

Using carbohydrate counting in diabetes clinical practice

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ABSTRACT

Carbohydrate counting is a meal planning approach used with clients who have diabetes that focuses on carbohydrate as the primary nutrient affecting postprandial glycemic response. The concept of carbohydrate counting has been around since the 1920s, but it received renewed interest after being used as 1 of 4 meal planning approaches in the Diabetes Control and Complications Trial. In the trial, carbohydrate counting was found to be effective in meeting outcome goals and allowed flexibility in food choices. Recent practice pattern surveys have shown an increasing interest in and use of carbohydrate counting for medical nutrition therapy for persons with diabetes. Carbohydrate counting can be used by clients with type 1, type 2, and gestational diabetes. Three levels of carbohydrate counting have been identified based on increasing levels of complexity. Level 1, or basic, introduces clients to the concept of carbohydrate counting and focuses on carbohydrate consistency. Level 2, or intermediate, focuses on the relationships among food, diabetes medications, physical activity, and blood glucose level and introduces the steps needed to manage these variables based on patterns of blood glucose levels. Level 3, or advanced, is designed to teach clients with type 1 diabetes who are using multiple daily injections or insulin infusion pumps how to match short-acting insulin to carbohydrate using carbohydrate-to-insulin ratios. All 3 levels emphasize portion control and offer opportunities for using creative teaching methods, such as "food labs," and use of a variety of carbohydrate resource tools and publications. In this article, glycemic effects of protein, fat, and fiber intake are discussed for persons with type 1 and type 2 diabetes. Decision trees are introduced for each level of carbohydrate counting and show the usual progression through each level. Carbohydrate counting as a meal planning approach offers variability of food choices with the potential for improving glycemic control. Research opportunities are available for those interested in comparing carbohydrate counting with other meal planning approaches for clients with diabetes and the effects on clinical outcomes. *J Am Diet Assoc.* 1998;98:897-905.

Carbohydrate counting is a meal planning approach used with clients who have diabetes that focuses on the total amount of carbohydrate eaten at meals and snacks. As 1 of 4 meal planning approaches used in the Diabetes Control and Complications Trial (1), carbohydrate counting has received renewed interest in recent years. Carbohydrate counting can be easy to use for clients and professionals and allows variety in food choices to fit a person's preferences and lifestyle (1). The primary premises of carbohydrate counting are that carbohydrate found in foods is the primary nutrient affecting postprandial blood glucose levels (2-5) and that careful attention to carbohydrate quantity and distribution can improve metabolic control.

HISTORICAL BACKGROUND

Carbohydrate counting is not a new concept. Soon after the discovery of insulin in 1921, references appeared in the literature (6-8) that indicate that carbohydrate counting was used in meal planning for persons with diabetes in the United States and in Europe. Joslin et al (6,7) reported tests in which they administered similar amounts of different carbohydrate-containing foods to compare dextrose to starches. No statistical differences were found in glycosuria or blood glucose using the various test meals. The "total glucose" value of carbohydrate, protein, and fat was figured to be 100%, 58%, and 10%, respectively (6-8). Foods were grouped according to their carbohydrate content; fruits and vegetables each included several categories based on percentage carbohydrate. Calculations of positive and negative carbohydrate balance were made according to the difference between total carbohydrate intake and glycosuria during a test period. If the dietary carbohydrate exceeded the amount of glucose in the urine, the subject was thought to be in positive carbohydrate balance. Ultimately, the total glucose value of the diet was used to determine the necessary dose of insulin (7).

Dietetics curriculums, however, have not focused on the meal planning approach per se. Rather, dietetics and other health care curriculums have taught the exchange system as the standard meal-planning tool for persons with diabetes. This has resulted in the exchange system being perceived as "the diabetic diet" or "the American Diabetes Association

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(grams of carbohydrate in serving size on label [or in reference book] x your serving size)/serving size on label = grams carbohydrate in your serving

Example from cereal box

(26 g carbohydrate on label x 2 c serving size)/1.25 c serving size on label = 52/1.25 = 41.6 or 42 g carbohydrate in your serving

42 g carbohydrate ÷ 15 g (amount in 1 carbohydrate choice) = 2.8, or round up to 3, carbohydrate choices

FIG 1. Formula for figuring grams of carbohydrate or carbohydrate choices from information about carbohydrate sources.

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FIG 2. Resource publications for carbohydrate counting.

dict." The first exchange lists were published in 1950 to provide a structured system based on grouping foods with similar distributions of carbohydrate, protein, and fat so that foods within a group could be exchanged (9). The 1976, 1986, and 1995 revisions of the exchange lists have shown increasing emphasis on carbohydrates. The 1995 lists state that starch, fruit, and milk choices are interchangeable and add another group—other carbohydrates—which includes some sugar-containing foods not mentioned in previous exchange lists (10). For years, consistency of carbohydrate has been a central

concept in meal planning for persons with diabetes, including the exchange system for meal planning.

