

NUTRITIONAL RECOMMENDATIONS FOR INDIVIDUALS WITH DIABETES

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INTRODUCTION

This chapter will summarize current information on nutritional recommendations for persons with diabetes for health care practitioners who treat them. The key take home message is that the 1800 calorie ADA diet is dead! The modern diet for the individual with diabetes is based on concepts from clinical research, portion control, and individualized lifestyle changes. It cannot simply be delivered by giving a patient a diet sheet in a one-size-fits-all approach. The lifestyle modification guidance and support needed requires a team effort, best led by an expert in this area; a registered dietitian (RD), or a referral to a diabetes self-management education (DSME) program that includes instruction on nutrition therapy. Dietary recommendations need to be individualized for and accepted by the given patient. It's important to note that the nutrition goals for diabetes are similar to those that healthy individuals should strive to incorporate into their lifestyle.

Leading authorities and professional organizations have concluded that proper nutrition is an important part of the foundation for the treatment of diabetes. However, appropriate nutritional treatment, implementation, and ultimate compliance with the plan remain some of the most vexing problems in diabetic management for three major reasons: First, there are some differences in the dietary structure to consider, depending on the type of diabetes. Second, a plethora of dietary information is available from many sources to the patient and healthcare provider. Nutritional science is constantly evolving, so that what may be considered true today may be outdated in the near future. Different types of diabetes require some specialized nutritional intervention; however, many of the basic dietary principles are similar for all patients with diabetes, prediabetes, metabolic syndrome or who are overweight or obese. Lastly, there is not perfect agreement among professionals as to the best nutritional therapy for individuals with diabetes, and ongoing scientific debate that spills over into the popular press may confuse patients and health care providers.

The following recommendations are consensus-based, and they emphasize practical suggestions for implementing nutritional advice for most individuals with diabetes.

Ali et al, recently reported that although there have been improvements in risk factor control and adherence to preventative practices, almost half of U.S. adults with diabetes did not meet the recommended goals for diabetes care. [1] Thus, still more needs to be done to improve overall care of patients with diabetes.

NUTRITION THERAPY RECOMMENDATIONS FOR THE MANAGEMENT OF

ADULTS WITH DIABETES BY THE AMERICAN DIABETES ASSOCIATION,

2013

GENERAL GOALS

The nutrition therapy goals for the individual with diabetes have evolved in the past few years and have become more flexible and user-friendly. These goals include the following:[2]

- To promote and support healthful eating patterns, emphasizing a variety of nutrient dense foods in appropriate portion sizes in order to improve overall health and specifically to:
- Attain individualized glycemic, blood pressure, and lipid goals. General recommended goals from the ADA for these markers are as follows:*

 - A1C <7%
 - Blood pressure,<140/80mmHg
 - LDL cholesterol ,<100 mg/dL
 - triglycerides <150 mg/dL
 - HDL cholesterol.>40 mg/dL for men
 - HDL cholesterol .>50 mg/dL for women

- Achieve and maintain body weight goals
- Delay or prevent complications of diabetes
- To address individual nutrition needs based on personal and cultural preferences, health literacy and numeracy, access to healthful food choices, willingness and ability to make behavioral changes, as well as barriers to change
- To maintain the pleasure of eating by providing positive messages about food choices while limiting food choices only when indicated by scientific evidence
- To provide the individual with diabetes with practical tools for day-to-day meal planning rather than focusing on individual macronutrients, micronutrients

*A1C, blood pressure, and cholesterol goals may need to be adjusted for the individual based on age, duration of diabetes, health history, and other present health conditions. Further recommendations

for individualization of goals can be found in the ADA Standards of Medical Care in Diabetes [3].

GOALS FOR SPECIFIC CLINICAL SITUATIONS

The goals of medical nutrition therapy (MNT) as they apply to specific clinical situations include the following: [4]

1. For individuals with type 1 diabetes, participation in an intensive flexible insulin therapy education program using the carbohydrate counting meal planning approach can result in improved glycemic control.
2. For individuals using fixed daily insulin doses, consistent carbohydrate intake with respect to time and amount can result in improved glycemic control and reduce the risk for hypoglycemia.
3. A simple diabetes meal planning approach such as portion control or healthful food choices may be better suited to individuals with type 2 diabetes identified with health and numeracy literacy concerns. This may also be an effective meal planning strategy for older adults.
4. People with diabetes should receive DSME according to national standards and DSMS when

their diabetes is diagnosed and as needed thereafter.

PUTTING GOALS INTO PRACTICE

How should these goals best be put into practice? The following guidelines will address the above goals and help put them to work for your patients. The Diabetes Control and Complications Trial (DCCT) and other studies demonstrated the added value individualized consultation with a registered dietitian familiar with diabetes treatments, along with regular follow-up, has on long-term outcomes and is highly recommended to aid in lifestyle compliance.[5]

TARGET GUIDELINES FOR MACRONUTRIENTS: THE 3 MAJOR

COMPONENTS OF DIET

Many studies have been completed to attempt to determine the optimal combination of macronutrients. It appears that overall, the best mix of carbohydrate, protein, and fat depends on the individual metabolic goals and preferences of the person with diabetes. It's most important to ensure that total calories are kept in mind for weight loss or maintenance. [6]

CARBOHYDRATES: Amount, Type, Nutritive/Non Nutritive Sweeteners, and Fiber

The primary goal in the management of diabetes is to achieve as near normal regulation of blood glucose (postprandial and fasting) as possible. The amount and possibly the type of carbohydrate in a food influence overall glucose control. The total amount of carbohydrate (CHO) consumed has the strongest influence on glycemic response. Currently there is inadequate evidence in isocaloric comparison recommending a specific amount of carbohydrates for people with diabetes.[7] The majority of persons with type 1 or type 2 diabetes in the U.S. report eating moderate amounts of carbohydrate (~45% of total energy intake). [8] Monitoring total grams of carbohydrate, whether by use of experienced based estimation or carbohydrate counting, can be useful tools in achieving good glycemic control, especially for patients with type 1 diabetes. The ADA recommends the following: [9]

- For good health, carbohydrate intake from vegetables, fruits, whole grains, legumes, and dairy products should be advised over intake from other carbohydrate sources, especially those that contain added fats, sugars, or sodium.
- Monitoring carbohydrate, whether by carbohydrate counting, or experience-based estimation remains a key strategy in achieving glycemic control.
- Substituting low-glycemic load foods for higher-glycemic load foods may modestly improve glycemic control. While substituting sucrose-containing foods for isocaloric amounts of other carbohydrates may have similar blood glucose effects, consumption should be minimized to avoid displacing nutrient dense food choices.
- People with diabetes should consume at least the amount of fiber and whole grains recommended for the general public.
- Use of nonnutritive sweeteners (NNSs) has the potential to reduce overall calorie and carbohydrate intake if substituted for caloric sweeteners without compensation by intake of additional calories from other food.

Nutritive Sweeteners

Sucrose, also known as “table sugar” is a disaccharide composed of one glucose and one fructose molecule and provides 4 kcals/gm.

Available evidence from clinical studies shows dietary sucrose has no more effect on glycemia than equivalent caloric amounts of starch. It’s important to note that excess energy intake from nutritive sweeteners or foods and beverages containing high amounts of nutritive sweeteners should be avoided, since they provide “empty” calories and can lead to weight gain. [9]

Fructose is a common naturally occurring monosaccharide found in fruits, some vegetables and honey. High fructose corn syrup is high in processed fructose and is used abundantly in processed foods as a less expensive alternative to sucrose.

- Fructose consumed as “free fructose” (i.e., naturally occurring in foods such as fruit) may result in better glycemic control compared with isocaloric intake of sucrose or starch, and free fructose is not likely to have detrimental effects on triglycerides as long as intake is not excessive (12% energy).
- People with diabetes should limit or avoid intake of sugar-sweetened beverages (SSBs) (from any caloric sweetener including high-fructose corn syrup and sucrose) to reduce risk for weight gain and worsening of cardiometabolic risk profile.

A recent meta-analysis of 18 controlled feeding trials in people with diabetes compared the impact of fructose with other sources of carbohydrate on glycemic control. The analysis found that an isocaloric exchange of fructose for carbohydrates did not significantly affect fasting glucose or insulin and reduced glycated blood proteins in these trials of less than 12 weeks duration, a potential limitation of the studies.[10] Strong evidence exists that consuming high levels of fructose-containing beverages may have particularly adverse effects on selective deposition of ectopic and visceral fat, lipid metabolism, blood pressure, and insulin sensitivity compared with glucose-sweetened beverages. [11] Thus, recommendations about the optimal amount of dietary fructose remain controversial due to potential metabolic consequences that could lead to further insulin resistance and obesity.

Non-nutritive Sweeteners

Non-nutritive sweeteners provide insignificant amounts of energy and elicit a sweet sensation without increasing blood glucose or insulin concentrations. There are currently seven non-nutritive, FDA-approved sweeteners found to be safe when consumed within FDA acceptable daily intake amounts (ADI).[12]

1. Sucralose (Splenda) is synthesized from regular sucrose, but altered such that it is not absorbed. Sucralose is 600 times sweeter than sucrose. It is heat stable and can be used in cooking. It was approved for use by the FDA in 1999
2. Saccharine (Sugar Twin, Sweet ‘N Low) is 200 to 700 times sweeter than sugar. A cancer-related warning label was removed in 2000 after the FDA determined that it was generally safe.
3. Acesulfame K (Ace K, Sunette) is 200 times sweeter than sucrose. It can be used in cooking. The bitter aftertaste of acesulfame can be greatly decreased or eliminated by combining acesulfame with another sweetener. [
4. Neotame is a derivative of the dipeptide phenylalanine and aspartic acid. It is 7,000-13,000 times sweeter than sucrose and does not have a significant effect on fasting

- glucose or insulin levels in patients with type 2 diabetes.
5. Stevia (Truvia) derived from the plant *stevia rebaudiana*, is a non-caloric, natural sweetener. Stevia has been used as a sweetener and as a medicinal herb since ancient times and appears to be well-tolerated. It has an intensely sweet taste. Five randomized controlled trials showed minimal effects on blood glucose, insulin, blood pressure or weight.
 6. Luo han guo is the most recently approved GRAS (generally recognized as safe) sweetener. It is also known as monk fruit or Swingle fruit extract. It is 150-300 times sweeter than sucrose, and may have an aftertaste at high levels.

Sugar alcohols (polyols)

Polyols are hydrogenated monosaccharides, and include such sugars as sorbitol, mannitol, erythritol, xylitol and D-tagatose as well as the hydrogenated disaccharides isomalt, maltitol, lactitol and trehalose. The polysaccharide derived hydrogenated starch hydrolysates [HSH] are also included in this category. Polyols are used as sweeteners and bulking agents, and designated GRAS by the FDA. Polyols are only partially absorbed from the small intestine, allowing for the claim of reduced energy per gram. Polyols contain, on average, 2 kcals/gm, or 1/2 the calories of other nutritive sweeteners. Studies of subjects with and without diabetes have shown that sugar alcohols cause less of a postprandial glucose response than sucrose or glucose.[12] However, polyols can cause diarrhea at ≥ 20 gms especially in children. Although a diet high in polyols could reduce overall energy intake or provide long-term improvement in glucose control in diabetes, such studies have yet to be done.

Fiber

- People with diabetes should consume at least the amount of fiber and whole grains recommended for the general public.

