Carbohydrate counting-1: South Asian framework

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Abstract

Carbohydrate counting or "carb counting" is a meal planning technique for persons with diabetes for managing blood glucose levels by tracking the grams of carbohydrate consumed at meals. It has shown to improve glycaemic control and glycaemic variability and decreases risk of hypoglycaemia in persons with diabetes especially on insulins. It needs basic education of the patient regarding meal plan, assessment of carbohydrate content of various foods and also exchange lists. It also gives flexibility of food choice, helps to identify patterns in blood glucose levels and adjustment of pre meals short acting insulins as related to food intake. In this short review we have summarised basic principles of carbohydrate counting, its application in clinical practice and also exchange lists primarily pertaining to South Asian population.

Keywords: Carbohydrate counting, Exchange list, Diabetes, Glucose monitoring, Insulin.

Introduction

Carbohydrate counting or "carb counting," is a meal planning technique for managing blood glucose levels by tracking the grams of carbohydrate consumed at meals and snacks. It focuses on carbohydrate as the primary nutrient affecting postprandial glycaemic response. Foods that contain higher carbohydrates have the greatest effect on post-prandial blood glucose levels as compared to foods that contain primarily protein or fat.[1] This concept has been used since 1960s and was even used as meal planning approach in Diabetes Control and Complications Trial (DCCT) for intensive glycaemic management.[2]

Concept of Exchange List

Exchange lists are foods listed together under different food groups because each serving of a food has about the same amount of carbohydrate, protein, fat, and calories as the other foods on that list. It helps patients to learn

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carbohydrate counting.

Once the carbohydrate allowance per day is decided, different carbohydrate foods can be 'exchanged' with one another to provide flexibility and variety in the standardized calorie-level meal pattern in the individual diet plan.[3] One carbohydrate exchange (approximately 20 grams) contributes to approximately 80 Kcal which is considered as one serving of carbohydrate (regardless of the source) in carbohydrate counting. Exchange list of various food items pertaining to South Asian population has been shown in Table-1.

Clinical Significance of Carb Counting

The allotment of carbohydrates ensures sufficient supply of exogenous carbohydrate in each meal throughout the day. It is a desirable method for individuals who wish to have a more flexible eating regimen, an inconsistent carbohydrate intake, have been unsuccessful with past diet plans and have willingness or ability to learn a new approach.[2]

Usually the amount of carbohydrate for each meal and snack is adjusted based on the pre-meal blood glucose reading. Depending on the reading, more or less carbohydrate may be eaten and insulin dose is adjusted. Also on occasional days when patient is willing to eat a much larger meal than usual, carbohydrate counting determines the extra insulin units required.

Requisites of Carb Counting
A. Meal plan

The first step is to get a meal plan. A meal plan is a guide that signifies the amount of calories, carbohydrates, proteins and fats to be consumed per day at each meal-time and snack-time. Such kind of information can be presented in the tabular form with the help of professionals/dieticians for better understanding for individuals.

B. Assessment of Carbohydrates

The next step involves learning which foods contain carbohydrate. Considering the foods groups, except fats, all the food groups contain certain amount of carbohydrates, with sugars, cereals and pulses containing maximum amount. It is mandatory to

Table-1: Carbohydrate exchange list for commonly used Indian/South Asian food items.

Food item	Amount containing 1 serving of CHO	Food item	Amount containing 1 serving of CHO
	Cereal Exchange		
	Each Serving (20g) = 15 g carbohydrate, 2 g protein, 0-1 g fat, 70 calories		
Flour (different grains)	30 g	Upma ,raw	25 g
Chapatti	1	Porridge, raw	25 g
Paratha	1	Oats, raw	25 g
Bread	1.5 slices	Pasta, raw	25 g
Naan	1	Rice	25 g
Pancake	1	Rice fakes	25 g
Puri	1.5	Cornflakes	25 g
Vermicelli, raw	25 g	Potato	90 g
	Pulses and Legumes		
	Each Serving (30 g) = 17g carbohydrate, 7 g protein, 0-1 g fat, 100 calories		
Bengal gram whole	41 g	Lentil	40 g
Green gram dal	40 g	Rajma	40g
Green gram whole	40 g	Soyabean	100g
	Vegetables and Fruits		
	Each Serving (100-150g) =7-8 carbohydrate, 1-2 g protein, 0 g fat, 35 calories		
Apple	150 g	Brinjal	520 g
Banana	80 g	Cucumber	800 g
Grape fruit	286 g	Peas, green	130 g
Mango, ripe	118 g	Cabbage	450 g
Orange	184 g	Carrot	130 g
Papaya	287 g	Pumpkin	450 g
Pear	168 g	Ladies finger	320 g
Pineapple	186 g	Bottle gourd	800g
Guava	160 g	Tomato, ripe	580 g
Sapota	94 g	Spinach	700 g
	Milk and Milk products		
	Each Serving (250ml) = 11 g carbohydrate, 8 g protein, 7.5 g fat, 150 calories		
Buffalo milk	400 ml	Curd	700 g
Cow milk	470 ml	Channa (paneer), cow	1.8 kg
Toned milk	470 ml	Cheese	320 g
Double toned milk	470 ml	Khoya, cow	80 g
	Sugar exchange		
	Each Serving (5 g) = 5 g carbohydrate, 0 g protein, 0g fat, 20 calories		
Sugar, jam, honey, jaggery	20 g		
	Common snacks and Desserts		
Biscuit, sweet	2 piece/30g	Kachori	1 piece
Samosa (potato)	1 piece	Idli	2-3
Uttapam	1 piece	Dosa 1 medium	1 piece
Gulab jamun	1 piece	Noodles, plain	Half plate
Cake, plain	40 g	Bun (hotdog or hamburger)	Half piece
English muffin	Half piece		