PRACTICE PATTERNS AND MEAL PLANNING APPROACHES

Practice patterns of dietitians in the United States are changing as a variety of meal planning approaches for persons with diabetes are available and are being used (9). During the past decade, several surveys of dietitians who provide medical nutrition therapy for persons with diabetes have been conducted to determine current practice patterns as well as to assess the needs of dietitians (11-13). These surveys identified the need for a variety of meal planning approaches to be used in addition to the most widely used method, the exchange system. Thus, in 1993, The American Dietetic Association and the American Diabetes Association Steering Committee on Diabetes Nutrition Resources recommended the development and publication of 5 new nutrition resources for diabetes meal planning (13). Carbohydrate counting was 1 of the 5 approaches described in these resources.

In October 1996, the Diabetes Care and Education dietetic practice group offered a skills development workshop on carbohydrate counting at the 79th Annual Meeting and Exhibition of The American Dietetic Association. The session, which was limited because of the requirements of a hands-on, interactive workshop that included a food lab, was sold out. The dietetic practice group conducted a pre-workshop survey of practice patterns of the workshop participants. A profile of the 200 workshop attendees indicated that 95% were registered dietitians and 16% were certified diabetes educators.

By specialty, the participants included generalists (64%), diabetes nutritionists (18%), and other (18%). Practice settings included hospital inpatient (31%), private practice (19%), hospital outpatient (14%), clinic (10%), and other (26%). The participants used a variety of meal planning approaches: exchange system (92%), general guidelines (75%), menu systems (45%), and carbohydrate counting (44%). Of those using carbohydrate counting, 24% were using basic, level 1; 13% were using intermediate, level 2; and 10% were using advanced, level 3. Responses regarding the use of results from monitoring blood glucose levels to make food changes were as follows: 23%, always; 44%, usually; 21%, occasionally; 12%, never. Sixty-three percent of respondents reported using the results of self-monitoring of blood glucose levels to make recommendations for medication adjustments, 67% used these results to make changes in diet, and 83% used these results for recommendations about physical activity. Approximately half of the respondents reported that they usually or always ask clients to weigh and measure foods and approximately half occasionally or never do.

A follow-up survey was conducted 6 months later; response rate was 64%. The follow-up survey showed an increase of 21% in the use of carbohydrate counting in general. Use of level 1 carbohydrate counting increased by 22%, level 2 increased by 11%, and level 3 increased by 5%. These increases were statistically significant. The use of self-monitoring of blood glucose level did not change significantly in regard to making decisions about changes in diet, recommending medication adjustments and physical activity, and asking clients to weigh and measure foods. The survey results suggest that dietetics professionals need to increase emphasis on the importance of teaching clients portion control skills and how to interpret the results of monitoring blood glucose levels to adjust diabetes therapy. Mastery of these skills is a prerequisite to advancing to the more complex levels of counting carbohydrates and calculating carbohydrate-to-insulin ratios.

WHY COUNT CARBOHYDRATES?

Carbohydrate counting is based on 2 tenets. First, scientific evidence gathered using modern research methods (2-5) and clinical observations have shown that carbohydrate is the main factor affecting postprandial blood glucose excursions and, thus, insulin requirements. Second, carbohydrate is converted to glucose within the first 2 hours after eating (3,4) and appears in the systemic circulation within the first 15 minutes (4). The 1994 American Diabetes Association nutrition recommendations report that scientific evidence does not support previous recommendations to avoid sugars, or simple carbohydrates, in favor of starches, or complex carbohydrates, because all carbohydrate, whether starch or sugar, is metabolized to glucose in the body (14). Published research was reviewed extensively regarding use of sucrose in the diets of persons with type 1 and type 2 diabetes. The research showed no difference in glycemic response or insulin requirements between high-starch vs high-sucrose diets (15). Therefore, recommendations emphasize that priority should be given to the total amount of carbohydrate rather than the type (14).

As a result of these recommendations, the traditional dogma stating that people with diabetes must avoid sugars has changed. This does not mean that persons with diabetes can indulge in cookies, cake, and sugar. Rather, sweets containing sucrose or other sweeteners may be substituted occasionally for other carbohydrates in the meal plan. Healthful food choices remain the bottom line. When using the carbohydrate counting approach, one must consider the other macronutrients, fat and protein, even though, in usual amounts, they have minimal direct effect on blood glucose level. Weight gain may become a problem if protein and fat are disregarded.

