisfying, and their relatively low calorie content makes them less conducive to weight gain than equal volumes of more calorie-dense foods (8–10).
Simply telling families to cook more meals at home is not effective. Instead, families need to be provided with basic tips on how to prepare healthy, quick meals and to get children interested in cooking early through nutrition education.

**Conclusion**

Parents influence their children’s food choices through food purchasing decisions and role modeling. In addition, the food environment that parents create at home have substantial effects on health and diabetes risks early in a child’s life. Focusing on what children are not eating as much as what they are eating is extremely important. Overweight children tend to become overweight adults, which increases their risk of developing heart disease, diabetes, hypertension, sleep apnea and stroke. Among the devastating and long-lasting effects on an overweight child are the possibilities of encountering health problems, as well as falling victim to social discrimination because of their body weight. As the 2010 DGA point out, health care providers and nutrition educators need to work in partnership with parents, children, teachers and caregivers to serve as healthy role models for children. This will help to promote healthy living, prevent overweight and obesity, thereby decreasing the incidence of insulin resistance and T2DM in children.

**References**


<table>
<thead>
<tr>
<th>Food Environment Measure</th>
<th>Time Frame</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of meals and snacks eaten at fast-food restaurants</td>
<td>1977-1995</td>
<td>200</td>
</tr>
<tr>
<td>Number of commercially prepared meals consumed per week</td>
<td>1981 - 2000</td>
<td>14</td>
</tr>
<tr>
<td>Food at home expenditures by families and individuals as a share of disposable income (% of income)</td>
<td>1970 - 2008</td>
<td>-42</td>
</tr>
<tr>
<td>Food away from home expenditures by families and individuals as a share of disposable income (% of income)</td>
<td>1970 - 2008</td>
<td>26</td>
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<tr>
<td>Total food expenditures by families and individuals as a share of disposable income (% of income)</td>
<td>1970 - 2008</td>
<td>-24</td>
</tr>
<tr>
<td>Share of daily caloric intake from food away from home</td>
<td>1977-78 to 1994-96</td>
<td>77</td>
</tr>
<tr>
<td>Average number of items carried in a supermarket</td>
<td>1978 - 2008</td>
<td>449</td>
</tr>
</tbody>
</table>
Abstract

Sedentary lifestyles are associated with premature deaths in America. Recommendations for exercise throughout the lifespan of children, adults, pregnant individuals and older adults are presented. Registered dietitians (RDs) and diabetes educators have unique opportunities to encourage a balance of nutrition and physical activity, and should collaborate with exercise specialists to help patients identify and achieve their lifestyle goals. Special exercise needs of people with diabetes are also addressed. The 2010 Dietary Guidelines for Americans refer to the evidence-based 2008 Physical Fitness Guidelines for Americans for activity recommendations. This resource is based on scientific evidence.

Introduction

“Those who think they have not time for bodily exercise will sooner or later have to find time for illness.” Edward Stanley, Earl of Derby (1826-93), British statesman, The Conduct of Life Address at Liverpool College, December 20, 1873.

It is estimated that every year approximately 191,000 preventable deaths occur in the United States which are linked to physical inactivity (1). Data from longitudinal cohort studies suggest that lack of physical activity is associated with at least a 1.5- to 2.0-fold higher risk of most chronic diseases of lifestyle such as type 2 diabetes (T2DM), coronary heart disease and hypertension (2). Regular exercise may prevent T2DM in high-risk individuals (1,2). For people with T2DM, exercise is a key component of self management. In addition to promoting healthy nutrition, RDs and diabetes educators play an important role in promoting and providing support for patients who exercise through connections with resources that will help them take action. In collaboration with other members of the healthcare team, specifically exercise specialists, patients are encouraged to adopt healthier lifestyles. This article presents current physical activity recommendations to help RDs and diabetes educators promote and improve the fitness and health of their clients.

Literature Review

Before the 1990s, intensive vigorous exercise was encouraged even though there was little evidence-based research on physical activity at that time. During the 1990s, a surge of scientific evidence on the benefits of exercise emerged. Most of the recent recommendations are based on this previous scientific evidence.

Exercise Through the Lifespan: Evidence and Recommendations

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Moscow, Idaho


A technical review for diabetes and exercise is currently being evaluated and updated.

