

GLYCAEMIC INDEX OF INDIAN FOODS

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In the management of diabetes mellitus, diet has been recognized as a cornerstone of therapy. There is considerable evidence to show that better control of blood sugar prevents or delays the debilitating complications of diabetes¹. The use of carbohydrate both in terms of quantity as well as quality in diabetic diet, has always been a key therapeutic issue². The amount of total carbohydrate recommended for the diabetic diet has varied significantly over the years³. However, from 1970 onwards, diabetic associations of several countries recommend diet with high carbohydrate and restricted fat^{4,5}.

There are many traditional beliefs regarding the type of carbohydrate in the diabetic diet, which in recent years are questioned. According to traditional thought, simple sugars are rapidly digested and absorbed and therefore diabetics should restrict preparations containing simple sugars.

Recent studies of Jenkins and co-workers⁶ demonstrate that different carbohydrate sources raise the blood sugar to a variable extent and simple carbohydrate exchanges based on chemical analysis are not sufficient to predict the physiological response. As a measure of glycaemic response, they have suggested the use of glycaemic index to classify carbohydrate containing foods into low and high glycaemic substances. Glycaemic index is based on blood glucose response to a food in comparison with response to an equivalent amount of glucose. Jenkins group⁶ and Walker and Walker⁷ published glycaemic indexes of several Western and African foods. From their studies, it is evident that contrary to conventional belief, ingestion of simple sugar like fructose results in a glycaemic response that is 20-29% that of glucose intake whereas ingestion of an equal amount of complex carbohydrate in carrots and potatoes results in a blood glucose response that is 80-90% of glucose.

As there is a paucity of data on glycaemic index of Indian culinary, we selected 10 common Indian preparations containing different cereals and pulses for characterising glycaemic index. The composition of these preparations computed on the basis of Nutritive Value of Indian Foods³ is given in Table 1. As it is customary to take breakfast preparations with a chutney, all the preparations in the present study are served with tomato chutney. Each one of the test preparations is so designed as to provide around 360 calories and 50g carbohydrate.

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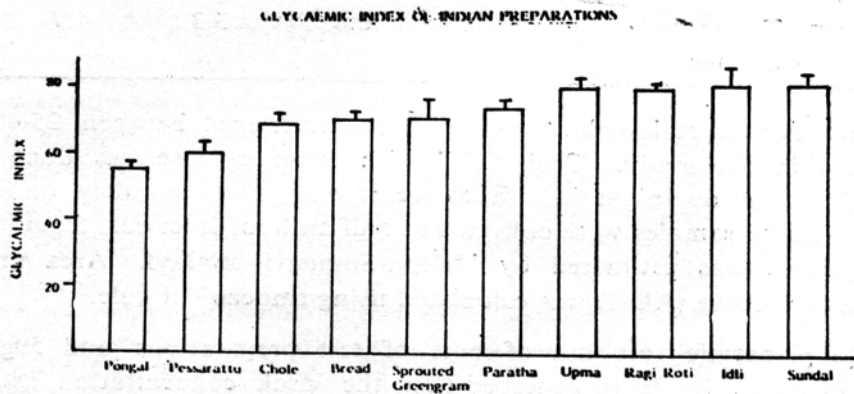
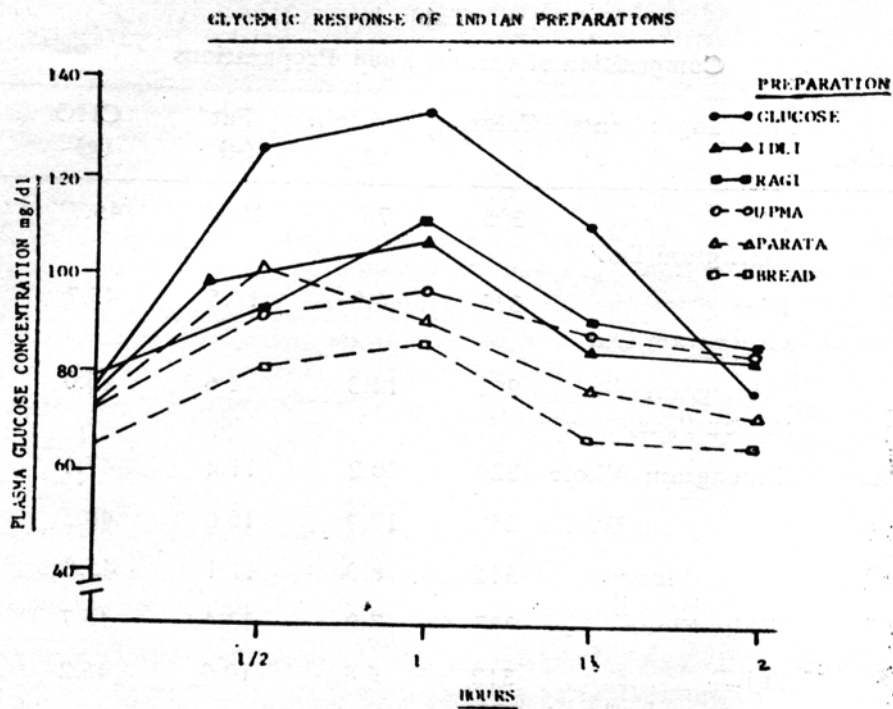
Table 1
Composition of various Food Preparations