Some consider carbohydrate counting to be a simpler and less structured meal planning approach because it focuses on 1 macronutrient. Clients cannot ignore protein and fat, however, and must monitor intake to avoid excessive energy and fat consumption. Our clinical experience is that carbohydrate counting offers an alternative for clients who are frustrated by more structured and complex meal planning approaches. This simpler approach works well for clients who do not eat balanced meals or those who eat an abundance of carbohydrate-containing foods. They may achieve the bottom line of glycemic control if they are willing to work within a carbohydrate goal for meals and snacks. They may decline the more healthful carbohydrate choices such as fruits, vegetables, milk, and whole-grain breads and cereals, but at least they can be consistent with amounts of carbohydrate. Carbohydrate counting is an excellent vehicle to demonstrate to clients the relationships among food, medication, activity level, and blood glucose level, thereby giving them feelings of greater control and confidence in self-management.

Clients with all types of diabetes—those with newly diagnosed diabetes and those with longstanding duration of the disease—are possible candidates for carbohydrate counting. Selection of this approach should be based on careful nutrition assessment. For example, an obese person with type 2 diabetes may have lipid disorders that require special additional attention to the amounts and types of fats consumed. Assessment should be ongoing to determine which level of carbohydrate counting is appropriate and whether a client is meeting goals for treatment outcomes. The desired outcomes realized most frequently are increased lifestyle flexibility as a result of greater variety of food choices within carbohydrate goals, client satisfaction, and improved metabolic control. Dietary behaviors associated with improved glycemic control in the Diabetes Control and Complications Trial (16) included adherence to diet, of which carbohydrate consistency and portion

control are key factors, and management of changes in food intake by adjusting insulin dose or by matching insulin to food, that is, using carbohydrate-to-insulin ratios. These and other diet-related behaviors were related to lowering of the level of the glycosylated hemoglobin, HbA_{1c}, which was associated with an overall reduction in the development of diabetes complications.

LEVELS OF CARBOHYDRATE COUNTING

Three levels of carbohydrate counting have been identified: level 1, or basic; level 2, or intermediate; and level 3, or advanced. Level 1 introduces the concept of carbohydrate counting and encourages inclusion of consistent amounts of carbohydrate at meals and snacks. Level 2 focuses on relationships among food, medication, activity, and blood glucose level and introduces the concept of how to make adjustments based on blood glucose patterns. Level 3 is designed to teach clients who use multiple daily injections of insulin or continuous, subcutaneous insulin infusion by insulin pump how to match short-acting insulin to carbohydrate using carbohydrate-to-insulin ratios. Client education booklets for each level have been published jointly by The American Dietetic Association and American Diabetes Association (17-19). The carbohydrate food lists in these booklets are identical to those in the *Exchange Lists for Meal Planning* (10); thus, clients who already have a copy of that publication could use the exchange lists to count carbohydrates.

All 3 levels emphasize portion control. Recommended tools for portion control include measuring cups, spoons, and a food scale that weighs in grams and ounces. A critical step in teaching carbohydrate counting is to convince the client of the value of developing accurate portion-control skills. A useful teaching method designed for this purpose is a food lab. In a food lab, clients practice weighing and measuring actual foods and figuring carbohydrate content in an individual or group setting. This method can help to overcome client resistance to developing these skills. In addition to the usual portion-control tools, using a variety of bowls, plates, cups, and glasses typically found in most homes provides more practical experience. In the clinic or office practice setting, nonperishable items such as popcorn, dry cereal, and water (instead of juice or milk) can be used indefinitely to simulate amounts usually consumed by the client. Foods to weigh include pretzels, fresh fruit, bread products, and baked goods. Bread products such as a bagel, dinner roll, pancake, and biscuit can be stored between uses in plastic bags in a freezer. In a workshop setting, cooked items such as a baked potato, rice, and pasta provide additional weighing and measuring experience. Clients also learn how to use food labels and carbohydrate resource books (Figures 1 and 2).

Blood glucose results are an important measure of success at all levels of carbohydrate counting. Clients need to monitor and record their blood glucose levels. Target blood glucose levels should be determined by the client and the health care team and may include goals for premeal and postmeal levels (20-22).

Level 1

Level 1 carbohydrate counting is designed for people with type 1, type 2, or gestational diabetes mellitus who desire a less structured method of choosing foods, or who have difficulty using their current meal planning approach, or whose intake of carbohydrate is inconsistent. At this level clients learn why consistent carbohydrate intake is important in relation to blood glucose levels. They also learn which foods contain carbohydrates, the concept of carbohydrate choices, how to