The 2010 US Dietary Guidelines states, “Americans are encouraged to meet the 2008 physical activity guidelines for Americans. Children and adults should avoid inactivity, some physical activity is better than none, and more is better. Achieving energy balance and a healthy weight depends on both energy intake and expenditure.” (3). The 2008 Physical Activity Guidelines for Americans were the first of its kind issued by the federal government. These guidelines were based on the first major review of the scientific literature on the benefits of physical activity in more than a decade (4).

### Research studies with a physical activity component

The Diabetes Prevention Program (DPP) study was a 27-center randomized clinical trial which produced convincing evidence that people with prediabetes can prevent or delay T2DM with lifestyle changes (5). Subjects were adults with prediabetes, most of whom were overweight and had a family history of T2DM. Of the 3,200 subjects, 1,709 participated in the lifestyle arm of the study. Each participant was challenged to lose 7% to 10% of their body weight by doing 150 minutes of moderate exercise and strength training per week based on newer research as well as reducing calorie and fat intake. This quantity of exercise was selected based on public health recommendations and the Surgeon General’s Report on Physical Activity and Health at that time. During the 3-year study, each individual had frequent contact with a “lifestyle coach,” most of whom were RDs. These case managers provided support and feedback throughout the study. Sixteen sessions of training were provided. Subjects in the lifestyle arm of the study experienced a 58% reduction in the incident of diabetes. Those who lost 7% of their body weight had up to a 90% decrease in incidence indicating that weight loss was the best predictor of preventing diabetes. The Diabetes Prevention Program Outcome Study (DPPOS) was a 6-year follow-up to the DPP study, which produced similar results.

The Action for Health in Diabetes (Look AHEAD) research group conducted a 4-year evaluation of lifestyle interventions (6). In a multicenter randomized clinical trial on the incidence of major cardiovascular events, the effects of an intensive lifestyle intervention were compared with diabetes support and education. A total of 5,145 overweight and obese individuals with T2DM participated in the study. The intensive lifestyle group decreased their caloric intake using a variety of strategies and participated in physical activity for more than 175 minutes per week. The goal was to achieve and maintain a 7% decrease in body weight. The diabetes support and education intervention group had greater improvements in weight loss, improved fitness, hemoglobin A1C (A1C) levels, systolic blood pressure and increased high-density lipoprotein levels compared with the diabetes education and support groups. Low-density lipoprotein levels decreased more in the diabetes support and education intervention group because of increased use of lipid-lowering medications. Table 1 shows the 4-year results of the Look AHEAD trial. In addition to providing intensive lifestyle counseling, the study showed that increasing the intensity of exercise resulted in greater improvements in A1C levels (7). Many of these subjects are participating in the 13.5-year follow-up component of the Look AHEAD study, in which the long-term benefits of intensive lifestyle changes will be studied.

Clinical trials have provided strong evidence that resistance training is effective in lowering A1C levels in older adults with T2DM (8–10). One randomized controlled trial revealed the additive benefit of combined aerobic and resistance exercise in 251 adults from 39 to 70 years of age with T2DM. The study group participated in aerobic exercise, resistance training or both. A sedentary control group was also included. Exercise training was performed three times a week for 22 weeks and the primary outcome measure was the change in A1C value at 6 months. Study findings indicated that high intensity

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### Table 1. Four-Year Results of the Look AHEAD Trial (5)

<table>
<thead>
<tr>
<th></th>
<th>Lifestyle Intervention Group</th>
<th>Diabetes Support and Education Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss</td>
<td>-6.15%</td>
<td>-0.88%</td>
</tr>
<tr>
<td>Treadmill fitness</td>
<td>12.74%</td>
<td>1.96%</td>
</tr>
<tr>
<td>Hemoglobin A1C</td>
<td>-0.36%</td>
<td>0.09%</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>-5.33 mm Hg</td>
<td>-2.97 mm Hg</td>
</tr>
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<td>Diastolic blood pressure</td>
<td>-2.92 mm Hg</td>
<td>-2.48 mm Hg</td>
</tr>
<tr>
<td>High-density lipoprotein</td>
<td>3.67 mg/dL</td>
<td>1.97 mg/dL</td>
</tr>
<tr>
<td>Low-density lipoprotein</td>
<td>-11.27 mg/dL</td>
<td>-12.84 mg/dL</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>-25/56 mg/dL</td>
<td>19.75 mg/dL</td>
</tr>
</tbody>
</table>
progressive resistance training, along with moderate weight loss, was effective in improving A1C levels as well as muscular strength, and are feasible and effective in older patients with T2DM. A1C levels fell significantly more with resistance training and weight loss than with weight loss alone. At 3 months, A1C values fell 0.6 ± 0.7% with resistance training as compared to 0.07 ± 0.8% with weight loss alone (P < .05). At 6 months, the A1C continued to fall to 1.2 ± 1.0% vs. 0.4 ± 0.8% (P < .05) (9).

