EDITORIAL

Understanding the Importance of Glycemic Index and Glycemic Load in the Management of Diabetes Mellitus

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Introduction

Diabetes mellitus (DM) is the most common endocrine disorder in both developing and developed nations [1]. In India, one in three in urban population and one in five in rural population are found to have latent (glucose intolerance) or frank DM [2]. Though the exact upsurge in diabetes in India is not known, change in lifestyle, increased calorie intake, sedentary life, environmental factors and stressful life are among the potential contributors. Diabetes is usually treated by insulin and oral hypoglycemic agents [3]. However, life style modification through practice of regular exercise, relaxation of body-mind and proper nutrition improves the condition to a greater extent and plays an important role in the long-term treatment of DM. Nevertheless, planning and achieving a proper diet for diabetic patients is the mainstay in clinical strategy in the diabetic management [4].

In general, there is a psychological fear in the public for eating carbohydrate-rich food due to the increasing prevalence of diabetes in the society. But, people at large should understand that eating carbohydrate per se does not cause diabetes, rather the glycemic load of the diet on the body is more important in the genesis of diabetes mellitus [5]. Usually, the advice to eat less simple sugar such as glucose or fructose and to eat more complex carbohydrates or polysaccharides is based on the fact that consuming more starch foods would cause smaller rise in blood glucose than the simple sugars. However, such an assumption is more simplistic since the glycemic response (the level of rise in blood glucose following intake of that particular food) to the complex carbohydrates has been found to vary considerably. Recently, it has been observed that the more accurate indicator of the relative glycemic response is glycemic load, which incorporates the relative quality of carbohydrates characterized by their glycemic index [5].

Glycemic Index: The glycemic index (GI) is a scale that ranks carbohydrate-rich foods for how much they can raise blood glucose levels compared to direct intake of glucose, in the 2-3 hours after eating [6]. That mean absorption of glucose from the intestine is quicker for a food with high GI than with a low GI. The GI of 55 or less ranks as low, a GI of 56-69 is medium, and a GI of 70 or more ranks as high for different food items. Eating a meal containing high GI foods can cause a rapid rise in blood glucose level compared to a meal having low GI foods, containing the same number of calories and nutrients. Therefore, in general one should eat less of high GI

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foods and opt for low and medium GI foods. The disadvantage of a high GI meal is that a quick rise in blood sugar level by it stimulates the pancreas to pour more quantity of insulin into circulation to lower the blood glucose level. The extra insulin remaining in blood helps to rapidly lower the blood glucose level, but by itself insulin is a stimulus for release of other hormones that increase hunger and appetite to restore the blood glucose level. Thus a vicious cycle sets in, which increases the cumulative food intake; and in the long run this exhausts the pancreatic secretion. If the transport of glucose from intestine to blood is faster compared to the speed of movement of glucose into the tissues by insulin, the blood glucose remains high for a longer duration (>2 hrs), and the excess glucose gets converted and deposited as fat. This leads to obesity along with the glucose intolerance. Below are given some of the carbohydrate-rich food and their GI [4]. The numbers are in respect to white bread being 100.

Food	GI	Food	GI
Honey	83	Sweet potato	77
Sugar, white	142	Potato	81
Glucose	137	Potato, steamed	93
Soft drink	97	Potato, boiled, mashed	104
Cherries	32	Potato, baked	121
Grapes	66	Potato, microwaved	117
Apple	54	French fries	107
Orange	63	Beets	91
Mango	80	Carrots	101
Banana	77	Soya beans	25
Pineapple	94	Bengal gram dal	16
Pear, fresh	53	Green gram	54
Plum	55	Red kidney beans (Rajma)	27
Water melon	103	Millet (bajra)	82
Milk, full fat	39	Semolina	94
Milk, skim	46	Raggi	123
Apple juice	58	Jowar	110
Pineapple juice	66	Chick pea flour chappati	39
Orange juice	74	Maize chapatti	89
Kellog's	59	Rice, parboiled	68
Wheat biscuit	100	Rice, brown	79
Cream of wheat	100	Rice, white	83
Rice bran	27	Sweet corn	78
Pastry	84	Wheat kernels	59
Cake, sponge	66	Banana, unripe	100
Pizza, Cheese	86	Pumpkin	107

As we noted here, a food item may not have high carbohydrate content, but has high GI; for example, the carbohydrate content of carrot is only 10.7%, but its GI is 101, which is quite high.

Glycemic Load: Though the glycemic index of the food determines the rapidity at which the blood glucose level is attained by that food item, the quantity of the carbohydrate consumed also significantly determines degree and duration of blood glucose level and insulin response. Therefore, recently the concept of glycemic load has evolved to describe the quality and quality of the carbohydrate that should be present in the meal or the diet for attaining and maintaining a particular blood glucose level. The glycemic index indicates how rapidly a particular carbohydrate food increases blood sugar level, whereas the glycemic load of the food item determines how much of the carbohydrate item should be eaten to attain a longer blood glucose level. A sustained blood glucose level as attained by high glycemic load foods contributes more than the transient hyperglycemia in the genesis of insulin resistance. The glycemic load is calculated by the formula: glycemic index divided by 100 and multiplied by its available carbohydrate content, i.e. the carbohydrates minus fibre expressed in grams. For example, the GI of watermelon is 103, which is very high among the fruits. But, the glycemic load for watermelon calculated on basis of 6 grams per serving quantity is $103/100 \times 6 = 6.18$. Thus, the glycemic load of watermelon is about 6. Similarly, the glycemic load of ice cream is just 8, whereas the glycemic load of white rice is 23. For food substances, the glycemic load of 20 or more is considered high, the glycemic load of 11 to 19 is considered medium, and the glycemic load of 10 or less is considered low. For comparison, list of GI and glycemic load of some few foods items are given below in the tabular form [5].

Food	Glycemic index	Glycemic load
Apple	54	6
Pear	53	4
Watermelon	103	6.18
Baked beans	48	7
Spaghetti	38	18
Ice cream	61	8
White rice	83	23
Bran	42	4

Preventive Perspectives: Diabetes being a problem of persistent hyperglycaemia, dietary modifications should be done to encourage intake of foods having low glycemic index and low glycemic load. This can be achieved by following means [5].

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

The rapid economic growth in India associated with high level of stress, easy accessibility and availability of junk foods with very high glycemic load and sedentary life style have contributed to the development of epidemic of diabetes in our country. Therefore, apart from emphasising the practise of regular exercise and yoga, due emphasis should be given on dietary improvement keeping in mind the glycemic index and glycemic load of the food materials.

References

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