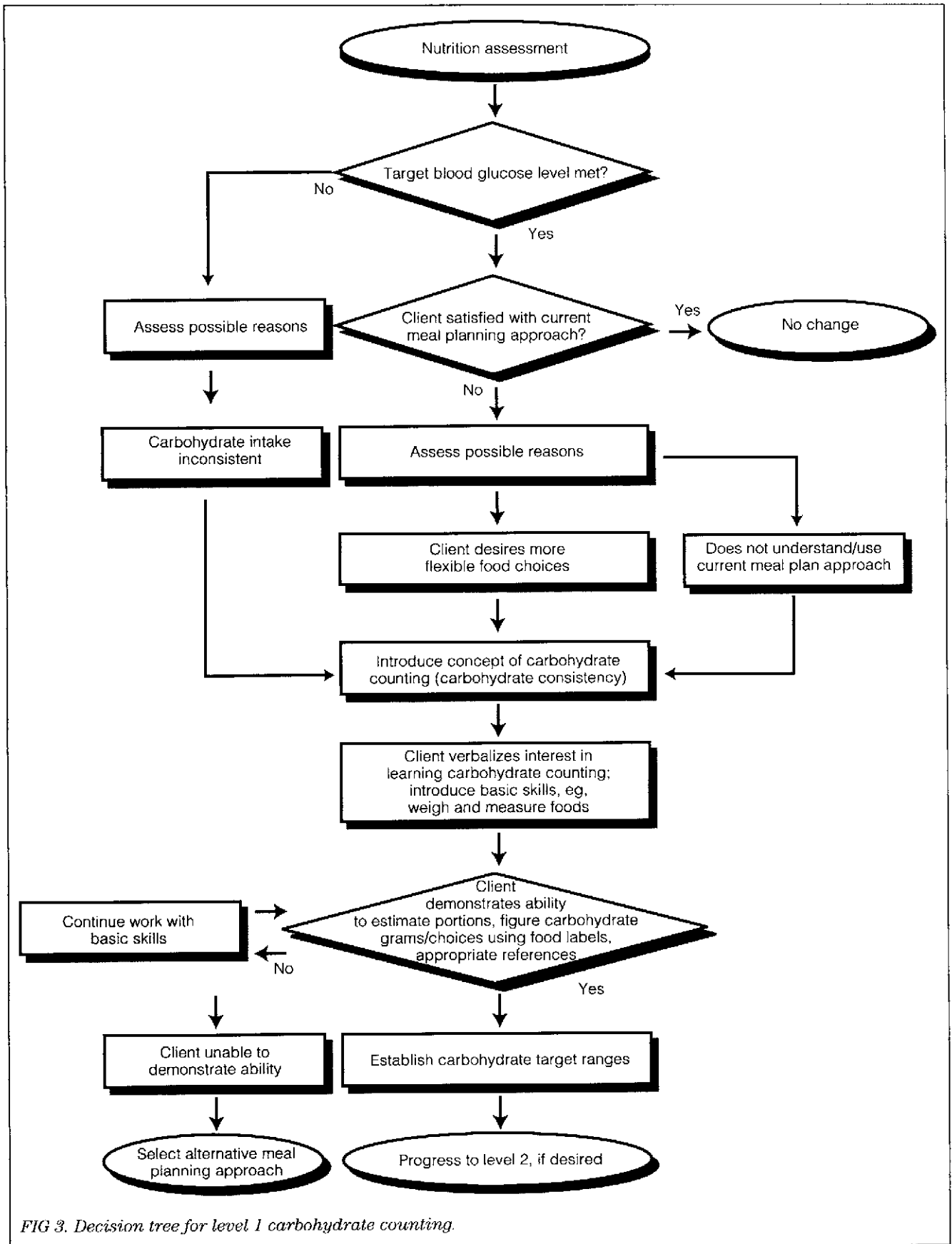


FIG 3. Decision tree for level 1 carbohydrate counting.