Clinical Application and Recommendations

There are many reasons to be physically active and maintain a healthy lifestyle. The Centers for Disease Control and Prevention recommends regular physical activity (sidebar). Benefits of regular exercise include improved strength and endurance for those participating in recreational activities or competitive events; better stress management and overall well-being; for maintaining or losing weight and prevention of chronic disease (11).

Table 2 summarizes the exercise risks associated with diabetes-related complications (12).

Before beginning an exercise program, patients with diabetes should be assessed for conditions that may place them at higher risk for acute emergencies or injury such as hypoglycemia unawareness or pre-existing orthopedic problems. They should also be assessed for chronic complications that may require treatment prior to beginning an exercise program such as retinopathy and nephropathy. These conditions may require modifications or specific precautionary measures.

The Centers for Disease Control and Prevention recommends regular physical activity for these reasons (11):

- Control your weight
- Reduce your risk of cardiovascular disease
- Reduce your risk for T2DM and metabolic syndrome
- Reduce your risk of some cancers
- Strengthen your bones and muscles
- Improve your mental health and mood
- Improve your ability to do daily activities and prevent falls, if you are an older adult
- Increase your chances of living longer

Adult Physical Activity Recommendations

Adults should participate in moderate-intensity aerobic activities for at least 30 minutes a day, 5 or more days per week, or in vigorous-intensity aerobic activity 20 minutes a day, 3 or more days per week. For weight management and weight loss, 60 to 90 minutes of physical activity on most days of the week is recommended (13). The 2008 Physical Activity Guidelines for Americans recommend that exercise time be prescribed in minutes per week and spread out to meet individual needs (4).

Adults should engage in strength training activities 2 to 3 days per week, with a minimum of eight to ten different exercises. Repetitions of each exercise vary depending on the desired outcomes. Between 3 and 20 repetitions, with the last repetition being difficult, is the general recommendation. One of three sets of each exercise should be performed, targeting all the major muscle groups. Proper form should be emphasized, with the same muscle groups not being targeted on consecutive days, to reduce the risk of injury (13,14).

Stretching is recommended to reduce the risk of injury and muscle soreness and to increase flexibility. Stretching should take place after a warm-up and again after the aerobic or strength training exercise and should cause the muscle to feel tight, but not painful. Holding each stretch for 15 to 30 seconds and stretching all the major muscle groups is key (13). All adults should consult their physician before starting an exercise program; especially if they have a chronic disease or other medical issues.

Children and Adolescents Physical Activity Recommendations

Children and adolescents should get at least 60 minutes a day of combined moderate- and vigorous-intensity aerobic activity (15). According to the Surgeon General’s Vision for a Healthy and Fit Nation 2010 “making physical activity fun can affect how children and teenagers respond to changes in their routine. Programmed, repetitious exercise may work for adults, but rarely for children. Look for ways to add physical activity throughout the day” (16). Shorter bouts of higher-intensity exercise, rather than exercises of prolonged duration, seem to keep younger children more engaged by being more “playlike” and better suited to
their attention spans. Parents need to set a positive example for their children, by leading a healthy, active lifestyle. Engaging children in fun physical activities will lead to their becoming more likely to carry these habits into adulthood.

Younger children work their muscle groups by climbing and performing gymnastics, but as children get older they can benefit from strength training exercises. The National Strength and Conditioning Association recommendations for adolescents and strength training are one to three sets of 6 to 15 repetitions on a variety of exercises, 2 to 3 nonconsecutive days per week. Adolescents should be supervised by a trained professional and proper warm-up and stretching is necessary (17).