The definition and understanding of fiber has changed in past years. *Dietary fiber* is defined as the carbohydrate and lignin found in plants that is not digested by the stomach or absorbed in the GI tract. *Functional fiber* is the portion of fiber attributed to have beneficial physiologic effects in humans. *Total fiber* is the sum of both dietary and functional fiber. Although solubility

of fiber was thought to determine physiological effect, more recent studies suggest that other properties of fiber, such as fermentability or viscosity may be more important. [13] Intake of dietary fiber is associated with lower all-cause mortality in people with diabetes [14]. A fiber rich meal is processed more slowly, which promotes early satiety, may be less caloric, lower in fat and added sugars, which can help combat obesity and also may prevent risk of heart disease and colon cancer.[15] The Dietary Guidelines for Americans, 2010, advocates consumption of 14 g dietary fiber per 1,000 calories consumed, or an average of 25 grams for adult women and 38 grams for adult men. This recommendation is based on epidemiologic studies showing protection against cardiovascular disease.[16] The mean intake of dietary fiber in the United States in 2009-2010 ranged from only 11-19 g/day. Fiber supplements and bulk laxatives are used frequently as additional dietary fiber sources, but since few fiber supplements have been studied for physiological effectiveness, the best advice is to consume fiber from foods. [17] A recently published systematic review of the literature concluded that the consumption of whole grains was not associated with significant improvements in glycemic control in individuals with type 2 diabetes; however, it may have other benefits, such as reductions in systemic inflammation.[18]

As with the general population, individuals with diabetes should consume

at least half of all grains as whole grains. High fiber containing carbohydrate sources (>5g/serving) include legumes, whole grain breads and cereals, whole fruits and vegetables and should be included as part of the daily carbohydrate intake. The goal of 25-35 gms of daily fiber intake may be difficult to achieve for some people, as large amounts of fiber can cause negative GI effects, such as bloating and gas. If the patient is not accustomed to larger amounts of fiber in their diet, it should be added slowly.

The websites below contain links to a comprehensive table listing fiber content of foods, and a calculator to help select foods with higher fiber content to help reach daily fiber goals.

<http://fnic.nal.usda.gov/consumers/eatinghealth/fiber> [19]

<http://www.webmd.com/diet/healthtool-fiber-meter> [20]

Resistant starches and Fructans

Resistant starches are starch enclosed within intact cell walls. These include some legumes, starch granules in raw potato, retrograde amylose from plants modified to increase amylose content, or high-amylose containing foods, such as specially formulated cornstarch, which are not digested and absorbed as glucose. Resistant starches are completely fermented in the colon. [It has been proposed that resistant starches may affect postprandial glucose response, reducing hypo and hyperglycemia. However, there are no published long-term studies in subjects with diabetes to prove benefit from the use of resistant starch.[21]

Fructans are an indigestible fiber that has been suggested to have a glucose-lowering effect. Inulin is a fructan commonly added to many processed foods in the form of chicory root. Currently there are no published long-term studies in subjects with diabetes to prove glucose lowering benefit from the use of fructans [21].

Practical Tips on CHO Intake

- Include a good source of fiber containing food with every meal or snack.

- Start the day with some whole grains. Hot cereals - Old-fashioned or steel-cut oats. Cold cereals - Look for those that list whole wheat, whole oats, or other whole grain first on the ingredient list without added sugars
- Use whole grain breads for lunch or snacks. Check the label to make sure that whole wheat or another whole grain is the first ingredient listed.
- Eat less potatoes. Instead, try brown rice or less well known grains like bulgur, wheat berries, millet, or hulled barley or quinoa.
- Switch to whole grain pasta. If the whole grain products are too chewy, look for those that are made with half whole-wheat flour and half white flour.
- Include beans/legumes which are an excellent source of slowly digested carbohydrate as well as a great source of lean protein. Substitute for meat 1-2 times per week.
- Strive to include a variety of fresh fruits and vegetables in meals every day.

FAT

- Evidence is inconclusive for an ideal amount of total fat intake for people with diabetes; therefore goals should be individualized; fat quality appears to be far more important than quantity.

Due to the high risk of CVD (cardiovascular disease) in individuals diagnosed with diabetes, the goal for dietary fat intake (amount and type) for patients with diabetes is similar to that of patients with CVD but without diabetes. Recent studies have found that decreasing the amount of saturated fatty acids and trans fatty acids, the principal dietary fatty acids linked to elevating LDL cholesterol, reduces the risk of CVD.[22] The American Heart Association, and American Diabetes Association currently recommend limiting the amount of dietary saturated and trans fat intake.[23,24] Recommendations from the Institute of Medicine and the Academy of Nutrition and Dietetics for healthy individuals are that 20% to 35% of total calories should come from fat.[25,26] Currently, limited research on recommendations on percent of total calories coming from fat exists for individuals with diabetes.[27]

The 2013 Standards of Medical Care for Diabetes from the American Diabetes Association recommends that: [28]

- Saturated fat intake should be less than or equal to 7% of total calories.
- Reducing intake of trans fat lowers LDL cholesterol and increases HDL cholesterol, therefore intake of trans fat should be minimized.

The American Heart Association has developed the *Meet the Fats* campaign to help individuals learn more about healthy vs unhealthy fats. Among the campaign's top priorities is to encourage replacing high trans fat partially hydrogenated vegetable oils, animal fats and tropical oils with healthier oils and foods higher in unsaturated fats — monounsaturated and polyunsaturated.[29]

Monounsaturated Fatty Acids

- In people with type 2 diabetes, a Mediterranean-style, monounsaturated fatty acid (MUFA)-rich eating pattern may benefit glycemic control and CVD risk factors and can, therefore, be recommended as an effective alternative to a lower-fat, higher-carbohydrate eating pattern.

Monounsaturated fats (MUFA) are typically found in vegetable oils such as olive, peanut, and canola oil and remain liquid at low temperatures. Foods high in MUFA include avocado, fatty fish, and nuts and nut butters. Several large prospective observational studies have documented that diets rich in MUFA are associated with a reduced risk of CVD. Recently, the Evidence Analysis Library of the Academy of Nutrition and Dietetics discovered that a 5% energy replacement of saturated fatty acid (SFA) with MUFA improves insulin responsiveness in insulin-resistant and type 2 diabetic subjects [30,31]

Polyunsaturated Fatty Acids

Polyunsaturated fats are usually liquid at room temperature, and are found in vegetable oils such as corn oil, safflower oil, and soybean oil. There is limited evidence in people with diabetes on the positive effects of omega-6 polyunsaturated fatty acids (PUFAs). Controversy exists on the best ratio of omega-6 to omega-3 fatty acids; PUFAs and MUFAs are recommended substitutes for saturated or trans fat. [32]

Omega-3 Fatty Acids

- Evidence does not support recommending omega-3 (EPA and DHA) supplements for people with diabetes for the prevention or treatment of cardiovascular events.
- As recommended for the general public, an increase in foods containing long-chain omega-3 fatty acids (EPA and DHA) (from fatty fish) and omega-3 linolenic acid (ALA) is recommended for individuals with diabetes because of their beneficial effects on lipoproteins, prevention of heart disease, and associations with positive health outcomes in observational studies.
- The recommendation for the general public to eat fish (particularly fatty fish) at least two times (two servings) per week is also appropriate for people with diabetes.

Some types of fatty fish contain unique polyunsaturated fats called omega-3 fatty acids, one of the most studied areas in nutrition science. The consumption of 2 servings (8 ounces) per week of fish high in EPA and DHA is associated with a reduced risk of both sudden death and death from coronary artery disease in healthy adults. [33] Studies on the effect of omega-3 fatty acids (both from food and supplements) in persons with diabetes have been inconclusive.[34] In addition to providing EPA and DHA, regular fish consumption may help by replacing other foods higher in saturated and trans fats from the diet, such as fatty meats and full-fat dairy products. Preparing fish without frying or adding cream based sauces is recommended. Fish with high amounts of omega-3 include salmon, albacore tuna, mackerel, sardines, herring and rainbow trout.

Saturated Fats

- The amount of dietary saturated fat, cholesterol, and trans fat recommended for people with diabetes is the same as that recommended for the general population.

Saturated fats are usually solid or almost solid at room temperature. All animal fats, such as those in meat, poultry, and dairy products, are saturated. Processed and fast foods contain high amounts of saturated fats. Vegetable oils also can be saturated, and include palm, palm

kernel and coconut oils.

Few research studies have been undertaken to look at the difference between the amount of SFA in the diet and glycemic control and CVD risk in people with diabetes. The ADA nutrition position paper recommends people with diabetes follow the guidelines for the general population. The Dietary Guidelines for Americans, 2010 recommends consuming less than 10% of calories from SFAs to reduce CVD risk.[34]

In general, saturated fats are discouraged because they increase LDL-cholesterol and total cholesterol concentrations. Diets high in saturated fats have been implicated in an increased risk of cardiovascular disease. Three randomized controlled trials found that diets containing $\geq 7\%$ SFA and ≥ 200 mg/day cholesterol reduced LDL cholesterol level from 9% to 12% compared to baseline values or to a more standard Western-type diet. [35] Therefore, people with diabetes should strive to limit saturated fat intake to between 7-10% of total calories.

Trans Fats

Trans fatty acids (TFA) are also called hydrogenated fats, which are fats created when oils are "partially hydrogenated". The process of hydrogenation changes the chemical structure of unsaturated fats by adding hydrogen atoms, or "saturating" the fat. Hydrogenation converts liquid oil into stick margarine or shortening. Manufacturers use hydrogenation to increase product stability and shelf-life. Thus, a larger quantity can be produced at one time, saving manufacturing costs. Research studies show that synthetic TFA can increase LDL cholesterol and lower HDL cholesterol. With the mandatory TFA labeling in 2006, a big push has been made by food manufacturers to remove it from processed and baked goods. Although the TFA content in foods has decreased recently (through food reformulation), it is important to monitor the type of fat used to replace TFA, as it might be saturated fat. Also, the FDA recently determined that trans fats are no longer considered generally recognized as safe (GRAS)[36]

Table 1. DIETARY FATS

Type of Fat	Main Source
Monounsaturated	Canola, peanut, and olive oils; avocados; nuts such as almonds, hazelnuts, and pecans; and seeds such as pumpkin and sesame seeds.
Polyunsaturated	Sunflower, corn, soybean, and flaxseed oils, and also in foods such as walnuts, flax seeds, and fish.
Saturated	Whole milk, butter, cheese, and ice cream; red meat; chocolate; coconuts, coconut milk, and coconut oil
Trans	Some margarines; vegetable shortening; partially hydrogenated vegetable oil; deep-fried foods; many fast foods; some commercial baked goods (check labels)

Stanols and Sterols

- Individuals with diabetes and dyslipidemia may be able to modestly reduce total and LDL cholesterol by consuming 1.6–3 g/day of plant stanols or sterols typically found in enriched foods

Plant sterols are naturally occurring cholesterol derivatives from vegetable oils, nuts, corn, woods and beans. Hydrogenation of sterols produces stanols. The generic term to describe both sterols, stanols and their esters is phytosterols. An important role of phytosterols is their ability to block absorption of dietary and biliary cholesterol from the gastrointestinal tract. The LDL lowering property of both sterols and stanols is considered equivalent in short term studies.[36] The amounts of sterols and stanol esters found naturally in a normal diet are insufficient to have a therapeutic effect. Thus, many manufacturers add them to various foods for their LDL cholesterol lowering effects. You can find added phytosterols in margarine spreads, juices, yogurts, cereals, and even granola bars.

A recent meta-analysis reviewing well controlled studies found that the short-term use of food supplements high in plant sterols is a safe and effective strategy to help maximize the benefits of dietary and lifestyle treatment, either with or without statin therapy, among the majority of dyslipidemic patients with a need for further lipid-lowering. Products that contain plant sterols can help reduce LDL cholesterol by more than 10 percent. The amount of daily plant sterols needed for results is at least 2 grams — which equals about two 8-ounce (237-milliliter) servings of plant sterol-fortified orange juice a day. [36] The evidence on long term use and in people with diabetes is less substantiated, as not many studies have been completed.[37,38] The EAL from the Academy of Nutrition and Dietetics advocates use of plant sterol/stanol esters in amounts of 2 g/day, which equates to approximately 2 tablespoons/day as part of a cardioprotective diet.[39] The taste of these fortified margarines is comparable to regular margarine, but they cost 3-4 times more than regular spreads. It is also important to keep in mind that these fortified foods should be used as a substitute for regular foods, not as an additive, as more is not better and will provide extra calories which can lead to weight gain.

Practical Tips on Fat Intake

- Try to eliminate trans fats from partially hydrogenated oils. Check food labels for trans fats; limit fried fast foods.
- Limit intake of saturated fats by cutting back on processed and fast foods, red meat and full-fat dairy foods. Try replacing red meat with beans, nuts, skinless poultry, and fish whenever possible, and switching from whole milk and other full-fat dairy foods to lower fat or preferably non-fat versions.