Food Preparation	Main Ingredients	Calories	Protein (g)	Fat (g)	CHO (g)	Fibre (g)
Idli	Rice Blackgram Dal	305	7.0	10.4	45.7	0.3
Pongal	Rice Greengram Dal	311	8.0	10.5	45.7	0.3
Chole	Whitegram (Chick Peas)	300	14.3	4.6	46.0	1.7
Pesarattu	Greengram Whole	320	20.2	11.4	47.1	0.9
Sundal	Bengalgram Whole	350	17.0	10.0	48.3	1.3
Paratha	Wheat Flour	315	8.0	11.1	45.8	1.3
Bread	White Flour	337	7.0	13.6	46.7	0.2
Upma	Suji	312	6.8	10.9	46.2	0.4
Ragi Roti	Ragi	312	4.7	11.8	46.5	2.4
Tomato Chutney	Tomatoes Onions	50	0.8	3.3	4.0	0.7

Forty normal male volunteers of our Institute, aged between 25-40 years, participated in the study. Oral GTT with 50gm glucose was done in each individual after an overnight fast. Each recipe was given separately on a second occasion. Blood samples were collected at half an hour intervals from 0-2 hrs. Plasma glucose was estimated by Nelson-Somogyi method. Area under the plasma glucose curve (AUC) was calculated using trapezoidal rule.

The glycaemic response of some of test preparations and 50g glucose is shown in Figure 1. It is observed that the peak concentration as well as overall glycaemic response of all test preparations is significantly lower as compared to glucose.

The glycaemic indexes of test preparations, calculated as suggested by Jenkins and co-workers⁶ are given in Figure 2. The glycaemic index of bread in the present study is 70 which is similar to that reported by Jenkins and coworkers⁶ and by Walker and Walker⁷. It is observed that pongal and pesarattu, containing green gram have low glycaemic index as compared to others.

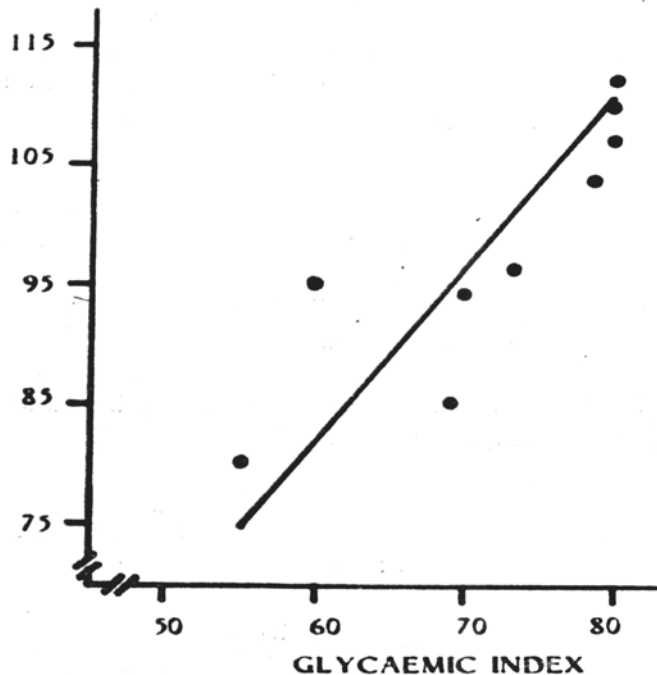


Although sundal and chole have high protein content than others, the glycaemic index is not low, thereby indicating that the level of protein in a preparation may have no influence on glycaemic response.

The relationship between the peak plasma concentration (C_{max}) and glycaemic index is shown in Figure 3. There is a significant correlation between C_{max} and glycaemic index ($r=0.852$; $P<0.01$). This indicates that the preparation with high glycaemic index tends to raise the peak blood glucose concentration to a greater extent as compared to a food preparation with low glycaemic index.

RELATIONSHIP BETWEEN GLYCAEMIC INDEX AND Cmax

$$r = 0.852 \quad P < 0.01$$
$$y = 3.82 + 0.69x$$



The slope of the glycaemic response is calculated as suggested by CallePascual⁹. There is a significant inverse correlation between the slope and glycaemic index of different test preparations ($r = -0.636$; $P < 0.05$). This indicates that preparations with lower glycaemic index raise the blood glucose to a lesser extent and also at a slower rate as compared to higher glycaemic index substances.

Then what are the factors which affect glycaemic response? Several factors such as fibre content¹⁰, physical form of the preparation¹¹, nature of cooking¹², presence of antinutrients¹³, fat and protein content¹⁴ have been shown to affect glycaemic response. But the role of some of these factors is doubtful. For example, it has been shown that there is no difference in glycaemic response of orange juice and orange, and also of white bread and brown bread, although there is considerable difference in fibre content of these foods¹⁵. Similarly, although fat is associated with decreased gastric emptying time, addition of fat to a carbohydrate load does not necessarily alter its glycaemic effect¹⁶. The current evidence indicates that our knowledge of the glycaemic response to different carbohydrates is inadequate to predict consistently and accurately the glycaemic response to a particular food. The differences observed in the glycaemic index of different test preparations in the present study may be due to differences in nature of carbohydrate, fibre content, physical form of preparation

and also the type of cooking. The results of the study lend support to the current concept that with chemical analysis of food for its carbohydrate content it is not possible to predict the physiological response to a food.

Summary

In the limited study we conducted on 10 preparations based on different cereals and pulses, we observed that glycaemic index of commonly consumed Indian preparations is not widely different and we did not identify any Indian preparation with very low glycaemic index. Of all the foods tested, preparations containing green gram, such as pongal and pesarattu have a lower glycaemic index as compared to others. There is a need to extend these studies to other food preparations and also to mixed meals in normals and diabetics to elucidate the factors affecting the glycaemic response to a food.

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