It is especially important for school-aged children and adolescents with diabetes to get regular exercise. With the increased prevalence of obesity and T2DM in youth, physical education should be included in the curriculum of every school day. To maintain blood glucose levels within their target ranges during exercise, students with type 1 diabetes (T1DM) may need to adjust their insulin and food intake. Blood glucose levels will need to be monitored more often while participating in physical activity. Teachers and coaches must be able to identify symptoms and assist in the treatment of hypoglycemia. A quick-acting source of glucose and the student’s glucose meter should be available at all times. The student’s school records should include detailed instructions.

The Diabetes Research in Children Network Study Group concluded that in youth with T1DM, prolonged moderate aerobic exercise results in a consistent decrease in plasma glucose.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Recommendations</th>
<th>Risks Associated</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperglycemia (T1DM)</td>
<td>If deprived of insulin for 12-48 hours and ketones are present, avoid vigorous exercise</td>
<td>Increased hyperglycemia and ketosis</td>
<td></td>
</tr>
<tr>
<td>Hypoglycemia (people treated with insulin or insulin secretagogues)</td>
<td>If pre-exercise glucose &lt;100 mg/dL, add carbohydrate</td>
<td>Hypoglycemia</td>
<td></td>
</tr>
<tr>
<td>Retinopathy (PDR)</td>
<td>Avoid vigorous aerobic and resistance exercise</td>
<td>Vitreous hemorrhage, retinal detachment</td>
<td></td>
</tr>
<tr>
<td>Severe NPDR</td>
<td>If foot injury or open sore restrict to non–weight-bearing activities</td>
<td>Skin breakdown and infection, Charcot joint destruction</td>
<td>Moderate-intensity walking does not lead to increased risk of foot ulcers or reulceration (21)</td>
</tr>
<tr>
<td>Autonomic neuropathy</td>
<td>Prior to increasing the intensity of exercise, the patient should go through cardiac investigation; patients at high risk for cardiovascular disease (CAD) should start with short periods of low-intensity exercise and slowly increase the intensity and duration</td>
<td>Decreased cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation, impaired night vision, erratic carbohydrate delivery due to gastroparesis causing hypoglycemia</td>
<td>The AdbA consensus statement concluded that routine screening of patients at risk of CAD is not recommended (22)</td>
</tr>
<tr>
<td>Albuminuria; nephropathy</td>
<td>Likely no specific exercise restrictions for people with diabetic kidney disease</td>
<td>Increased urinary protein excretion</td>
<td>There is no evidence that vigorous exercise increases the rate of progression of diabetic kidney disease</td>
</tr>
</tbody>
</table>

ADA = American Dietetic Association; CAD = coronary artery disease; NPDR = nonproliferative diabetic retinopathy; PDR = proliferative diabetic retinopathy

Table 2. Exercise Risks Associated With Diabetes Related Complications (12)
conditions. They should consult their healthcare providers before starting an exercise regimen to determine safe activities. Supervised exercise sessions may be beneficial for individuals with medical issues (13).

**Pregnancy Physical Activity Recommendations**

Exercise can be safe for women before, during and after pregnancy. Recommendations for aerobic activity are moderate-intensity, fairly light to somewhat hard on the Borg Scale of Perceived Exertion. The exercise should be performed in durations of 30 to 40 minutes, 3 to 7 days a week. Caution should be taken to avoid becoming overheated during an activity. Avoiding vigorous-intensity exercises and long durations are also recommended. Strength training may be started or continued during pregnancy, but the intensity should be decreased to avoid the risk of the Valsalva maneuver (forcibly exhaling while keeping the mouth and nose closed). This may elevate the heart rate and blood pressure, which can be dangerous to the fetus (20). A pregnant woman should breathe naturally and never hold her breath. Table 3 lists the warning signs for pregnancy (21).

Pregnant women should discuss exercise with their healthcare provider. Women who were physically active before becoming pregnant can continue exercising, but may have to adjust their routine if it is overly vigorous. Sedentary pregnant women can benefit from a supervised exercise program. All pregnant women should avoid exercises that increase the risk of falling to prevent abdominal injury. Supine exercises should be avoided after the first trimester because of the decrease in uterine blood flow.