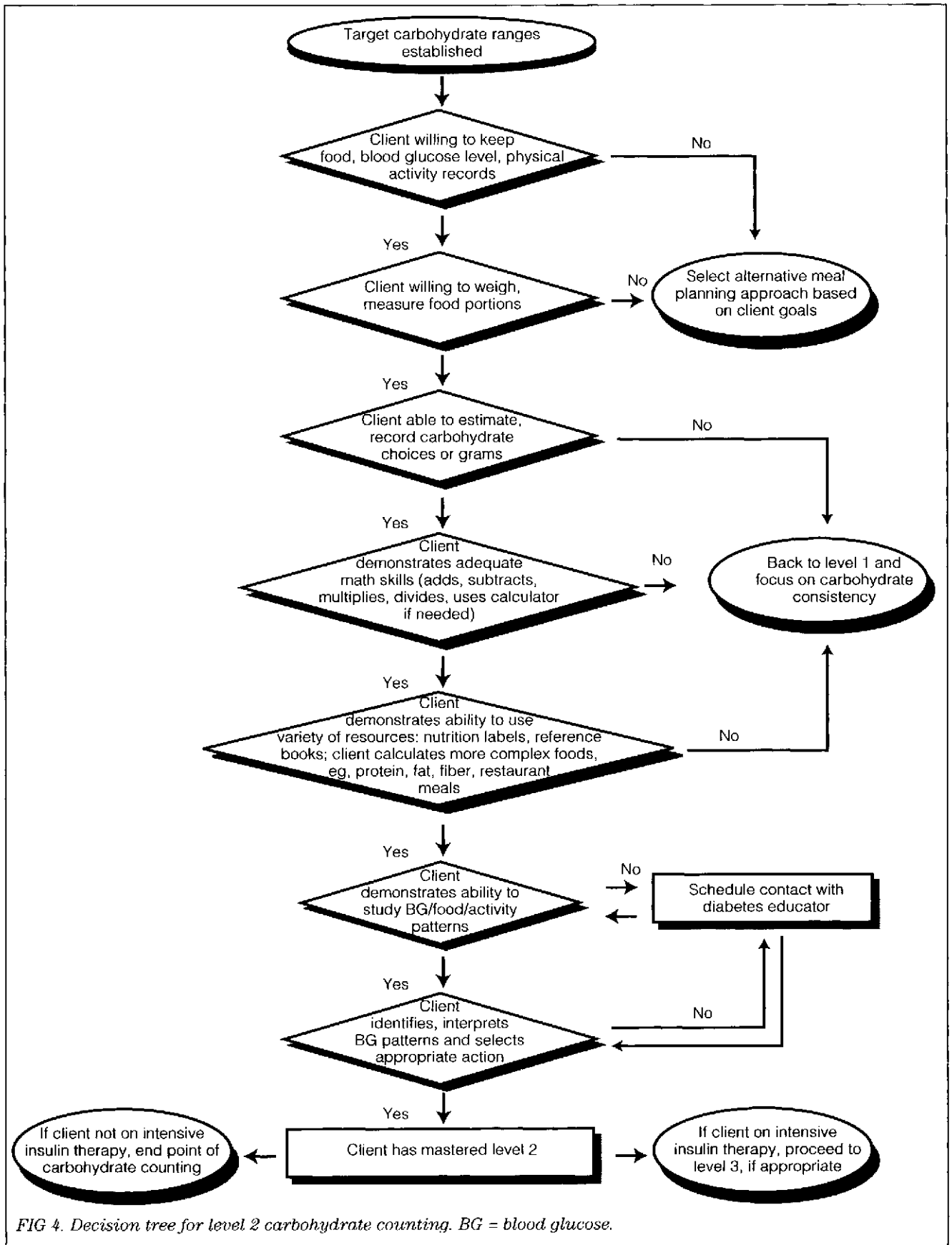


FIG 4. Decision tree for level 2 carbohydrate counting. BG = blood glucose.

start counting grams of carbohydrate, use of the Nutrition Facts panel on food labels, and how to use food lists to count carbohydrate. Clients are encouraged to keep food records and to identify portion sizes that they usually eat by weighing and measuring amounts. Practice exercises provide the client and the registered dietitian with an idea of the client's usual carbohydrate intake. These activities help to establish and negotiate target carbohydrate intake for meals and snacks.

The target range for carbohydrate grams at meals and snacks can be negotiated with a client. For example, if a client's usual range is 40 to 90 g carbohydrate per meal, then an average of 55 to 65 g per meal may be an acceptable target range for the client. During a trial period the client works with the carbohydrate target range and keeps records of food intake, blood glucose levels, and physical activity. Follow-up contacts via telephone or fax or in person help determine whether the carbohydrate target range is working or if it needs to be renegotiated. These activities complete the client's progression through level 1 (Figure 3).

Level 2

Level 2 carbohydrate counting is designed for people with type 1, type 2, or gestational diabetes who have mastered level 1 and desire more advanced skills. At this level clients continue to develop their record-keeping skills and learn to identify patterns of blood glucose levels that are related to their food, diabetes medications, and physical activity. Finding these blood glucose patterns, interpreting them, and taking appropriate action is called pattern management.

Pattern management Pattern management can be approached as a 3-step process. In step 1, the client and dietitian study the records and look for blood glucose levels outside the client's target range. For example, the target range for premeal blood glucose level could be 4.4 to 6.7 mmol/L¹, and blood glucose levels above or below the target range are identified. Possible explanations for blood glucose levels outside the target range are discussed with the client. Possible explanations for high blood glucose level might include excessive carbohydrate intake at previous meal or snack; not taking diabetes medication as directed, or medication needs adjustment; less physical activity than usual; high-fat foods at previous meals or snacks; and illness or stress. Possible explanations for low blood glucose level include delayed or omitted meals or snacks; not taking diabetes medication as directed, or medication needs adjustment; less carbohydrate intake than usual at previous meal or snack; and increased physical activity.