*1 exchange of CHO = 20-25 g
*Other food groups such as meat and meat products, oil and dry nuts do not contribute to significant amount of carbohydrate.
*Total calorie containment, type of carbohydrate shall also be taken into account besides carbohydrate counting.

consider following points:

♦ Know which foods contain carbohydrates

♦ Learn to estimate the amount of carbohydrate in each food item

♦ Add the amount of carbohydrate from each food

item at one meal.

C. Measuring Tools

This step necessitates accurate carb counting with precise calculation of the portion sizes of foods. Measuring cups or common household measures can even be used by a lay man. Some of the common challenges faced during

Table-2: Challenges of carbohydrate counting.

Practical issues
◆ Level of knowledge of the health staff/diabetic educator
◆ Resources available for teaching the method and the time spent with the patient
◆ Educational background of the patient
◆ Patient motivation
◆ Accuracy: under or over-estimation of carb in dishes
Coping strategies
◆ To make this method more accurate and practical, it is mandatory to guide patients appropriately via measuring utensils, food models, labels, leaflets and such familiar and locally available objects.

carb counting are summarised in Table-2.

Clinical Evidence

Day-to-day consistency in the amount of carbohydrate eaten at meals and snacks is reported not only to improve glycaemic control but also glycaemic variability and decreases both hypoglycaemic or hyperglycaemic episodes, in persons on either medical nutrition treatment (MNT) alone, oral glucose lowering medications, or fixed insulin regimens.[4,5] It enables patients to adjust their mealtime insulin doses (in patients on either pre-meal short acting insulins or those on insulin pump) to match actual carbohydrate intake, known as the insulin-to-carbohydrate ratios.[6,7] It helps in evaluating the impact of carbohydrate intake and food choices on blood glucose and setting nutrition goals.[2] All such factors in fact contribute to 'primary self-care activities'.[8]

Carb counting has shown to significantly improve glycaemic level even in patients with end stage renal disease.[1] In spite of better glycaemic control, it does not cause increase in weight or in insulin requirements in children and adolescents with type 1 diabetes.[9] Moreover it may result in improvement in certain lipid parameters like increased HDL levels and decreased cardiovascular disease risk.

Conclusion

Carb counting gives flexibility of food choice and helps to identify patterns in blood glucose levels as related to food intake. It helps individuals to take action based on blood glucose patterns. Furthermore, it helps assess carbohydrate/insulin ratio especially useful for persons on multiple daily insulin injections to understand the relationship between food eaten and insulin injected and to adjust pre-meal insulin. All primary care providers should make an attempt to teach patients basic principles of carb counting and empower patients in self-management of diabetes.

References

1. Kitajima Y, Mikami N, Hyodo T, Hida M, Kawakami J. Carbohydrate Counting: A Simple Method of Dietary Management for Glycemic Control in Japanese Diabetic Hemodialysis Patients. Contrib Nephrol 2017; 189: 262-9.
2. Chiesa G, Piscopo MA, Rigamonti A, Azzinari A, Bettini S, Bonfanti R, et al. Insulin therapy and carbohydrate counting. Acta Biomed.2005; 76 Suppl 3: 44-8.
3. Gupta L, Khandelwal D, Singla R, Gupta P, Kalra S. Pragmatic dietary advice for diabetes during Navratris. Indian J Endocrinol Metab. 2017; 21: 231-7.
4. Kalra S, Mukherjee JJ, Venkataraman S, Bantwal G, Shaikh S, Saboo B, et al. Hypoglycemia: The neglected complication. Indian J Endocrinol Metab. 2013; 17: 819-34.
5. Spiegel G, Bortsov A, Bishop FK, Owen D, Klingensmith GJ, Mayer-Davis EJ, et al. Randomized nutrition education intervention to improve carbohydrate counting in adolescents with type 1 diabetes study: is more intensive education needed? J Acad Nutr Diet. 2012; 112: 1736-46.
6. Finner N, Quinn A, Donovan A, O'Leary O, O'Gorman CS. Knowledge of carbohydrate counting and insulin dose calculations in paediatric patients with type 1 diabetes mellitus. BBA Clin. 2015; 4: 99 101.
7. Fu S, Li L, Deng S, Zan L, Liu Z. Effectiveness of advanced carbohydrate counting in type 1 diabetes mellitus: a systematic review and meta-analysis. Sci Rep. 2016; 6: 37067.
8. Kalra S, Gupta Y. Self-management of diabetes in primary care. J Pak Med Assoc. 2015; 65: 686-7.
9. Goksen D, Atik Altinok Y, Ozen S, Demir G, Darcan S. Effects of carbohydrate counting method on metabolic control in children with type 1 diabetes mellitus. J Clin Res Pediatr Endocrinol. 2014; 6: 74-8.