**Table 3. Warning Signs for Pregnancy (21)**

<table>
<thead>
<tr>
<th>Stop exercising and call the doctor if any of these symptoms are experienced during exercise:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vaginal bleeding</td>
</tr>
<tr>
<td>• Increased shortness of breath</td>
</tr>
<tr>
<td>• Headache</td>
</tr>
<tr>
<td>• Calf pain or swelling</td>
</tr>
<tr>
<td>• Decreased fetal movement</td>
</tr>
<tr>
<td>• Dizziness or feeling faint</td>
</tr>
<tr>
<td>• Chest pain</td>
</tr>
<tr>
<td>• Muscle weakness</td>
</tr>
<tr>
<td>• Uterine contractions</td>
</tr>
<tr>
<td>• Fluid leaking from the vagina</td>
</tr>
</tbody>
</table>

**Older Adult Physical Activity Recommendations (65 years of age and older)**

Older adults can benefit from aerobic and strength training exercises similar to those achieved by younger persons. The recommendations for physical activity are the same as for younger adults (19), but for older individuals who are not able to perform moderate-intensity exercises, light- to moderate-intensity exercises may be appropriate with increases in duration rather than intensity. Exercise time is cumulative, so 10 minutes here and there add up for deconditioned adults or those suffering from chronic diseases.

Many older adults have pre-existing chronic conditions, so determining the mode of exercise is very important to encourage participation without causing pain. Water exercises or riding a stationary bike may be more appropriate for people with arthritis or have artificial knees and hips, compared with walking or using an elliptical machine. Fall prevention should be emphasized with strength training and stretching exercises to improve balance. Use of appropriate equipment will limit the possibility of falls in older adults, who are at higher risk for pre-existing medical conditions.
speech, good silence and nothing too much.” Ralph Waldo Emerson

References

Help End Childhood Obesity…
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Kids Eat Right (KER), the first joint initiative of the American Dietetic Association and the ADA Foundation, is a member-driven campaign supporting the efforts of the White House and the First Lady to end the childhood obesity epidemic within a generation.

Kids Eat Right provides resources and support for members to become active volunteers in their community and to promote the quality nutrition approach to childhood obesity prevention.

Enroll as a Campaign Volunteer today. We need your expertise to reach our goals!

Visit www.kidseatright.org/volunteer.
Abstract
Many pharmacologic antihyperglycemic agents are available for the treatment of type 2 diabetes mellitus (T2DM). However, none have been approved by the Food and Drug Administration for the prevention of diabetes. This article reviews current literature on antihyperglycemic medications that may have a role in the treatment of patients with prediabetes to prevent the progression to T2DM.

Introduction
The first step in identifying pharmacologic agents that may be useful in preventing T2DM is to define those persons who are at greatest risk for developing T2DM. The second step is determining if there are modifiable risk factors that can be targeted to prevent T2DM. Prediabetes poses significant risk for not only diabetes but also cardiovascular disease; therefore, medical interventions in patients with prediabetes should be aimed at reducing direct cardiovascular risk as well as the risk of progression to T2DM.

Literature Review
Multiple risk-assessment models have been designed to predict the risk for T2DM. One study used a point system in a Chinese population and demonstrated a strong 10-year risk prediction (N = 2960, 548 achieved outcome of T2DM) (1). The underlying theme appears to be insulin resistance, which was identified by surrogate markers, such as elevated fasting glucose levels (the strongest indicator), body mass index and triglycerides (Table 1). Increased age and white blood cell count were also associated with increased risk. Because high-density lipoprotein (HDL) cholesterol is associated with reduced risk, high HDL levels scored negative points.

In T2DM, the body’s cells, both peripherally at adipocytes and myocytes, and in the liver, have reduced responsiveness to the major glucose-regulating pancreatic hormones: insulin, glucagon, and amylin. Hepatic insulin resistance allows increased glucose production and release by the liver. Despite high glucose concentrations, peripheral cells are essentially deprived of the glucose they need because their glucose uptake systems are desensitized. Even higher insulin levels than those seen in T2DM are needed for appropriate cellular glucose uptake. Meanwhile, a chronically high glucose concentration, necessary to meet the cellular needs of the body, causes microvascular and macrovascular damage. Insulin resistance often can be identified years before the diagnosis of T2DM through the diagnosis of prediabetes. Therefore, attention will be focused on drugs that improve insulin sensitivity.