- In place of butter or margarine, use liquid vegetable oils rich in polyunsaturated and monounsaturated fats in cooking and at the table.
- Eat one or more good sources of omega-3 fats every day—fish, walnuts, canola or soybean oil, ground flax seeds or flaxseed oil

PROTEIN

The 2013 ADA Nutrition therapy recommendations for adults with diabetes position statement states the following: [40]

- For individuals with diabetes and no evidence of diabetic kidney disease, evidence is inconclusive to recommend an ideal amount of protein intake for optimizing glycemic control or improving one or more CVD risk measures; therefore, goals should be individualized. For people with diabetes and diabetic kidney disease (either micro- or macroalbuminuria), reducing the amount of dietary protein below usual intake is not recommended because it does not alter glycemic measures, cardiovascular risk measures, or the course of GFR decline.
- In individuals with type 2 diabetes, ingested protein can increase insulin response without increasing plasma glucose concentrations. Therefore, carbohydrate sources high in protein should not be used to treat or prevent hypoglycemia.

The statement above regarding not reducing dietary protein intake in patients with varying stages of nephropathy is a change from previous recommendations. This is based on several RCTs and two recent meta-analyses that have not shown improvements in renal parameters with restriction of dietary protein. The ADA Standard of Medical Care in Diabetes-2013 states that dietary protein restriction might be considered particularly in patients whose nephropathy seems to be progressing despite optimal glucose and blood pressure control and use of ACE inhibitor and/or ARBs [41]. The National Kidney Foundation recommends 0.8 g protein/ kg body weight for people with diabetes and stages 1–4 chronic kidney disease as a means of reducing albuminuria and stabilizing kidney function .The Joslin Diabetes Center, advocates a protein intake of 20–30% of total energy intake or not less than 1.2 g / kg ideal body weight for individuals with type 2 diabetes. This is in line with the average American intake of 1-1.5 g/kg/day of protein. [42]

There is no strong evidence to suggest benefit from plant protein over animal protein, however high biologic value sources of protein such as meat, poultry, fish, milk products, eggs and soy, which contain all 9 essential amino acids should be emphasized, to make up 50-75% of protein consumed. [43]

Further research is still needed to define the optimal macronutrient content for fat (SFA, TFA, UFA), protein, and carbohydrate to attain the most beneficial lipid and lipoprotein profile in the general population and in patients with diabetes at increased risk for CVD.

TARGET GUIDELINES FOR MICRONUTRIENTS

- There is no clear evidence of benefit from vitamin or mineral supplementation in people with diabetes who do not have underlying deficiencies.
- Routine supplementation with antioxidants, such as vitamins E and C and carotene, is not advised because of lack of evidence of efficacy and concern related to

long-term safety.

- There is insufficient evidence to support the routine use of micronutrients such as chromium, magnesium, and vitamin D to improve glycemic control in people with diabetes.
- It is recommended that individualized meal planning should include optimization of food choices to meet recommended dietary allowance (RDA)/dietary reference intake (DRI) for all micronutrients.

In patients with diabetes who have no underlying deficiencies, there is no clear evidence of benefit from vitamin or mineral supplements. People with diabetes should be aware of the necessity for meeting vitamin and mineral needs from natural food sources through intake of a balanced diet. . Specific populations, such as the elderly, pregnant or lactating women, strict vegetarians or vegans, and patients on calorie-restricted diets may benefit from a multivitamin mineral supplement [44], although excessive doses of certain vitamin or mineral supplements when there is no deficiency has been shown to be of no benefit and may even be harmful.

VITAMINS

Since diabetes is a state of increased oxidative stress, interest in recommending large doses of antioxidant vitamins has been high. Current studies demonstrate no benefit of carotene and Vitamin E in respect to improved glycemic control or treatment of complications. Routinely supplementing the diet with antioxidant supplements is not recommended due to lack of evidence showing benefit in large, placebo-controlled clinical trials and concerns regarding potential long-term safety. [44]

Vitamin D

Vitamin D supplementation has also garnered recent interest due to some positive findings from observational studies. However, data pooled from vitamin D intervention trials is conflicting and lack conclusive evidence in support of routine vitamin D supplementation related to changes in diabetes risk or measures of glucose homeostasis. [44,45]

MINERALS

Sodium

- The recommendation for the general population to reduce sodium to less than 2,300 mg/day is also appropriate for people with diabetes.
- For individuals with both diabetes and hypertension, further reduction in sodium intake should be individualized

Since few studies have been undertaken on sodium restriction in people with diabetes, the 2013 ADA nutrition therapy guidelines recommendation is to follow the guidelines for sodium intake for the general population. In hypertensive, salt-sensitive individuals, reduced sodium intake to 1500 mg can lower blood pressure. Food manufacturers and restaurants will need to

provide additional reduced sodium alternatives to help accomplish this goal [46] According to the 2013 ADA standards of medical care, the sodium intake recommendation is <1500 mg per day, which will be difficult for many patients to accomplish. It will require not adding salt to foods during cooking or at the table, as well as avoidance of consumption of most pre-prepared and pre-packaged foods. [47] Some recent evidence in people with type 1 and type 2 diabetes measuring urine sodium excretion has actually shown increased mortality associated with very low sodium intakes, potentially requiring caution for universal sodium restriction to 1,500 mg in the diabetes population without hypertension.[48] The 2013 standards also list other lifestyle modifications, including loss of excess body weight; increasing consumption of fruits and vegetables (8 –10 servings/day), and low-fat dairy products (2–3 servings/day); avoiding excessive alcohol consumption (no more than 2 servings/day in men and no more than 1 serving/day in women); and increasing activity levels. These nonpharmacological strategies may also positively affect glycemia and lipid control. [49]. The DASH (Dietary Approaches to Stop Hypertension) diet, which is high in fruit and vegetables, low-fat dairy products, and low in saturated and total fat; has been shown in large, randomized, controlled trials to significantly reduce blood pressure. [50] The DASH diet was rated best overall and best diet for diabetes in a recent report published in US News and World Report. The report was based on scores of 35 diets rated by nutrition and diet, diabetes and cardiac experts.[51]

Magnesium

Studies in support of magnesium supplementation to improve glycemic control are unclear and complicated by differences in study designs as well as base line characteristics. [52] There is some evidence that higher dietary intake of magnesium may help prevent type 2 diabetes in both men and women at higher risk for developing the disease. [53] Additional long term studies are needed. Dietary sources of magnesium include nuts, whole grains, and green leafy vegetables.

Chromium

Several studies have demonstrated a potential role for chromium supplementation in the management of insulin resistance and type 2 diabetes,. According to the ADA position statement, the findings with more significant effects were mainly found in poorer quality studies, limiting transferability of the results. Routine supplementation of chromium is therefore currently not recommended for treating diabetes or obesity. [54].

CINNAMON AND HERBAL SUPPLEMENTS

There has been interest in the past several years on the effect of cinnamon in individuals with diabetes. The most recent ADA position statement concludes that after a review of the evidence, there is not enough clear data to substantiate recommending the use of cinnamon. The paper goes on to say that the use of any herbal supplements, which are not regulated and vary in content, may provide more risk than benefit, in that herbs may interact with other medications that are taken to control diabetes.[54]

ALCOHOL

- If adults with diabetes choose to drink alcohol, they should be advised to do so in moderation

(one drink per day or less for adult women and two drinks per day or less for adult men).

- Alcohol consumption may place people with diabetes at increased risk for delayed hypoglycemia, especially if taking insulin or insulin secretagogues. Education and awareness regarding the recognition and management of delayed hypoglycemia is warranted.

The ADA position paper states that moderate alcohol consumption has minimal detrimental short or long term effects on blood glucose in people with diabetes, with some epidemiologic data showing improved glycemic control with moderate intake. Moderate intake may also contribute to cardiovascular risk reduction and mortality benefits in people with diabetes, no matter the type of alcohol. Thus, the recommendations for alcohol consumption for people with diabetes are the same as for the general population [54]

Alcohol intake greater than in moderation can lead to hypoglycemia through several mechanisms, including the inability of alcohol to be converted into glucose, the inhibitory effect of alcohol on gluconeogenesis, and its interference in normal counter regulatory hormonal responses to impending hypoglycemia. However, one drink for women and two drinks for men per day can usually be incorporated into the diet for patients with type 1 diabetes with no major effect on blood glucose. One drink is defined as 12 oz beer, 5 oz wine or 1.5 oz of hard liquor. To decrease the risk of hypoglycemia, it is best to have the alcohol with food. Consuming alcohol in a fasting state may contribute to hypoglycemia in patients with type 1 diabetes. Symptoms of hypoglycemia can be similar to drunkenness, so advise others that the person has diabetes so proper treatment for hypoglycemia can be undertaken. When calculating the need for meal related boluses of insulin, one should account for the carbohydrate content of the alcohol if drinking sweet wines, liqueurs, or drinks made with regular juice or soda. Selecting dry wine, light beer or hard liquor made with noncaloric mixers is preferable.[55]

PUTTING IT ALL TOGETHER- FOR TYPE 1 PATIENTS AND PATIENTS ON

INSULIN

CARBOHYDRATE COUNTING

Both the amount and type of carbohydrate (CHO) in food can influence blood glucose levels. Monitoring carbohydrate, whether by carbohydrate counting, exchanges or experienced-based estimation, remain an important strategy used in improving glycemic control. [54] CHO counting is based on the concept that each serving of CHO equals approximately 15 gms of CHO. The average person needs about 3 to 4 choices (45-60 gms) of CHO at each meal. This number could vary more or less depending on calorie needs (i.e., pregnant/nursing, ill, etc.), medication, and activity. Carbohydrate counting is routinely taught to motivated patients with diabetes, so that they can more easily estimate the amount (grams) of CHO in a particular food. Furthermore, setting CHO counting goals for each meal allows the patient to more easily match their CHO intake to the appropriate mealtime insulin dose. Potential advantages of CHO counting include improved glucose control, flexibility in food choices, and simplification of meal planning. Disadvantages include weight gain, unhealthy eating, hypoglycemia and high lipid levels. There are no evidence-based studies showing superiority over other dietary management methods, and CHO counting requires motivation on the patient's part.[56]

A good online resource for basic carbohydrate counting can be found on the UCSF website:

<http://dtc.ucsf.edu/living-with-diabetes/diet-and-nutrition/understanding-carbohydrates/counting-carbohydrates/>[57]

GLYCEMIC INDEX (GI) AND LOAD (GL)

- Substituting low-glycemic load foods for higher-glycemic load foods may modestly improve glycemic control

The use of the glycemic index (a scale that ranks carbohydrate rich foods by how much they raise blood glucose levels) has been developed to identify and classify over 600 foods and their blood glucose raising potential. It has been demonstrated that high fiber, low GI foods can help delay the absorption of glucose into the bloodstream, consequently helping to control blood glucose levels. As a general rule, refined grain products and potatoes have a higher GI, legumes and whole grains have a moderate GI, and non-starchy fruits and vegetables have a low GI. Many factors can influence the GI of a food, such as methods of cooking, physical state of a food, and how much fat and protein are consumed in conjunction with that food. [58] The ADA states use of the glycemic index and glycemic load may provide a modest additional benefit

for glycemic control over that observed when total carbohydrate is considered alone. The reasoning behind a less than robust recommendation is that the literature on GI and GL in individuals with diabetes is complex, and it is often difficult to separate the independent effect of fiber compared with that of the GI on glycemic control and other outcomes. Other organizations more highly advocate its use, including the Diabetes and Nutrition Study Group (DNSG) of the European Association and the [Diabetes UK Nutrition Working Group [59] It is important that persons with diabetes who want to use the GI to better manage their glucose control are taught how specific foods and meals affect their own blood glucose levels, rather than adhering only to the existing GI. For example, a patient could compare a low GI food, such as oatmeal (GI = 50) with cornflakes (GI = 84) to determine the relative effect of each on their own blood glucose.