In step 2 the client and dietitian find and interpret blood glucose patterns, noting the frequency and circumstances related to these patterns. They discuss reasons for these patterns and look for solutions to problems. In step 3 the client and dietitian decide, based on what they have learned in steps 1 and 2, which items of the diabetes management regimen need adjustment. They list possible strategies to try, which may include changing diabetes medication dose or timing, changing amount or timing of carbohydrate intake, increasing, decreasing, or changing timing of physical activity.

Weight gain Possible reasons for weight gain when using level 2 carbohydrate counting include client's lack of attention to protein and fat intake while focusing on 1 macronutrient (carbohydrate) and overtreating hypoglycemic reactions. Cli-

ents' carbohydrate choices may be high in fat, and they may be consuming larger meat portions than is reasonable and adding extra fat from spreads and dressings. They may experience improvements in glycemic control resulting in less energy lost through glycosuria. Rehydration, experienced with euglycemia, also adds weight. Another reason for weight gain is hypoglycemia, especially when ice cream and candy bars are used for treatment. Prevention and appropriate treatment of hypoglycemic episodes can reduce energy intake. Clients should practice the 15/15 rule: take 15 g carbohydrate, preferably in the form of glucose (23); wait 15 minutes and test blood glucose level again to see if the response to the carbohydrate is adequate.

At level 2, clients also develop skills in managing more complex foods such as combination foods and restaurant meals. They learn about the indirect effects of protein, fat, and fiber on blood glucose levels. In type 2 diabetes the addition of protein and fat to a meal can lower glycemic response (3). Dietary fiber must be increased to at least 40 g/day to produce a meaningful reduction of blood glucose level, and only water-soluble fiber has a metabolic effect (24). Soluble fiber delays gastric emptying and intestinal digestion of other carbohydrates. Because dietary fiber is, for the most part, not digested and absorbed like other carbohydrates, fiber is not considered available as a potential source of glucose (25). Thus, clients learn that if a food contains 5 g dietary fiber or more, they should subtract the fiber grams from the total carbohydrate grams for that food. Clients who take short- or rapid-acting insulin may be guided on how to make occasional simple insulin adjustments to manage extra carbohydrate intake. For example, they may need to take 1 to 1½ units of short- or rapid-acting insulin for each additional carbohydrate choice or 15 g carbohydrate. Carbohydrate consistency is still encouraged at level 2. Clients who wish to increase their skills in matching insulin to carbohydrate should go on to level 3 (Figure 4).

Level Three

Level 3 carbohydrate counting is designed primarily for people with type 1 diabetes who are receiving intensive insulin therapy, that is, multiple daily injections of insulin or continuous, subcutaneous insulin infusion by insulin pump. Use of carbohydrate-to-insulin ratios allows the client to match the amount of short- or rapid-acting insulin given before meals, and sometimes snacks, to the amount of carbohydrate to be consumed. Before establishing the carbohydrate-to-insulin ratio the client needs to have followed a consistent meal plan while insulin doses are adjusted to meet target blood glucose levels. The client must have mastered carbohydrate counting levels 1 and 2, must be proficient in insulin adjustment for altering basic daily doses, and must have mastered insulin supplementation (adding or subtracting short- or rapid-acting insulin at meal-times to help correct premeal blood glucose levels).

Based on a client's food, insulin, exercise, and blood glucose records, a dietitian can calculate the carbohydrate-to-insulin ratio using either the carbohydrate gram method or the carbohydrate choices method. In the carbohydrate gram method, the grams-per-unit ratio is obtained by dividing the grams of carbohydrate consistently consumed at a given meal by the number of units of short- or rapid-acting insulin needed to meet goals for blood glucose level. For example, a client who consistently consumes 60 g carbohydrate at a meal and requires 6 units regular or lispro insulin to achieve target blood glucose levels has a ratio of 10 g carbohydrate per 1 unit insulin. In the carbohydrate choice method, the units-per-carbohydrate-choice ratio is obtained by dividing the number of units of short- or rapid-acting insulin needed to meet goals for blood

¹To convert mmol/L glucose to mg/dL, multiply mmol/L by 18.0. To convert mg/dL glucose to mmol/L, multiply mg/dL by 0.0555. Glucose of 6.0 mmol/L=108 mg/dL.