Antihyperglycemic Drugs

Insulin and Insulin Secretagogues.
Insulin and insulin secretagogues (e.g., the sulfonylureas) are valuable pharmacologic therapies necessary for many patients with T2DM. These agents primarily overcome relative cellular insulin resistance by further increasing serum insulin levels (hyper-insulinemia is typically already present) to potentiate glucose uptake into peripheral cells and the liver, lowering serum glucose. These agents are often associated with significant weight gain. However, they do not appear to be helpful in preventing T2DM and no clinical trials in patients with prediabetes suggest otherwise.
Table 2. Incidence of T2DM (3)

<table>
<thead>
<tr>
<th>Intervention:</th>
<th>RRR* T2DM at 2.8 years Incidence per 100 PY (3)</th>
<th>RRR for MS at 3 years Cumulative incidence (4)</th>
<th>Total RRR in incidence of T2DM after 10 years (5) Incidence of new T2DM diagnosis per 100 PY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive lifestyle intervention †</td>
<td>58% (95% CI: 48-66%) 4.8 cases per 100 PY</td>
<td>41% (P &lt; 0.001) Incidence = 34%</td>
<td>34% (95% CI: 24-42%) 5.9 new cases per 100 PY (95% CI: 5.1-6.8)</td>
</tr>
<tr>
<td>Metformin 850 mg twice daily</td>
<td>31% (95% CI: 17-43%) 7.8 cases per 100 PY</td>
<td>17% (P = 0.03) Incidence = 45%</td>
<td>18% (95% CI: 7-28%) 4.9 new cases per 100 PY (4.2-5.7 95% CI)</td>
</tr>
<tr>
<td>Placebo</td>
<td>Control group (no RRR) 11 cases / 100 PY</td>
<td>Control group (no RRR) Incidence = 51%</td>
<td>Control Group (no RRR) 5.6 new cases per 100 PY (4.8-6.5 95% CI)</td>
</tr>
</tbody>
</table>

*CI = confidence interval; MS = Metabolic Syndrome; PY = patient years; RRR=relative risk reduction; T2DM = type 2 diabetes mellitus;
† Intensive lifestyle intervention consisted of a diet and exercise regimen designed to achieve and maintain a 7% weight loss and to accumulate 150 minutes of exercise per week.

**Metformin.** Metformin is the most promising drug with the literature showing the most potential for reducing progression from prediabetes to T2DM. Metformin functions as a hepatic insulin sensitizer and reduces hepatic glucose release. An additional benefit is that metformin is weight neutral, or may even help some patients lose weight. It often affects the lipid profile positively by decreasing triglyceride and low-density lipoprotein (LDL) cholesterol levels and may even elevate HDL.

The landmark multicenter United Kingdom Prospective Diabetes Study (2) (UKPDS) bolstered support for metformin as initial therapy for T2DM and showed that in obese patients, metformin is significantly superior to “conventional therapy” (diet alone). Whether metformin is beneficial during prediabetes was more intentionally measured in the Diabetes Prevention Program (DPP). In the initial 2.8-year period in the DPP, three interventions were compared in adults at high-risk for T2DM: (1) intensive lifestyle modification, (2) metformin (without lifestyle modification), and (3) placebo. Inclusion criteria required impaired glucose tolerance and fasting glucose concentration higher than 95 mg/dL. Results indicate that intensive lifestyle modifications and metformin each aid in the prevention of diabetes in high-risk adults. Additional analysis found both treatments superior to placebo in reducing the incidence of metabolic syndrome (Table 2) (3).

Lifestyle interventions alone were more beneficial than metformin alone for the first few years in the DPP. In the years following the initial 2.8-year period, the intensive lifestyle intervention group exhibited weight gains and a rate of occurrence of new T2DM cases (years 2.8 to 10) that was comparable to the rate seen with the placebo. Nevertheless, the first 2.8-year intensive lifestyle interventions produced the greatest relative risk reduction (RRR) over 10 years.

The highly intensive lifestyle intervention was associated with a 31% higher cost than metformin ($2,412 for metformin vs. $3,540 for lifestyle intervention over 3 years) (6). Ideally, the DPP would have been designed with a fourth group (metformin + intensive lifestyle intervention) to determine benefit beyond either intervention alone. Other studies have indicated that metformin is superior to placebo combined with lifestyle modifications to prevent T2DM (7) and has a positive impact on abdominal adiposity, serum insulin concentration and hyperlipidemia (8).