The basic technique for following low GI guidelines is simply a "this for that" approach – i.e.: replacing high GI foods with low GI foods. One need not count numbers or do any sort of mental arithmetic to make sure they are eating a healthy, low GI diet. Some tips include:

- Increasing the consumption of whole grains, nuts, legumes, fruit, and non-starchy vegetables
- Decreasing the consumption of starchy high-glycemic index foods like potatoes, white rice, and white bread
- Decreasing the consumption of sugary foods like cookies, cakes, candy, and soft-drinks

GLYCEMIC LOAD

The glycemic load (GL) combines the GI and the total CHO content of an average serving of a food. It is defined as the GI multiplied by the amount of carbohydrate per serving of food in grams and dividing the total by 100 It was introduced as a measure of the overall effect of a food on blood glucose and insulin levels. The GL is a more accurate indicator of the relative response to carbohydrate, as it attempts to incorporate both the quality and quantity of CHO consumed. [60]

A 2011 review article on GI and GL in the diabetes diet by Marsh, et al concludes that both the amount and type of carbohydrate are important in predicting glycemic response to a meal. Diets based on low GI carbohydrate containing foods have been associated with a reduced risk of type 2 and CVD, and intervention studies have shown improvements in insulin sensitivity and A1C in those with diabetes. Low GI diets may also assist with weight management through effects on satiety and fuel partitioning. Since no demonstrated negative effects of a low GI diet have been demonstrated, the GI can be an important consideration in the dietary management of diabetes. [61]

SPECIAL CONSIDERATIONS FOR PATIENTS TREATED WITH INTENSIVE INSULIN REGIMENS

The following guidelines are the starting point for the nutritional component of patients on intensified insulin management regimens, usually patients with type 1 diabetes, regardless of what meal plan approach is chosen: [62]

1. The initial diabetes meal plan should be based on the patient's normal intake with respect to calories, food choices, and times meals eaten.
2. Choose an insulin regimen that is compatible with the patient's normal pattern of meals, sleep and physical activity.
3. Synchronize insulin with meal times based on the action time of the insulin(s) used.
4. Monitor blood glucose levels and adjust the insulin doses as needed for usual intake.
5. Monitor A1C, weight, lipids, blood pressure, and other clinical parameters, modifying the initial meal plan as necessary to meet goals
6. It is also important for the patient to be consistent with what is eaten and when from day to day

With type 2 diabetes, the emphasis may need to be on making lifestyle changes to rectify metabolic abnormalities and meet weight loss goals to reduce the risk of chronic complications, especially CVD.

CHILDREN AND ADOLESCENTS

While medical nutrition therapy provided by registered dietitians resulted in better glycemic control in children with newly diagnosed type 1 diabetes, a survey of 45 pediatric clinics revealed that only 25 clinics had a pediatric dietitian available for children with diabetes. [63] The goals of children and adolescents with diabetes include the following:

1. Provide appropriate energy and nutrient intake to ensure optimal growth and development
2. Promote healthy lifestyle habits while preserving social, cultural and physiological well being
3. Achieve and maintaining the best possible glycemic control
4. Achieve and maintaining appropriate body weight and promoting regular exercise

Dietary advice should start gradually:

1. Emphasis should initially be on establishing supportive rapport with the family with simple instructions. More detailed guidelines should be administered later by the entire team, with focus on consistency in message and should include dietary guidelines to avoid hypoglycemia. Nutritional advice needs to be given to all caregivers; teachers, babysitters, extended family, etc.
2. Nutrition guidelines should be based on dietary history of the family and child's meal pattern and habits prior to the diagnosis of diabetes.
3. Activity/exercise schedules need to be assessed, along with 24 hour recall and 3 day food diary to determine energy intake. Growth patterns and weight gain need to be assessed every 3-6 months and recommended dietary advice adjusted accordingly. [63]

Dietary recommendations can be illustrated by use of the Choose My Plate method, which replaced the My Pyramid on the USDA website.

Half the plate should consist of fruits and vegetables, while the other half is divided between whole grains and lean sources of protein. The dairy is represented by a glass of nonfat or 1% milk or other nonfat or low fat dairy source. The general guidelines for macronutrients are similar to that of the adult diabetic population. [64]



Figure 1. Choosemyplate.gov

Video and print materials for patient use can be found on the website

SPECIAL CONSIDERATIONS

Prevention of hypoglycemia

Hypoglycemia usually occurs in patients taking insulin, but can occur in patients taking oral antihyperglycemic agents, especially a sulfonylurea. To help prevent hypoglycemia, the

following guidelines should be followed: [65]

1. Do not omit, delay or significantly change the amount of meals or snacks without changing the insulin dose or timing.
2. Adjust insulin dose and food intake when changing the amount of physical activity. Increasing the amount or duration of exercise can significantly decrease blood glucose. As a result, the insulin dose may need to be reduced by 1/3 or more, depending on person's insulin sensitivity.
3. Understand onset, peak, and duration of the insulin being used and the effect of increasing or decreasing the insulin dose.
4. Self-monitor blood glucose daily, both preprandial and postprandial. Occasional bedtime and middle of the night BGs can also be helpful in management.
5. Eat a meal or snack with alcohol, if you choose to drink. Drinking alcohol on an empty stomach can cause hypoglycemia.
6. Record your low glucose reactions. This can help you and your health care team see the patterns contributing to hypoglycemia and find ways to prevent them.
7. Carry some form of diabetes identification so that in an emergency others will know that you have diabetes. Use a medical identification necklace or bracelet and wallet card.
- 8.

Sick Day Management

Eating and drinking can be a challenge when the person with diabetes is sick. The main rules for sick day management are:

1. Continue to take diabetes medication (insulin or oral agent)
2. Self-monitor blood glucose
3. Test urine ketones
4. Eat the usual amount of carbohydrate, divided into smaller meals and snacks if necessary; Try to take the normal number of calories by eating easy-on-the-stomach foods like regular (non-diet) gelatin, crackers, soups and applesauce. –(if glucose is 250 mg/dL or >, all of the usual amount of carbohydrate may not be necessary)
5. If even these mild foods are too hard to eat, drink liquids that contain carbohydrates. Aim for 50 grams of carbohydrate every three to four hours. This may include regular (not diet) soft drinks. Other high-carbohydrate liquids and almost-liquids are juice, frozen juice bars, sherbet, pudding, creamed soups and fruit-flavored yogurt. Broth is also a good choice
6. Drink non caloric, caffeine free fluids frequently. Call the diabetes care team

A list of sick foods, including sugar containing items, such as soft drinks and gelatin, should be provided. See more at:

<http://www.diabetes.org/living-with-diabetes/treatment-and-care/whos-on-your-health-care-team/when-youre-sick.html#sthash.R7LdQQ5y.dpuf> [66]

Exercise

Exercise for individuals with diabetes has many benefits; for most, benefits outweigh risks. Although exercise has not been shown to improve glycemic control in type 1 diabetes, patients should be encouraged to exercise to improve cardiovascular and overall fitness, weight control, and for improved psychological well-being and quality of life.[67]

There are several factors that can affect the blood glucose response to exercise:[68]

- Type, amount and intensity of exercise
- Timing and type of the previous meal
- Timing and type of the insulin injection or oral diabetes agent
- Pre-exercise blood glucose level
- Person's fitness level

In individuals with type 1 diabetes, blood glucose monitoring is necessary to adjust insulin dosing and carbohydrate intake to reduce hypoglycemia during exercise. To reduce the risk of hypoglycemia, when exercise is planned, it may be preferable to adjust the dose of insulin before the exercise begins. On the other hand, if the exercise is unplanned, a carbohydrate supplement should be taken before the exercise begins. If the blood glucose is less than 100mg/dL a 15- to 30-g carbohydrate snack should be consumed, and glucose should be rechecked in 30 to 60 minutes. If glucose levels are less than 70 mg/dL, exercise should be postponed. Depending on the blood glucose level at the start of exercise, as well as length and intensity of the activity, a snack may need to be consumed before, during and after the exercise. Moderate intensity exercise can increase glucose uptake significantly, which may call for an additional 15 gms of carbohydrate for every 30-60 minutes of exercise above the normal routine.[68]

To better help with weight management, and avoid hypoglycemia, exercise should be scheduled post-meals when blood glucose levels are high. If this is not possible, it may be necessary to decrease medication dose to facilitate exercise without increasing caloric intake. [69]

Exercise can increase the rate of absorption of insulin into exercising limbs, especially when it is started immediately after the insulin injection. Inject insulin into a non-exercising area, such as the abdomen, to minimize the effect of exercise on insulin absorption. The response to exercise varies greatly in every individual, so adjustment in medication and food should be based on individual responses. Blood glucose monitoring is very important in understanding response patterns and tailoring an exercise program.[69]

Timing of Insulin and Meals

The greatest risk for hypoglycemia results when the peak insulin action does not coincide with the peak postprandial glucose. For example, the longer duration of action of regular insulin may lead to increased risk of late postprandial hypoglycemia, compared with rapid-acting insulin analogs, which peak closer to meal consumption. In addition, when the premeal insulin dose is too large for a particular meal relative to its CHO content, hypoglycemia can result. Such a mismatch may occur due to errors in estimating CHO or food intake in patients on

multiple daily injections (MDI) or on insulin pumps. Insulin calculations can be based on exchanges, carbohydrate counting, or predefined, set menus. If meals and the insulin regimen remain constant, then no problems will usually result. However, any changes in insulin or food intake require adjustment of one or the other, or both. Whatever regimen is employed, it must be individualized to the patient. Patients taking rapid-acting insulin may choose to give their insulin dose after the meal, if unsure of amount of food to be consumed. This approach can be especially helpful in children, nausea related to pregnancy, or other illness. If a smaller than normal meal is eaten, guidelines are available for reducing the insulin dose, or carbohydrate replacement in the form of fruit or fruit juice can be given, depending on the patient's particular insulin regimen. [70]

Hypoglycemia Treatment Guidelines

Hypoglycemia is defined as abnormally low blood glucose level ≤ 70 mg/dL. Symptoms include anxiety, irritability, light-headedness and shakiness. Advanced symptoms include headache, blurred vision, lack of coordination, confusion, anger and numbness in the mouth.

Hypoglycemia must be treated immediately with glucose. Follow the 15/15 rule: take 15 gms of simple carbohydrate which should increase blood glucose by 30-45 mg/dL within 15 minutes. When blood glucose dips below 70 mg/dL, patients should be advised to have one of the following "quick fix" foods right away to raise the glucose:

1. 3 or 4 glucose tablets
2. 1/2 cup (4 ounces) of any fruit juice
3. 1/2 cup (4 ounces) of a regular (not diet) soft drink
4. 8-10 pieces of hard candy (such as Lifesavers)
5. 2 Tbsp raisins
6. 1 cup nonfat milk

High-fat foods will delay peak of glucose levels from carbohydrate intake and should be avoided (e.g., treatment of hypoglycemia with chocolate bars)

After 15 minutes, blood glucose should be checked again to make sure that it is increasing. If it is still too low, another serving is advised. Repeat these steps until blood glucose is at least 70 mg/dL. Then, a snack should be consumed if it will be an hour or more before the next meal. [71]

Patients who take insulin or an oral antidiabetic drug that can cause hypoglycemia, such as a sulfonylurea, should be advised to always carry one of the quick-fix foods with them, when driving and also available nearby when sleeping. Wearing a medical ID bracelet or necklace is also a good idea, as well as having a glucagon emergency kit handy.

PUTTING IT ALL TOGETHER - TYPE 2 PATIENTS: EAT TO TREAT THE DYSMETABOLIC SYNDROME

Driven by the explosive increase in the prevalence of obesity, the number of patients with known diagnosis of type 2 diabetes has reached massive proportions in the U.S. and worldwide. The number of persons worldwide with diabetes has more than tripled since 1980. According to the 2014 National Diabetes Statistics report, diabetes affects 29.1 million people of all ages or 9.3 % of the U.S. population. This includes 21 million diagnosed, and an undiagnosed population of 8.1 million people. 90 to 95% of these people have type 2 diabetes. Another estimated 86 million people, that's 1 out of every 3 Americans 20 years of age and older have prediabetes. [72]

A lack of physical activity and an overabundance of readily available convenience foods (usually containing too many calories) can lead to obesity and in many cases the metabolic, or insulin-resistance syndrome. Insulin resistance increases the chance of developing type 2 diabetes and heart disease. [73] But adults are not alone in this problem, as there is also an increased rate of the diagnosis of type 2 diabetes in young people. Until 15 years ago, type 2 diabetes accounted for less than 3% of all cases of new-onset diabetes in adolescents, whereas now it has increased to over 45% of cases. [74] Obesity and insulin resistance are key factors, but not the only variables, that can increase the risk of developing type 2 diabetes.