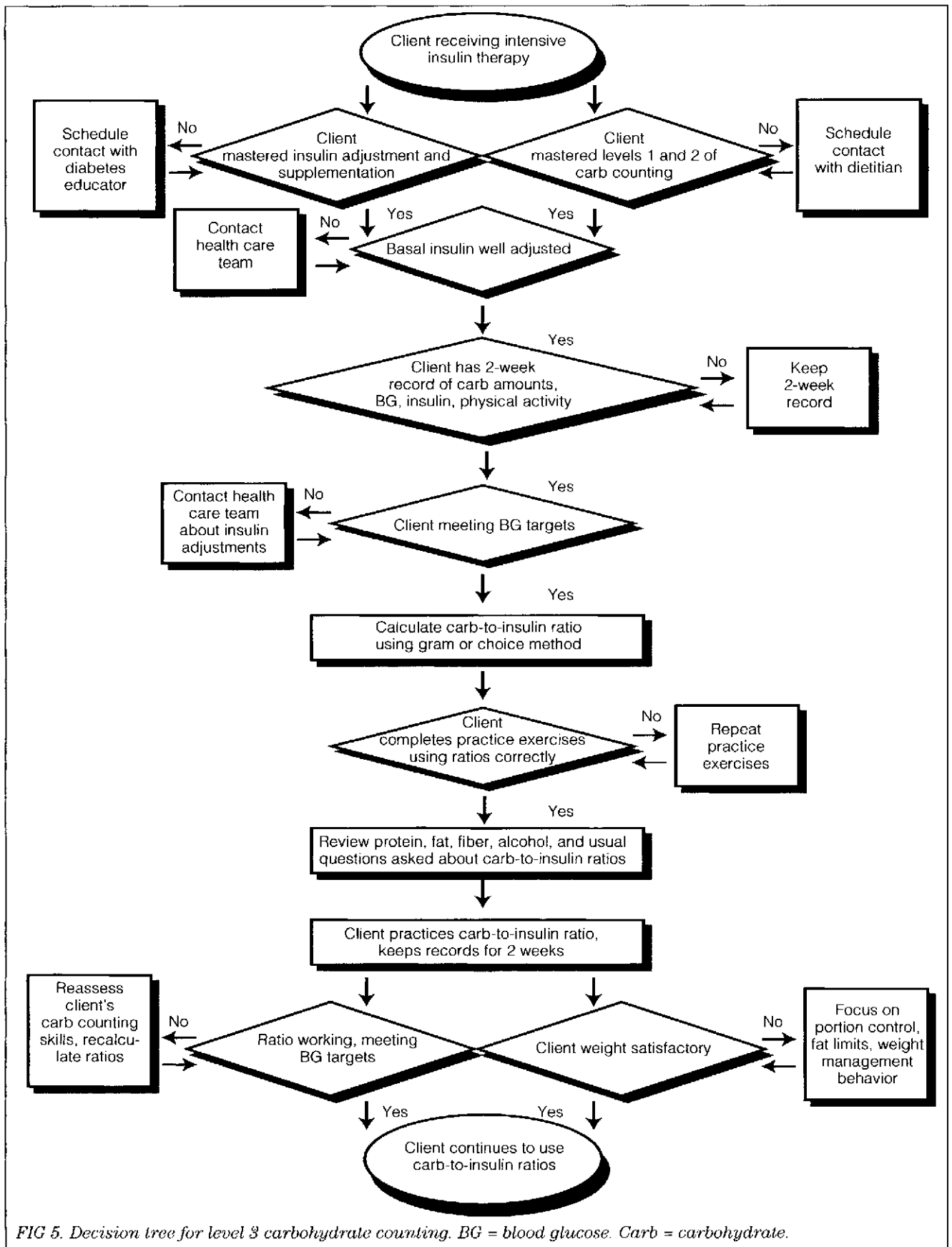


FIG 5. Decision tree for level 3 carbohydrate counting. BG = blood glucose. Carb = carbohydrate.

Table
Carbohydrate counting checklist

Activities	Pre ^a	Level 1	Level 2	Level 3
Patient contacts (no.)		1 to 3	1 to 3	1 to 3
Contact intervals (wk)		1 to 4	1 to 2	1 to 2
Length of visit (min)		30 to 90	30 to 60	30 to 60
Nutrition/diabetes history	X			
Why count carbohydrates		X		
Starch vs sugar		X		
Effects of carbohydrate		X	X	X
Effects of protein, fat		X	X	X
Good nutrition		X	X	X
Introduction to carbohydrate choices		X		
Portion control		X	X	X
Food labels		X	X	X
Carbohydrate resources			X	X
Set goals for carbohydrate intake ^b		X	X	X
Set goals for blood glucose level ^b		X	X	X
Keep food, blood glucose level, medication records		X	X	X
Assess readiness for next level ^b	X	X	X	
Review blood glucose records ^b		X	X	X
Evaluate blood glucose patterns ^b		X	X	X
Adjust plan ^b		X	X	X
Restaurant meals			X	X
Combination foods			X	X
Fiber			X	X
Choices vs grams		X	X	X
Estimate carbohydrate-to-insulin ratio				X
Use carbohydrate-to-insulin ratios				X
Snacking		X	X	X
Alcohol		X	X	X
Avoid weight gain		X	X	X

^aPre=before carbohydrate counting.