**Colesevelam.** Colesevelam is a bile acid sequestrant used for many years to lower LDL-cholesterol but has just recently been added to the antihyperglycemic drug armament. A recent physiologic study of colesevelam in rats indicated that the improved hemoglobin A1C (A1C) concentrations may occur because of the effects on glucagon-like peptide-1 (GLP-1) (9). Others have suggested a different mechanism through reduced bile acid stimulation of the farnesoid X receptor or other proteins/receptors (10).

Other recent studies suggest there may be a role for colesevelam in the prevention of diabetes, particularly in those with insulin resistance and hypercholesterolemia (11). In a study of 216 patients with untreated prediabetes who were randomized to either a colesevelam or placebo group, the colesevelam group experienced significantly improved
lubid markers (e.g., LDL cholesterol reduced 15.6%) as well as statistically significant fasting plasma glucose and A1C decreases. However, the clinical significance is debatable (-2.0 mg/dL and -0.1% with colesevelam and placebo, respectively, and much less than anticipated (>0.5% A1C reduction) when treating diabetes. A final A1C of less than 6.0% was noted in 37% of patients receiving colesevelam compared with 25% of patients receiving placebo \( (P = .05) \) and 40% of the colesevelam group experienced a normalization of fasting glucose values compared with 23% of the placebo group \( (P = .06) \).

**Thiazolidinediones.** Both of the currently available thiazolidinediones (pioglitazone and rosiglitazone) and one removed from the U.S. market because of its hepatotoxicity (troglitazone) appear effective in patients with prediabetes. Systemic pharmacodynamic effects make these drugs attractive choices for prediabetes because they target peripheral insulin sensitivity. They are also particularly useful against metabolic syndrome because of their effects on hyperglycemia and hypertension. Despite clinical efficacy, however, the use of these agents for T2DM prevention demands reconsideration. Recent analyses question the cardiovascular safety of these drugs, particularly rosiglitazone. Despite the absence of clear consensus on cardiac ischemic risk (12), the U.S. Food and Drug Administration (FDA) recently decided to restrict access to rosiglitazone.

**Alpha-Glucosidase Inhibitors.** These agents inhibit gut enzymes that cleave polysaccharides and disaccharides into monosaccharides, thereby slowing and reducing the absorption of dietary carbohydrates. These drugs may help prevent T2DM in a manner similar to commonly recommended diets in those with prediabetes (e.g., a lower carbohydrate-type diet); and may augment such diets effectively.

Five trials (\( N = 2,360 \) total participants) were analyzed which used acarbose in patients with impaired glucose tolerance or otherwise at risk for diabetes (13). The authors evaluated those studies with the least potential for bias and found that acarbose decreased occurrence of T2DM (over 3 years, number needed to treat = 10) in this population. Modest decreases in body mass index were noted (0.3 kg/m², 95% confidence interval, 0.1 to -0.5). The effect was even greater in the studies identified to have greater potential bias.

**Clinical Application**

Although no drugs are currently FDA-approved for diabetes prevention, a considerable amount of evidence indicates that metformin, acarbose, colesevelam, and/or a thiazolidinedione may prevent or delay the onset of T2DM. Although colesevelam has a modest effect, it is ideally combined with metformin for patients with prediabetes and hypercholesterolemia (4). The newer GLP-1 receptor agonists are considered to be potentially beneficial in delaying T2DM, but more data are needed. In patients with prediabetes, metformin should be considered the first-line drug treatment because of its low cost, depth and breadth of evidence, and positive impact on the lipid profile. Moreover, the American Diabetes Association (ADbA) Clinical Practice Guidelines recommend metformin as an initial drug therapy for T2DM and as an option for patients with prediabetes. Colesevelam added to metformin may be a particularly intriguing combination for patients with prediabetes or newly diagnosed diabetes with hypercholesterolemia.

It is still unclear if any of these drugs reverse metabolic abnormalities or if they merely delay the diagnosis of T2DM. Some argue that these drugs “mask” the diagnosis of diabetes by lowering glucose levels (the diagnosis of diabetes is typically based on glucose readings). This is a logical argument because even insulin and sulfonylureas, which may worsen insulin resistance, would likely delay the diagnosis of T2DM. However, the persistent and broad metabolic effects of metformin observed in the DPP and other studies suggest some degree of true disease prevention.

**Summary**

Strong evidence supports the use of metformin and other agents to prevent T2DM. In most clinical practice guidelines, the use of pharmacologic agents (metformin and thiazolidinediones) for the prevention of diabetes is rated “A.” Evidence also suggests that a comprehensive plan for the prevention of T2DM should include diet, physical activity and pharmacologic interventions.