In a study by Van Dam, et al, the Western dietary pattern (high in processed meat, red meat, French fries, refined grains, high-fat dairy products, and sweets), was associated with a 59% greater risk of diabetes in adult men, while a more “whole food” diet, deemphasizing processed foods (high in fruits and vegetables, whole grains, fish, and poultry) was associated with a 16% lower risk of diabetes in adult men. For men who ate a Western diet, the risk for diabetes was even greater if they were also obese or had a low level of physical activity. While these results do not prove that eating a Western diet causes type 2 diabetes, they certainly add to existing evidence that eating these types of food increases the risk for developing type 2 diabetes, and that being overweight and lack of exercise increases the risk even further. [75]

Other widely publicized studies, the Finland Diabetes Prevention Study [76,77] and the one and two year community implementation results of the Diabetes Prevention Program [78,79,80], confirmed the importance of exercise and nutrition therapy as a preventative measure for development of type 2 diabetes and primary treatment after the initial diagnosis of type 2 diabetes is made.

WHAT WEIGHT LOSS PLAN IS BEST? KEYS TO SUCCESS

While the general principles discussed in the first section apply to all patients with diabetes, those patients with type 2 diabetes who are overweight or obese (BMI 25.0 and greater) should have the major focus placed on weight loss and increased physical activity. With so many weight loss “diets” available, confusion abounds. Even the scientific literature is inconclusive. Most patients are looking for the quickest and easiest way to lose weight, and most have unrealistic expectations. Obesity does not occur overnight, and its treatment requires lifetime adjustments to food (energy) intake and energy expenditure (increased activity). As much as one would like to find the magic bullet that leads to quick and sustained

weight loss, the fact remains that there does not appear as yet to be a balance of macronutrients that consistently leads to the loss **and** maintenance of body weight, other than a reduction of total calories consumed. A study published in *Diabetologia* reported that a diet of only 600 calories a day for eight weeks may have helped reverse type 2 diabetes in newly diagnosed patients. According to the study, the diet helped reduce hepatic and pancreatic lipid levels, which normalized insulin production and blood glucose levels. However, more studies are needed to determine whether the results will be permanent, [81] and maintaining a 600 calorie diet long term is very unrealistic. In Roy Taylor's 2012 Banting Lecture, the twin cycle hypothesis concept was introduced, which postulates that chronic calorie excess leads to accumulation of liver fat with eventual spill over into the pancreas. He believes that type 2 diabetes is a reversible condition of intra-organ fat excess to which some people are more susceptible than others. This hypothesis is supported by both bariatric surgery and hypocaloric diet evidence demonstrating reversibility of type 2 diabetes. [82]

A recent two-year head-to-head trial comparing four weight loss diets with differing macronutrient content concluded that all four reduced calorie diets, regardless of macronutrient content, led to comparable modest weight loss with weight regain over time. [83] Another 12 month trial of 259 diabetic participants compared a low carbohydrate Mediterranean diet, a traditional Mediterranean diet and a 2003 ADA diet demonstrated greater weight loss, improved glycemic control and improved HDL levels [84] Although more comparative research is needed, a prudent recommendation for losing weight or maintaining a healthy weight is to be aware of the amount of food eaten in relation to the amount of calories expended in a day. Keeping a food and activity journal can help keep track and aware. A moderate intake of fats, with an emphasis on healthful unsaturated fats, and complex carbohydrates fits in line with a weight-loss or weight-maintaining diet. The most important variable in selecting a weight loss plan is the ability of the patient to follow it and maintain weight loss in the long run.

The cause of the obesity epidemic is likely complicated, but attributed to people consuming more energy than they burn, and the excess energy is stored as fat. The old adage generally remains true: "to lose weight 'calories in' must be less than 'calories out'. In other words, for weight loss to occur there must be a daily caloric deficit. It has been long held that one pound of fat is roughly equal to 3,500 kcal. Thus, a modest decrease in caloric balance (500-600 kcals/day) should result in a slow but progressive weight loss of 1-2 lbs/week. Experts are currently rethinking the 3500 calorie rule, which may be more complicated, as it ignores physiologic adaptations to changing body weight that lead to changes in both the resting metabolic rate as well as the actual energy cost of physical activity. In a recent report by Hall et al published in the *Lancet* recently, a mathematical modeling approach was used to estimate energy expenditure adaptations during weight loss. Using this model, the rule for an overweight adult is that every change in energy intake of 100 kJ per day, (or 10 kcal/day per pound of weight change), will equate to a weight change of about 1 kg. Body weight response to a change in energy intake may be very slow, with about half of the weight change achieved in approximately one year and most of the weight change occurring in about 3 years. [84]

Weight loss is a major challenge for most patients who, in our fast-paced environment, don't eat properly and fail to establish patterns of regular physical activity. The key to success is having a patient with diabetes commit to establishing a healthy lifestyle they can live with that emphasizes and incorporates more healthy food choices on most days and a daily exercise routine, taking into account the presence of possible complications. Developing an individualized weight loss program, preferably guided by a registered dietitian familiar with

diabetes management, along with regular follow-ups, will help promote and maintain weight loss. Initial physical activity recommendations should be moderate, gradually increasing the duration and frequency to 30-45 min of moderate aerobic activity 3-5 days/week. It is always important that a patient check with their physician before starting an exercise program.

The individualized approach to dieting shows powerful proof through the National Weight Control Registry, a prospective study of successful long-term dieters established in 1994. To be included, members must have maintained a 30-pound weight loss for at least a year. Tracking over 10,000 members, the Registry is now the largest collection to date of long-term weight-loss data. Most participants report keys to success are continuing to maintain a low calorie, low fat diet and doing high levels of activity. Other common themes to losing weight and keeping it off, according to data from the registry, include: [85]

1. 78% eat breakfast every day.
2. 75% weigh themselves at least once a week.
3. 62% watch less than 10 hours of TV per week.
4. 90% exercise, on average, about 1 hour per day.

CHILDREN AND ADOLESCENTS

Type 2 diabetes is becoming increasingly prevalent among young people who are driven, as is the case in adults, by lifestyle factors and food choices leading to increased body weight. The diabetogenic process may begin as early as fetal life, with maternal type 2 diabetes, abnormal birth weight and poor nutrition combining with sedentary lifestyle and dietary factors to produce an insulin-resistant phenotype that may accelerate the development of renal pathology and cardiovascular disease. [86] It is important for children and adolescents to be physically active as well as following healthy eating guidelines to promote normal growth patterns, without exceeding recommended weight ranges for age and/or height.

MEAL PLANNING APPROACHES

There is no one “diet” for diabetes. There are however, many meal planning guidelines available for patients with diabetes. A meal plan should not be thought of as a diet, but more of an individualized guideline for more healthful eating. Listed in the chart below are some of the basic guideline and more in-depth approaches. A brief explanation of the approaches, along with the resource list to obtain additional information, is included in this section.

BASIC NUTRITION AND GUIDELINE APPROACHES

Guideline approaches are less in-depth and complex, but they can offer the foundation for basic nutrition information. In some cases, guidelines alone may be enough to change eating behaviors in some patients with diabetes. Guideline approaches focus on making healthy food choices without weighing or measuring foods, using exchanges, or counting calories, fat or carbohydrate. Regardless of whether they are used alone, or in combination with a specific meal plan, guidelines are a good choice for beginning education about nutrition. Recognize that, due to education level, lack of motivation, etc. it may not be appropriate to move some

patients beyond this initial stage.

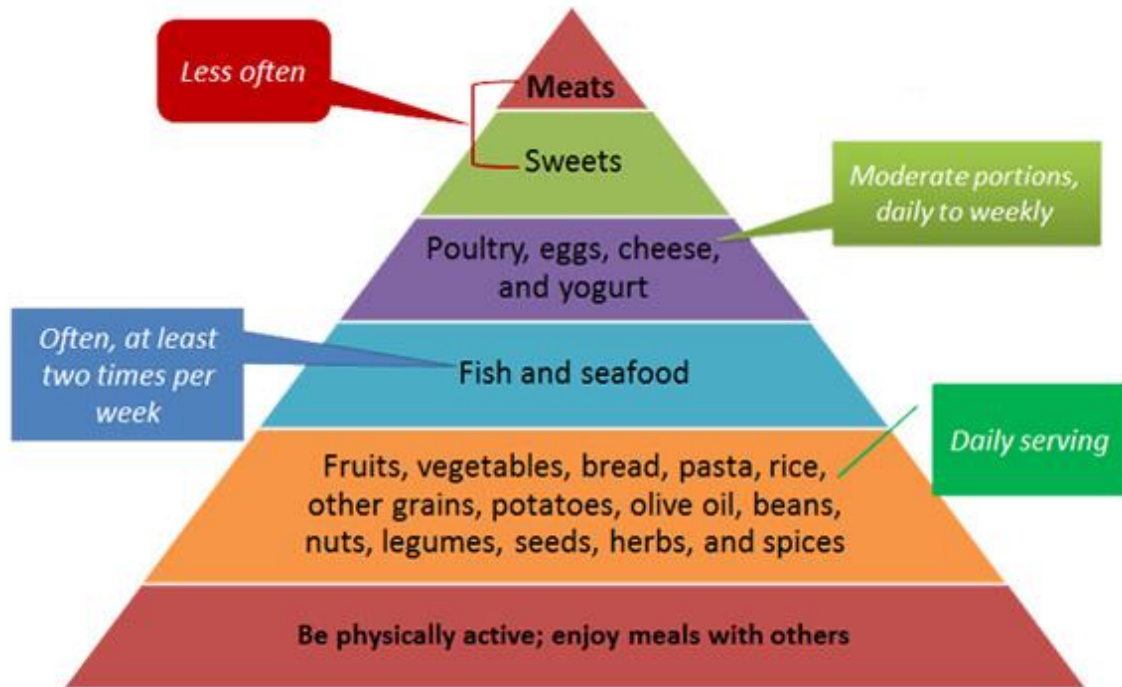
Choose My Plate replaces the retired Food pyramid, and contains general, simple guidelines for healthy eating using a small plate to visually illustrate foods and portion control. An explanation and picture of the guide is listed earlier in this chapter under section E, Children and Adolescents.[87]

Print materials and patient videos from the USDA are available at www.choosemyplate.gov.

Mediterranean Meal Plan The Mediterranean-style eating pattern derived from the Mediterranean region of the world has been observed to improve glycemic control and cardiovascular disease risk factors The Mediterranean eating pattern includes: [88,89,90]

- Vegetables, fruits, nuts, seeds, legumes, potatoes, whole grains, breads, herbs, spices, fish, seafood and extra virgin olive oil. Emphasis is placed on use of minimally processed foods, seasonal fresh and locally grown foods
 - Olive oil is the primary fat, replacing other fats and oils (including butter and margarine)
 - Total fat ranging from 25% to 35% of total energy, with saturated fat no more than 7% of calories
 - Low-to-moderate amounts of cheese and yogurt
 - Twice-weekly consumption of fish and poultry; approximately seven eggs/week
 - Fresh fruit as daily dessert; sweets only a few times/week
 - Red meat a few times/month (limited to 12 oz to 16 oz per month)
 - Regular physical activity to promote a healthy weight, fitness and well-being
 - Moderate consumption of wine, normally with meals; approximately two glasses/day for men and one glass/day for women

Figure 2



For more information see Authoritynutrition Mediterranean Diet Plan; Mediterranean Diet Pyramid from Oldways, and Mediterranean Diet Pyramid and the Healthy Eating Plate from Harvard University School of Public Health

What Do I Eat Now? is a book primarily used for the initial stage of type 2 diabetes meal planning. It includes an overview of diabetes nutritional management within the framework of basic eating guidelines. Other resources may be added to this tool, as appropriate, to move the patient toward more in-depth management. [91]

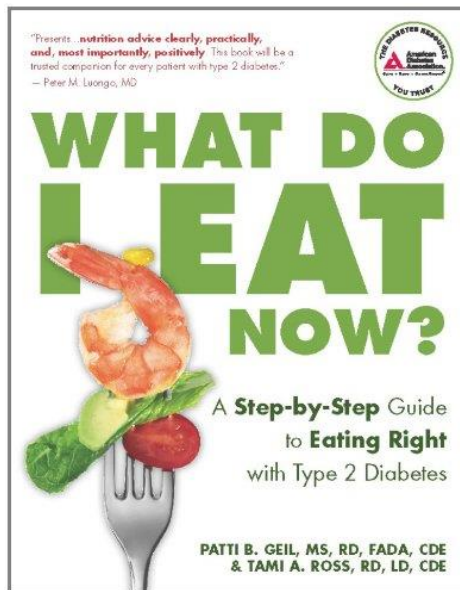


Figure 3

Nutrition PlaceMat for Diabetes

is a sturdy, heavily laminated, 11" by 17" place mat that can be easily used over and over to apply the meal plan.