^bContact/activities can be done at visit, by telephone, or by fax. Adapted from *Diabetes Medical Nutrition Therapy* (10), © 1997, The American Dietetic Association. Used by permission.

glucose level by the number of carbohydrate choices consistently consumed at a given meal. For example, a client who consistently consumes 6 carbohydrate choices at a meal and requires 9 units of insulin to achieve target blood glucose levels has a ratio of 1½ units per carbohydrate choice. Once clients understand how to use these ratios, they can eat more or less carbohydrate than usual and adjust insulin accordingly. More detailed explanations of how to use these 2 methods are available elsewhere (19,26).

At level 3, clients need to continue developing skills in estimating carbohydrate amounts and practicing portion control, so that they will be precise in matching their insulin doses to their anticipated carbohydrate intake. They must be vigilant about watching total energy intake, because their flexibility with carbohydrate amounts in meals and snacks places them at higher risk for weight gain. They must be aware of the indirect effects of protein, fat, and fiber intake on blood glucose levels and any corresponding insulin adjustments required. The addition of large amounts of protein to a meal can produce an increase in blood glucose level 3½ to 5 hours after the meal (27,28). Fat slows down gastric emptying time and may require an adjustment in the timing or a delay in the administration of the premeal short- or rapid-acting insulin to match the peak of insulin activity with the peak blood glucose response (27,28). Attention to the fiber content in foods will allow the client to more accurately match insulin to available carbohydrate in high-fiber foods, that is, total carbohydrate grams minus fiber grams.

A person's carbohydrate-to-insulin ratio may change over time, thereby requiring recalculation of the ratio in the same way as the initial calculation. Clients may need to use more than 1 ratio during the day. For example, a client may use 10 g carbohydrate per unit of insulin at breakfast and 15 g per unit at lunch or supper. The need for more than 1 ratio is influenced by time of day, degree of insulin resistance, and level of physical activity. Mastery of level 3 allows a range of total carbohydrate intake while maintaining optimal glycemic control—an ideal combination for persons with diabetes. As clients continue to use carbohydrate-to-insulin ratios, dietitians should periodically assess their portion control skills and monitor their weight, as there may be a tendency to gain weight with excess consumption of carbohydrate foods or disregard of protein and fat intake (Figure 5).

Glycemic Index

A discussion of carbohydrate counting is not complete without addressing the glycemic index. The glycemic index ranks foods on the basis of the glycemic effect of that food compared with a standard food, usually glucose or white bread (29,30). Foods with a high glycemic index, such as rice, produce a greater glycemic response than foods with a low glycemic index, such as legumes. Practical application of the glycemic index is challenging: the international tables of glycemic index include 565 entries with multiple entries for single foods that depend on the form and preparation of that food (30). There are 48 entries for rice alone. One study comparing the use of diabetic exchange lists to the glycemic index concluded that the carbohydrate exchange lists more accurately predicted postprandial glycemic response to carbohydrate-containing foods, as part of a mixed meal, than did the glycemic index of foods (31). Through monitoring of blood glucose level and record keeping, clients become aware of their own variability of glycemic response to specific carbohydrate foods; in effect, they learn their own glycemic index (29). They may learn that even small portions of certain foods, such as pizza, produce a greater than expected glycemic response (32). If they wish to use these

foods and maintain glycemic control, they can learn to adjust portion sizes, activity level, or diabetes medications (pills or insulin).

SUMMARY AND FUTURE DIRECTIONS

Carbohydrate counting is a meal planning approach that is being used more frequently for persons with diabetes. The graduated approach that includes 3 levels with progressive complexity has been helpful to clients and health care providers. A variety of content areas need to be covered at all levels and multiple visits by the client are highly useful (Table). Progress is being made nationally to secure third-party reimbursement for medical nutrition therapy, which should help with coverage and reimbursement for multiple visits. If multiple visits are not possible, clients can send records to their educators via fax, to be combined with data from telephone consultations, to achieve ongoing follow-up. Such encounters can be helpful and can be billed as an upgraded charge for subsequent office visits. Telemedicine is also promising as a follow-up tool.

Carbohydrate counting is a new approach for many dietitians. Ways to become more knowledgeable about this approach include attending workshops, reading journal articles and other publications (26,33-39), and networking with colleagues. Carbohydrate counting approaches to meal planning provide a wealth of research possibilities, such as comparing carbohydrate counting to the exchange system, glycemic index, or total available glucose (40) method. Using carbohydrate-to-insulin ratios, the carbohydrate gram method could be compared with the carbohydrate choice method. Outcomes of interest include glycemic control, weight management, and client satisfaction.

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