**References**


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**Disorders of Lipid Metabolism Evidence-Based Nutrition Practice Guideline FREE to all ADA Members**

You will find nutrition recommendations within this guideline related to individuals with Disorders of Lipid Metabolism which include the following topics, among many others:

- Medical nutrition therapy and nutrition assessment, monitoring and evaluation
- Cardio Protective Diet (e.g., Omega-3 Fatty Acids, Plant Stanols and Sterols)
- Micronutrient Intervention (e.g., Antioxidant Supplements, Homocysteine, Folate, Coenzyme Q10)
- Behavior/Physical Activity

To access visit [www.eatright.org](http://www.eatright.org), sign-in and select the Evidence Analysis Library link on left. Select "Guidelines" and click on "Nutrition Guideline List".
CPE Credit Self-Assessment Questionnaire

1) The Dietary Guidelines Advisory Committee report that _____ % of energy intake comes from added sugar and solid fat:
   a. 25  
   b. 30  
   c. 35  
   d. 40

2) It is recommended that efforts to prevent childhood obesity should begin at what age?
   a. in utero or before conception  
   b. toddler or preschool age  
   c. ages 5-10  
   d. ages 11-18

3) The new Dietary Guidelines for Americans emphasizes major points of:
   a. maintaining calorie balance over time to achieve and sustain a healthy weight  
   b. adhering to a strict component of food portion sizes through regular counseling sessions  
   c. focusing on consuming nutrient dense foods and beverages  
   d. a & c  
   e. all of the above

4) Infants born to women with gestational diabetes are at an increased risk for:
   a. obesity; cardiovascular metabolic syndrome  
   b. cancer; polycystic ovaries  
   c. stroke; heart attack  
   d. a & c  
   e. all of the above

5) Women with previous gestational diabetes: test positive for impaired glucose tolerance within _____ weeks after delivery; _____ % develop T2DM within 10 years; are _____ % more likely to develop gestational diabetes again.
   a. 4-6; 40; 10-40  
   b. 6-8; 45; 20-50  
   c. 6-12; 50; 30-85  
   d. 8-20; 60; 40-90

6. According to the SEARCH study, the highest percentage of Type 2 in adolescent diabetes cases were among:
   a. Latinos  
   b. Caucasians/Whites  
   c. African Americans  
   d. Asian/Pacific Islanders

7. Effective initial management in children with T2DM include:
   a. initiation of an oral hypoglycemic agent  
   b. recognition of the importance of cultural beliefs and behaviors  
   c. a focus on calorie restriction to decrease weight  
   d. monitoring of blood glucose levels at least 2 times per day

8. Key messages and strategies provided by the Dietary Guidelines for Americans include:
   a. dietary goals should be met through choices at a single meal  
   b. pressure to move children to improve their eating habits  
   c. increased use of high energy density foods  
   d. a balanced approach to meals with an emphasis on fewer unhealthful ingredients
9. A method/strategy to improve intake and promote adherence to the Dietary Guidelines for Americans is to:
   a. tell families to cook meals at home
   b. tell parents to serve their children so the parent is in charge of the amount of food consumed
   c. focus only on what the child is eating/consuming in his/her diet
   d. stress the importance of role modeling

10. The Centers for Disease Control and Prevention recommends regular physical activity to:
    a. control weight.
    b. prevent falls.
    c. reduce risk for T2DM.
    d. all of the above

11. Adult physical activity recommendations include at least:
    a. 20 minutes a day, 5 or more days a week of vigorous intensity aerobic activity
    b. 30 minutes a day, 5 or more days a week of moderate intensity aerobic activity
    c. 60 minutes a day, 7 days a week of walking
    d. 90 minutes a day, 3 or more days a week of light activity

12. Although no medications have been approved by the Food and Drug Administration to prevent diabetes, which of the following shows strong evidence to reduce the progression of prediabetes to T2DM?
    a. insulin
    b. insulin secretagogues
    c. metformin
    d. sulfonylureas

13. Evidence suggests the best plan for prevention of T2DM mellitus should include:
    a. diet
    b. diet and physical activity
    c. diet, physical activity and pharmacologic interventions
    d. pharmacologic interventions
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