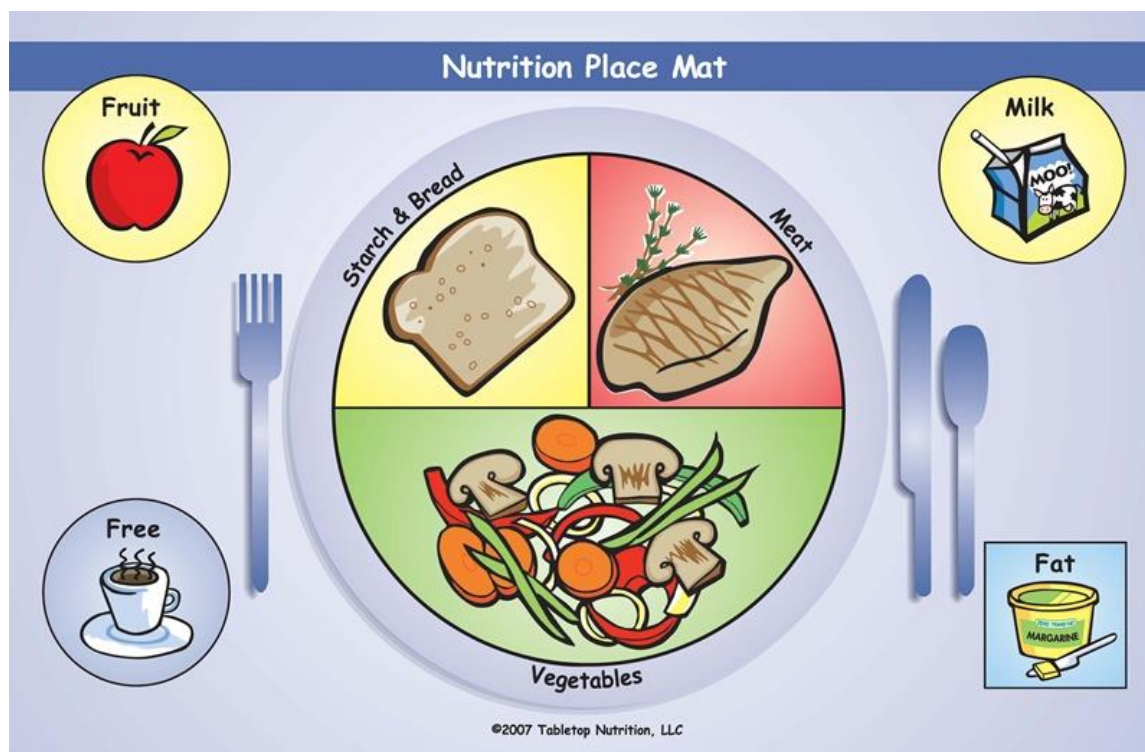
Figure 4.

Food List for Diabetes								How to use the Nutrition Place Mat
Starch & Bread	Fruit	Milk	More Carbs	Vegetables	Meat	Fat	Free Foods	
<ul style="list-style-type: none"> • Bagel, 4 oz, 1/4 • Beans, dry, cooked, 1/2 cup • Bread, 1 slice • Cereal, cooked, 1/2 cup • Cereal, unseasoned, 3/4 cup • Corn, 1/2 cup • Crackers, snack, 4-5 • English muffin, 1/2 • Hamburger or Hot Dog Bun, 1/2 • Pancakes, 4" across, 1/4" thick, 1 • Pasta, cooked, 1/3 cup • Peas, cooked, 1/2 cup • Pita, 6" across, 1/2 • Popcorn, plain, unbuttered, 3 cups • Potato, 1/2 medium • Potato, mashed, 1/2 cup • Rice, cooked, 1/3 cup • Squash, winter, cooked, 1 cup • Tortilla or taco shell, 6" across, 1 • Waffle, 1 small square <p>1 serving contains approximately C=18, P=3, F=2, and averages 80 calories.</p>	<ul style="list-style-type: none"> • Apple, 1 small • Apricots, 4 whole • Banana, 1 small • Blackberries/Blueberries, 3/4 cup • Canned fruit in juice or water, 1/2 cup • Dried fruit, 1/4 cup • Fruit juice, 1/3 to 1/2 cup • Grapefruit, 1/2 large • Grapes, 1/2 small • Kiwi, 1 • Mango, 1/2 small • Melon, 1 cup cubes • Nectarine, 1 small • Orange, 1 small • Peach, medium, fresh, 1 • Pear, large, fresh, 1/2 • Pineapple, fresh, 3/4 cup • Raisins, 2 Tbsp. • Raspberries, 1 cup • Plums, 2 small • Strawberries, 1-1/4 cup, whole • Tangerines, 2 small <p>1 serving contains approximately C=15, P=4, F=2, and averages 80 calories.</p>	<ul style="list-style-type: none"> • Buttermilk, 1 cup • Evaporated skim, 1/2 cup • Goat's milk, 1 cup • Kefir, 1 cup • Low fat or non fat, 1 cup • Soy milk, 1 cup • Nonfat, dry, 1/3 cup • Yogurt, low fat, artificially sweetened, 3/4 cup <p>1 serving contains approximately C=12, P=8, F=3 (for 1% milk) and averages 100 calories.</p>	<ul style="list-style-type: none"> • Cake, no icing, 2" square, 1 piece • Casserole or hot dish, 1/2 cup • Chili, 1/2 cup • Cookies, 2 small • Cupcake, frosted, 1/2 • Doughnut, glazed, 1/2 medium • Yogurt, plain, sugar-free, fat-free, 3/4 cup • Fruit juice bar, 1 • Ginger snaps, 3 • Ice cream, 1/2 cup • Maple syrup, honey, or table sugar, 1 Tbsp. • Muffin, large 1/5 • Nonfat frozen yogurt, 1/2 cup • Pizza, 12" thin crust, 1/8 • Potato chips, 9 to 13 • Pudding, sugar-free, 1/2 cup • Soup, broth, milk, or bean based, 1 cup • Spaghetti or pasta sauce, canned, 1/2 cup • Tortilla chips, 9 to 13 • Vanilla wafers, 5 <p>1 serving contains approximately C=11 with variable amounts P, F, and calories, depending on food choice.</p>	<p>One serving is 1/2 cup cooked or 1 cup raw *</p> <ul style="list-style-type: none"> • Asparagus • Beans • Broccoli • Cabbage • Carrots • Cauliflower • Celery • Green Beans • Greens (collard, kale, mustard, spinach) • Mixed vegetables, (without corn, peas or pasta) • Mushrooms • Onions • Pea pods • Peppers • Salad greens (lettuce, spinach) • Tomatoes • Tomato juice • Tompils • Zucchini <p>* If you eat at one meal 1 cup or more or one vegetable 1-1/2 cup of cooked vegetables or more then count the carbohydrate amount as 1 Carbohydrate Choice.</p> <p>1 serving contains approximately C=3, P=2, F=1, and averages 25 calories.</p>	<p>MEAT</p> <ul style="list-style-type: none"> • Beef, 1 oz. • Chicken, no skin, 1 oz. • Fish, 1 oz. • Ham, 1 oz. • Lamb, 1 oz. • Pork, 1 oz. • Seafood, 1 oz. • Veal, 1 oz. <p>MEAT SUBSTITUTES</p> <ul style="list-style-type: none"> • Cottage cheese, 1/4 cup • Cheese, 1 oz. • Egg, 1 • Egg substitute, plain, 1/4 cup • Egg whites, 2 • Peanut butter, 2 Tbsp • Salmon, water packed, 1/4 cup • Tempeh, 1 oz • Tofu, 1/2 cup • Tuna, 1 oz <p>1 serving contains approximately C=4, P=2, F=2, 30 for lean or medium fat meats, and averages 15 calories.</p>	<ul style="list-style-type: none"> • Avocado, med., 2 Tbsp • Bacon, 1 slice (20 sl/b) • Butter, stick, 1 tap • Cream cheese, regular, 1 Tbsp. • Cream cheese, low fat, 1-1/2 Tbsp • Cream, half & half, 2 Tbsp. • Margarine, regular, 1 tap. • Margarine, reduced-fat, 1 Tbsp. • Mayonnaise, regular, 1 Tbsp. • Oil, 1 tsp. • Peanut, 10 nuts • Peanut butter, 2 Tbsp. • Salad dressing, regular, 1 Tbsp. • Salad dressing, reduced fat, 2 Tbsp. • Sour cream, regular, 2 Tbsp. • Sour cream, reduced-fat, 3 Tbsp <p>1 serving contains approximately C=1, P=0, F=1, and averages 60 calories.</p>	<p>UNLIMITED USE</p> <ul style="list-style-type: none"> • Bouillon & broth • Club soda • Coffee or tea • Sugar-free soft drink • Gelatin dessert, sugar free • Homestead • Lemon Juice • Mustard • Nonstick cooking spray • Popsicles, sugar free • Spices • Sugar substitutes • Tabasco sauce • Tonic water, sugar free • Vinegar <p>LIMIT 3, and spread intake throughout day!</p> <ul style="list-style-type: none"> • Candy, hard, sugar-free, 1 candy • Cocoa powder, unsweetened, 1 Tbsp. • Gelatin, 1 Tbsp. • Cream cheese, fat free, 1 Tbsp. • Dill pickle, med., 1-1/2 • Jam or jelly, low sugar or light, 1 to 2 tsp. • Mayonnaise, fat-free, 1 Tbsp. • Salt, 1/4 cup • Sour cream, fat-free, 1 Tbsp. • Soy sauce, 1 Tbsp • Syrup, sugar-free, 2 Tbsp. • Taco sauce, 1 Tbsp • Yogurt, 2 Tbsp <p>Depending on food choice, there will be variable amount of C, P, & F in these food choices. Most contain negligible calories.</p>	<ol style="list-style-type: none"> 1. Develop an individualized meal plan with your Registered Dietitian, Nurse, Physician or Health Educator. 2. Write your meal plan targets in the space below the food pictures. 3. For your upcoming meal or snack, circle the food item on the list that you will eat. To stay on your meal plan, eat only the total number of items allowed. 4. When your meal is completed, simply wipe off the laminated Nutrition Place Mat with a tissue! 5. Use the Nutrition Place Mat to help follow healthy nutrition guidelines and portion control. The food pictures will help you visualize well-balanced meals! <p>Food Information Source: USDA Nutrient Database for Standard Ref., Release 19.</p>

One side of the Diabetes Place Mat lists food choices and individual portion sizes for each food category of the meal plan. This list replaces easily misplaced or damaged paper lists, which are often given to patients with diabetes.

When planning the meal, a wipe-off marker is used to write down the number of servings for each food category, as indicated on the plan. Then circle or tally the food choices in each category to track progress toward the plan's targets. Carbohydrate categories - starch and bread, fruit, milk and other carbohydrates - which affect blood sugar and which can be exchanged for each other, are color coded in yellow for easy identification and proper selection. Other food categories - vegetables, meat, fat and free foods - are individually color-coded.

Figure 5



The other side of the Diabetes Place Mat illustrates the "Plate Method" of managing a diet for proper nutrition and control of blood sugar and weight. It shows the proportions of each food category that are appropriate for a healthy, balanced diet.

The food groups shown on the top half of the Plate Method side are carbohydrates, which affect blood sugar the most - fruit, milk, and starch & bread. These are colored in yellow to distinguish them from the other food groups that don't significantly affect blood sugar (meat, vegetables, fat and free foods). The food categories are shown in proportion to how much of each might be eaten in a healthy, balanced diet.

The plate method is a great plan for patients who have poor math or reading skills, or are non-English speaking.[92]

CREATE YOUR PLATE: MEAL PLANNING TOOL KIT

Portion control tools to make meal planning for patients easier.



THE DASH EATING PLAN

Dietary Approaches to Stop Hypertension (DASH) is a flexible and balanced eating plan that is based on research studies sponsored by the National Heart, Lung, and Blood Institute (NHLBI). These studies showed that DASH lowers high blood pressure and improves levels of blood lipids which reduces the risk of developing cardiovascular disease.[93]The DASH plan was rated #1 by the US World News Report of all healthy dietary plans for 2015. U.S. News evaluated and ranked 35 popular diet plans with input from a panel of health experts. To be top-rated, a diet had to be relatively easy to follow, nutritious, safe, effective for weight loss and protective against diabetes and heart disease. The government-endorsed Dietary Approaches to Stop Hypertension (DASH) snagged the top spot.[94]

. The DASH eating plan:

- Emphasizes vegetables, fruits, and fat-free or low-fat dairy products
- Is low in saturated and trans fats
- Includes whole grains, fish, poultry, beans, seeds, nuts, and vegetable oils
- Is high in potassium, calcium, magnesium, fiber and protein
- Limits sodium, sweets, sugary beverages, and red meats
- Is lower in sodium than the typical American diet. Contains 2,300 mg of sodium per day which has been shown to lower blood pressure. Further lowering to 1,500 mg/day can further reduce blood pressure

For more information go to www.nhlbi.nih.gov/health/health-topics/topics/dash/followdash (DASH Eating Plan)

IN-DEPTH APPROACHES

These approaches are more in-depth for individuals who are motivated to follow a more

structured, focused meal plan.

Individualized Menus provided by a RD or RDN

Many patients like to have examples to follow when setting up meal plans. The menu describes in writing what foods and what quantities should be consumed over a period of days. A dietitian creates an individualized menu based on the nutritional counseling plan chosen and incorporates the patient's unique preferences, schedule, etc. The patient then has written examples to follow, and will learn how to create independently their own menus over time.

Month of Meals

These menus were created by committees of the Council on Nutritional Science and Metabolism of the American Diabetes Association, and staff of the American Diabetes Association National Service Center in response to frequent requests for menus from persons with diabetes and their families. The menus are designed to follow the exchange groups and provide 45-50% of calories from CHO, 20% protein and about 30% fat. The menus provide 1200 or 1800 calories, and instructions are provided on how to adjust caloric levels upward or downward. Each menu provides 28 days of breakfast, lunch, dinner and snacks with a different focus to help make planning meals easier.[95]

Exchange List Approach

The Exchange Lists for Meal Planning were developed by the American Diabetes Association and the American Dietetic Association (now the Academy of Nutrition and Dietetics), and have been in existence since 1950. It's now in its seventh edition as *Choose Your Foods: Food Lists for Diabetes*. A dedicated group of dietitians volunteered and revised the booklet to reflect current eating patterns and grocery store items. The concept is that foods are grouped according to similar nutritional value, and can be exchanged or substituted in the portion size listed within the same group. In 1995, the exchange lists were revised from 6 food groups to 3. They include

- Carbohydrate group – includes starches, fruit, milk and vegetable
- Meat and Meat Substitutes group – four meat categories based on the amount of fat they contain.
- Fat group – contains three categories of fats based on the major source of fat contained: saturated, polyunsaturated or monounsaturated.

The exchange lists also give information on fiber and sodium content. They can be utilized for patients with type 1 or 2 diabetes. The emphasis with type 1 patients is on consistency of timing and amount of food eaten, while with type 2 patients, the focus is on controlling the caloric values of food consumed.[96]

Basic Carbohydrate Counting

Basic carbohydrate counting was discussed in Section V; A.

Advanced Carbohydrate Counting

Although carbohydrate counting has been used seemingly effectively for many patients with type 1 diabetes, very few clinical trials have been undertaken to report actual outcomes. The results of the first randomized CT designed to test the effects of CHO counting in adult patients with type 1 diabetes treated with continuous subcutaneous insulin infusion (CSII) recently concluded improved Diabetes-Specific Quality-of-Life Scale score related to diet restrictions and was also associated with a modest, although significant, decrease in BMI and waist circumference. When patients who did not continuously use carbohydrate counting or CSII during the study were excluded from the analyses, carbohydrate counting was also associated with a significant reduction in A1C without an increase in hypoglycemic events. [97] A more recent published meta-analysis on effects of advanced CHO counting revealed a trend toward reduction in A1C, but not significant evidence to definitively determine the effects on glycemic control, weight, psychosocial measures, or hypoglycemic events.[98]

For those patients managed by insulin and at a more advanced level, the focus is to finely tune food intake, medication and activity based on patterns from daily food intake and blood glucose records.

Record keeping is an important first part of advanced carbohydrate counting. The meal time, amount and type of food eaten, estimates of CHO intake for each food item containing CHO, and total amount of CHO for each meal and snack must be recorded. Also, insulin dose, physical activity and blood glucose levels must be accurately documented for several weeks. Any unusual circumstances should be noted such as illness, stress, menstrual cycle, etc.

Ratio and correction factor calculation is another aspect of advanced CHO counting. The insulin-to-CHO ratio relays to the person with diabetes how much rapid or short-acting insulin is needed to metabolize the CHO that is consumed at a meal or snack. It allows greater flexibility in lifestyle and can improve glucose control.

To calculate the I:C (insulin to carbohydrate) ratio, divide the number of grams of CHO eaten at the meal by the units of prandial insulin. For example, if a person with diabetes takes 5 units of prandial insulin and ate 75 gms CHO, the I:C ratio is 75 divided by 5, which is 15. One unit of insulin is needed per 15 gms of CHO, assuming that the person's blood glucose is within target range. If not, an additional correction factor will be necessary. [99]

An "average" I:C ratio can be 1 unit of insulin for every 10 to 15 grams of CHO for an adult or 1 unit for every 20 to 30 grams of carbohydrate for a school-age child.

A correction factor is used to correct a high or low blood glucose level before a meal. The correction factor is added or subtracted to the prandial bolus insulin dose. For example, a factor of 1800 is used for rapid-acting insulin, and 1500 for regular insulin. Thus, if a person uses 60 units of total daily insulin and rapid insulin before meals, the correction factor would be 30 (1800 divided by 60). This means that 1 additional unit of insulin will lower blood glucose by approximately 30 mg/dL. Thus, if the pre-meal blood glucose is 169, and the target glucose is 130 or less, 1 extra unit of insulin should be given with the meal (169-130 = 39).]

The diabetes management team can help establish personal I:C ratios, specific amount of CHO in grams that are consumed, and appropriate correction factors.

Calorie Counting and Fat Counting

These are meal planning methods that can be useful for people with type 2 diabetes who want to lose weight. Knowledge regarding the amount of total calories and fat grams in a given food (including pre-prepared and fast foods) and becoming adept at label reading, can help promote weight loss when incorporated into other lifestyle changes. One of the first studies designed to determine empirically if people can learn a calorie counting system and if estimated food intake improves with training demonstrated that use of the Health Management Resources Calorie System tool (HMRe, Boston, MA, USA) helped to teach people how to estimate food intake more accurately.[95]

Table 2. RESOURCES FOR DIABETES NUTRITION EDUCATION

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CHOOSE MY PLATE (2015)

www.choosemyplate.gov

EAT OUT, EAT WELL

Hope S. Warshaw, MMSc, RD, CDE 2015

Your go-to resource for assembling healthy meals in just about any type of restaurant, from fast food to upscale dining and ethnic cuisines.

Order from: The American Diabetes Assn.,

www.shopdiabetes.org

1-800-232-6455

What Can I Eat? The Diabetes Guide to Healthy Food Choices 2014

A 28 page guide for planning meals and making the best food choices. Includes carb counting, glycemic index, plate method, eating out, meals/snack ideas, best food choices and more

Order from: The American Diabetes Assn., Inc. www.shopdiabetes.org
1-800-232-6455)

Eating Healthy with Diabetes, 4th Edition

Picture cues for portion sizes and color codes for food types teach how to put together a healthy diet plan to manage diabetes

Order from: The Academy of Nutrition and Dietetics. www.eatright.org
OR the American Diabetes Assn., Inc. www.shopdiabetes.org.

Diabetes Meal Planning Made Easy & Healthy Portions Meal Measure

Meet your health and nutrition goals with healthy diabetes meal plans, shopping strategies and our handy portion control guide.

Order from: The American Diabetes Association

<http://store.diabetes.org>

800-232-6455

DIABETES PLACE MAT KIT FOR PEOPLE WITH DIABETES

Order from: NCES Health & Nutrition Information Catalog

877.623.7266

http://www.ncescatalog.com/Nutrition-PlaceMat-for-Diabetes-Materials_p_1108.html OR
School Health Corporation <https://www.schoolhealth.com/nutrition-place-mat-for-diabetes.com>

Month of Meals Diabetes Meal Planner, 2010

Available from: Amazon.com or

American Diabetes Association, 1-800-232-6455; <http://store.diabetes.org>

CHOOSE YOUR FOODS: FOOD LISTS FOR DIABETES

(Formerly EXCHANGE LISTS FOR MEAL PLANNING)

Order from: Academy of Nutrition and Dietetics OR American Diabetes Associations;

www.eatright.org OR <http://store.diabetes.org>

Available in Spanish

MyFoodAdvisor <http://tracker.diabetes.org>

A website available on the American Diabetes Association site that helps track over 5,000 foods for CHO, protein and fat content. The site has meal planning options, menus and healthy substitutions.

THE COMPLETE GUIDE TO CARB COUNTING

Warshaw, H., 3rd edition; 2011

Order from American Diabetes Association, <http://store.diabetes.org>

The resources listed above are a sampling of the many available, primarily from the American Academy of Nutrition and Dietetics and the American Diabetes Association. There are several other organizations and websites which have educational materials available for persons with diabetes. A few which should be mentioned with their websites include:

- International Diabetes Center (www.ICDPublishing.com)
- Joslin Diabetes Center (www.joslin.org)
- National Diabetes Education Program (www.ndep.nih.gov; www.diabetes.niddk.nih.gov)
- Many pharmaceutical companies also have free nutrition education materials which can be obtained for persons with diabetes.

SUMMARY

Knowledge and individual application to improve adherence to the core foundational nutrition principles is one of the most important aspects of diabetes lifestyle management. There is no longer such a thing as an 1800 calorie ADA diet! The dietary goals covered here, along with other lifestyle changes, if consistently applied, can help to improve metabolic profiles and ultimately help prevent long-term complications associated with diabetes. Motivating the person with diabetes to make changes by working with a diabetes management team to implement an individualized program may help to elicit positive outcomes.

REFERENCES

1. Ali, M.K et al.; Achievement of Goals in US Diabetes Care: 1999-2010, N Engl J Med 2013;368:1613-24..
2. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 363821-42.
3. Standards of Medical Care in Diabetes-2013 Diabetes Care 2013;36(Suppl. 1):S11–S66
4. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position

- Statement by the ADA, *Diabetes Care* 2013, 36:3821-42.
5. The Diabetes Control and Complications Trial Research Group , The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus; *New England Journal of Medicine* 1993, 329(14):977-86.
 6. Standards of Medical Care in Diabetes-2013 *Diabetes Care* 2013;36(Suppl. 1):S11–S66
 7. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42.
 8. Franz, J et al; Evidence-based diabetes nutrition therapy recommendations are effective: the key is individualization. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy* 2014;7 65–72
 9. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42...
 10. Cozma AI, Sievenpiper JL, de Souza RJ,et al. Effect of fructose on glycemic control in diabetes: a systematic review and meta-analysis of controlled feeding trials. *Diabetes Care* 2012;35:1611–1620
 11. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42..
 12. Position of the Academy of Nutrition and Dietetics:Use of Nutritive and Nonnutritive Sweeteners *J Acad Nutr Diet.* 2012;112:739-758
 13. Slavin, J.L., et al; Position of the American Dietetic Association: Health implications of dietary fiber, *J Am Diet Assoc* 2008;108(8):1716-1731.
 14. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42.
 15. Cho, S.S.; Qi, L.; Fahey, G.C., Jr.; Klurfeld, D.M. Consumption of cereal fiber, mixtures of whole grains and bran, and whole grains and risk reduction in type 2 diabetes, obesity, and cardiovascular disease. *Am. J. Clin. Nutr.* 2013, 98, 594–619.
 16. U.S. Department of Agriculture; U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2010, 7th ed.*; U.S. Government Printing Office: Washington, DC, USA, 2010
 17. Slavin, J.L., et al; Position of the American Dietetic Association: Health implications of dietary fiber, *J Am Diet Assoc* 2008;108(8):1716-1731.
 18. Wheeler ML, Dunbar SA, Jaacks LM,et al. Macronutrients, food groups, and eating patterns in the management of diabetes: a systematic review of the literature,2010. *Diabetes Care* 2012;35:435-445.
 19. USDA website <http://fnic.nal.usda.gov/consumers/eatinghealth/fiber>, accessed April 2015.
 20. Webmd website <http://www.webmd.com/diet/healthtool-fiber-meter> accessed April 2015.
 21. Van Horn L, et al. The evidence for dietary prevention and treatment of cardiovascular disease. *Journal of the American Dietetic Association.* 2008;108:287
 22. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42.
 23. Millen, B.E., et al. 2013 American Heart Association/American College of Cardiology Guideline on Lifestyle Management to Reduce Cardiovascular Risk: Practice Opportunities for Registered Dietitian Nutritionists. *J Acad Nutr Diet* 2014;114, (11) 1723–1729
 24. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42
 25. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids.* Washington, DC, National Academies Press, 2002
 26. Position of the Academy of Nutrition and Dietetics: Dietary Fatty Acids for Healthy Adults. *J Acad Nutr Diet.* 2014;114:136-153.
 27. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42
 28. Standards of Medical Care in Diabetes-2013 *Diabetes Care* 2013;36(Suppl. 1):S11–S66
 29. American Heart Association website, www.heart.org; accessed April 2015.
 30. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, *Diabetes Care* 2013, 36:3821-42
 31. Academy of Nutrition and Dietetics Evidence Analysis Library. Available from http://andevidencelibrary.com/template.cfm?template=guide_summary&key=2984#supportevidence, 2011.

32. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
33. Position of the Academy of Nutrition and Dietetics: Dietary Fatty Acids for Healthy Adults. J Acad Nutr Diet. 2014;114:136-153.
34. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
35. Van Horn L, et al. The evidence for dietary prevention and treatment of cardiovascular disease. Journal of the American Dietetic Association. 2008;108:287
36. Gupta, A.K., et al; Role of phytosterols in lipid lowering: current perspectives; QJM 2011 Apr;104(4):301-8.
37. Bard, J.M., et al; Effect of phytosterols/stanols on LDL concentration and other surrogate markers of cardiovascular risk; Diabetes Metab. 2015 Feb;41(1):69-75
38. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
39. Academy of Nutrition and Dietetics Evidence Analysis Library. Available from http://andevidencelibrary.com/template.cfm?template=guide_summary&key=2984#supportevidence, 2011
40. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
41. Standards of Medical Care in Diabetes-2013 Diabetes Care 2013;36(Suppl. 1):S11–S66
42. Campbell, A.P. and Rains, T.M.; Dietary Protein Is Important in the Practical Management of Prediabetes and Type 2 Diabetes! .J Nutr. Jan 2015;145 (1)164S-169S
43. National Kidney Foundation: KDOQI clinical practice guidelines for diabetes and chronic kidney disease Am J Kidney Dis, 49 (Suppl 2) (2012), pp. S1–S179
44. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
45. Seida, J.C. et al; Clinical review: Effect of vitamin D3 supplementation on improving glucose homeostasis and preventing diabetes: a systematic review and meta-analysis;

1	
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 See comment in PubMed Commons below J Clin Endocrinol Metab. 2014 Oct;99(10):3551-60.
46. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
47. Standards of Medical Care in Diabetes-2013 Diabetes Care 2013;36(Suppl. 1):S11–S66
48. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
49. Standards of Medical Care in Diabetes-2013 Diabetes Care 2013;36(Suppl. 1):S11–S66
50. Saneei, P. et al.; Influence of Dietary Approaches to Stop Hypertension (DASH) diet on blood pressure: A systematic review and meta-analysis on randomized controlled trials Nutrition, Metabolism and Cardiovascular Diseases 2014 (24):12, 1253–1261.
51. <http://health.usnews.com/best-diet/best-overall-diets?int=9c2508> accessed April 2015
52. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
53. Hruby, A. et al. Higher Magnesium Intake Reduces Risk of Impaired Glucose and Insulin Metabolism and Progression From Prediabetes to Diabetes in Middle-Aged Americans Diabetes Care. 2014; 37(2): 419-427.
54. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
55. <http://www.diabetes.org/food-and-fitness/food/what-can-i-eat/making-healthy-food-choices/alcohol.html> accessed May 2015
56. Warshaw, H.S. and Kulkarni K. Complete Guide to Carb Counting, 3rd Edition
57. <http://dtc.ucsf.edu/living-with-diabetes/diet-and-nutrition/understanding-carbohydrates/counting-carbohydrates/> accessed May 2015
58. www.glycemicindex.com; University of Sydney accessed May 2015
59. Evert, A.B. and Boucher, J.L. et al; Nutrition Therapy Recommendations For the Management of Adults with Diabetes,;Position Statement by the ADA, Diabetes Care 2013, 36:3821-42
60. www.lpi.oregonstate.edu/infocenter/foods/grains/gigl.html, accessed May 2015
61. Marsh, K. et al, Glycemic index and glycemic load of carbohydrates in the diabetic diet, Curr Diab Rep (2011) 11:120–127
62. American Diabetes Association, Intensive Diabetes Management, 5th edition; 2012.
63. Virtanen, Suvi; Medical Nutrition Therapy of Children and Adolescents with Diabetes; Diabetes in Childhood and Adolescence, Pediatr

Adolesc Med. Basel, Karger, 2005, vol 10, pp139-149

64. ChooseMyPlate.gov USDA website accessed May 2015
65. www.mayoclinic.org/diseases-conditions/diabetic-hypoglycemia/basics/definition accessed May 2015
66. <http://www.diabetes.org/living-with-diabetes/treatment-and-care/whos-on-your-health-care-team/when-youre-sick.html> accessed May 2015
67. American Diabetes Association. Standards of medical care in diabetes – 2014. *Diabetes Care*. 2014;37(Suppl 1):S14-S80.
68. Shugart C, Jackson J, Fields KB. Diabetes in sports. *Sports Health*. 2010;2(1):29-38
69. Powers, M.A., *Handbook of Diabetes Medical Nutrition Therapy*
70. Kaufman FR, ed. *Medical Management of Type 1 Diabetes*. 6th ed. Alexandria, VA: American Diabetes Association; 2012.
71. Sisson EM, Cornell S. Pharmacotherapy for glucose management. In: Mensing C, ed. *The Art and Science of Diabetes Self-Management Education Desk Reference*. 2nd ed. Chicago, IL: American Association of Diabetes Educators; 2011:417-458.
72. CDC website: <http://www.cdc.gov/diabetes/data/statistics/2014statisticsreport.html> accessed May 2015
73. National Diabetes Information Clearinghouse; diabetes.niddk.nih.gov accessed May 2015
74. D'Adamo, E and Caprio, S. Type 2 diabetes in youth: epidemiology and pathophysiology; *Diabetes care*, 2011, 34:s161-5.
75. Van Dam, RM et al; Dietary patterns and risk for type 2 diabetes mellitus in U.S. men, *Ann Int Med*, 2002;136: 201-208
76. Lindstrom, J., et al; The Finnish Diabetes Prevention Study (DPS): Lifestyle intervention and 3-year results on diet and physical activity; *Diabetes Care* 2003, 26(12):3230-3236.
77. Saristo, T, et al; Lifestyle intervention for prevention of type 2 diabetes in primary care: one year follow-up of the Finnish national diabetes prevention program (FIN-D2D) *Diabetes Care*, 2010, 33(10): 2146-2151
78. Diabetes Prevention Program Research Group, Reduction in the incidence of Type 2 diabetes with lifestyle intervention or Metformin; *N Engl Jour Med* 2002, 346(6):393-403
79. Katula, J, et al; One year results of a community-based translation of the diabetes prevention program; *Diabetes Care* 2011, 34:1451-1457
80. Katula, J. et al; The Healthy Living Partnerships to Prevent Diabetes Study 2-Year Outcomes of a Randomized Controlled Trial *Am J Prev Med*. 2013 Apr; 44(4 0 4): S324–S332. doi: 10.1016/j.amepre.2012.12.015
81. Lim, EL, et al; Reversal of type 2 diabetes: normalization of beta cell function in association with decreased pancreas and liver triacylglycerol, *Diabetologia*, 2011, published online DOI 10.1007/s00125-011-2204-7
82. Taylor, R., Banting Lecture 2012, Reversing the twin cycles of Type 2 diabetes *Diabet Med*. 2013 Mar; 30(3): 267–275. Published online doi: 10.1111/dme.12039
83. Sacks FM, Bray GA, Carey VJ, et al. Comparison of Weight-Loss Diets with Different Compositions of Fat, Protein, and Carbohydrates. *N Engl J Med*. 2009; 360:859-873
84. Elhayany A, et al, A low carbohydrate Mediterranean diet improves cardiovascular risk factors and diabetes control among overweight patients with type 2 diabetes mellitus: a 1-year prospective randomized intervention study; *Diabetes Obes Metab*. 2010 Mar;12(3):204-9. doi: 10.1111/j.1463 1326.2009.01151
85. Hall, KD, et al; Quantification of the effect of energy imbalance on body weight; *Lancet* 2011, 378: 826-37.
86. Bloomgarden, Zachary; Type 2 Diabetes in the Young; *Diabetes Care* 2004; 27 (4): 998-1010.
87. ChooseMyPlate. United States Department of Agriculture Web site. <http://www.choosemyplate.gov>. accessed May 2015
88. <http://authoritynutrition.com/mediterranean-diet-meal-plan/> accessed May 2015
89. <http://oldwayspt.org/resources/heritage-pyramids/mediterranean-pyramid/overview> accessed May 2015
90. <http://www.hsph.harvard.edu/nutritionsource/> accessed May 2015
91. Geil, P., Ross, T; *What Do I Eat Now? A step by step guide to eating right with type 2 diabetes*; 2009
92. <http://www.ncscatalog.com/Nutrition-PlaceMat-for-Diabetes-or-Corporation> <https://www.schoolhealth.com/nutrition-place-mat-for-diabetes.com>
93. <http://www.nhlbi.nih.gov/health/health-topics/topics/dash> accessed May 2015
94. <http://health.usnews.com/best-diet/best-overall-diets> accessed May 2015
95. American Diabetes Association, *Month of Meals Diabetes Meal Planner*, 2010
96. *Choose Your Foods: Food Lists for Diabetes*; 2014 Academy of Nutrition and Dietetics, American Diabetes Association
97. Laurenzi, A, et al; Effect of carbohydrate counting and glucose control on quality of life over 24 weeks in adult patients with type 1 diabetes on continuous subcutaneous insulin infusion; *Diabetes Care* 2011, 34:823-827.
98. Schmidt, S., et al; Effects of advanced carbohydrate counting in patients with Type 1 diabetes: a systematic review; *Diabet. Med*. 2014,

31, 886–896.

99. Kulkarni, KH; Carbohydrate Counting: A practical meal planning option for people with diabetes; *Clin Diab* 2005 23, (3) 120-22

100. Martin, C, et al; Empirical evaluation of the ability to learn a calorie counting system and estimate portion size and food intake, *British Jour of Nutrition* 2007; 94:439-444.