



# 11

## *Introduction to Diet Therapy*

Diet therapy is concerned with the modification of the normal diet to meet the requirements of the sick individual. Its purposes are:

- To maintain good nutritional status.
- The energy requirements of patients with disease are similar to or less than or more than those of healthy subjects. Basal hypermetabolism of disease often offset by decreased physical activity.
- To correct deficiencies.
- To afford rest to the whole body or the part that is affected.
- To maintain body's ability to metabolise the nutrients.
- To bring about changes in body weight whenever necessary.

Diet therapy in most instances is not a remedy in itself but is a measure which supplements or makes the medical or surgical treatment more effective.

Diet is used as therapeutic purpose not only because of the presence of nutrients but also contains chemical substances which act as antioxidants, detoxifying agents or blocking or suppressing agents or help in excreting toxic substances or maintain proper intestinal flora or to improve the immunity. In planning diets these factors also should be kept in mind. While planning therapeutic diets, understanding drug-nutrient relationship is essential.

### **GLYCAEMIC INDEX**

All foods are not digested or absorbed at the same rate and hence their glycaemic index levels are different. In planning diets one need to consider glycaemic index of food.

The glycaemic index is a ranking of foods based on the postprandial blood glucose response compared with a reference food (Jenkins, 1981).

The ability of the food item to raise the blood sugar is measured in terms of glycaemic index. The area above the fasting glucose concentration is calculated and is expressed as a percentage of the area obtained after the ingestion of 50 g glucose or 50 g carbohydrate from white bread. The higher the area under the curve the higher the glycaemic index.



$$\text{Glycaemic index} = \frac{\text{Incremental area under the 2 hours plasma glucose curve after eating 50 g of CHO from test food}}{\text{Incremental area under the 2 hours plasma glucose curve after taking 50 g CHO from white bread}} \times 100$$

The index integrates multiple influences on glucose availability and is proposed as a means for prescribing diets in different diseases.

Foods low in GI may reduce the insulin demand, improve blood glucose control, reduce lipid concentrations and body weight and thereby could help prevent diabetes.

### Factors Affecting the Glycaemic Response to Food

The rate of digestion of the food is an important determinant of glycaemic response. Intrinsic and extrinsic factors that alter the rate of gastrointestinal motility, digestion and absorption and the nature of the starch, cooking method, particle size and the presence of fibre fat and proteins are all found to result in differences in the glycaemic index.

Glycaemic index is not significant in low energy foods in which the ratio of other desirable factors—minerals, vitamins and fibre to available carbohydrate is like carrots.

#### *Factors affecting glycaemic response to food*

Rate of ingestion

Food components

Protein and Fat content

Complex carbohydrates

Acidity

Methods of cooking and processing food

Physiologic effects

Pregastric hydrolysis

Gastric hydrolysis

Intestinal response

Intestinal hydrolysis and absorption

Pancreatic and gut hormone responses

Colonic effects

#### Rate of ingestion

Sipping 50 g of glucose slowly over a several hour period produces a much smaller increase in blood glucose than rapid intake of the same amount. Eating three apples takes more than 15 minutes whereas their juice can be consumed in 1.5 minutes. As the rate of ingestion increases the glycaemic index also increases.

#### Food components

**Protein and Fat content:** Foods rich in fat and protein like ice creams, groundnut and milk have low glycaemic index. But they are not recommended for diabetics because they have high calorific value. Pulses which have high protein are low in glycaemic index compared to cereals.

**Complex carbohydrates:** Starches have low glycaemic index compared to sugar. As the fruits ripen starch gets converted to glucose and glycaemic index increases.



The glycaemic index of starch is affected by the proportion of amylose to amylopectin in the grains. The higher the proportion of amylopectin, the higher the glycaemic index because amylopectin, which is made up of branched-starch molecules is more easily hydrolysed in the gut than is the single strand amylose. Some starches are more slowly digested not only because of amylose content but also because they are protected in structure for the enzymes to act.

Complex carbohydrates like fibre which is not disrupted adequately, take longer time to pass through the stomach and small intestine. Soluble fibre with the viscosity increasing property slow down passage and delay gastric emptying. Foods with soluble fibre such as beans have a low glycaemic index.

Most varieties of rice have high GI. Rice with higher amylose content is low in GI. Rice bran which is rich in fibre and oil is low in GI. Brown rice and red rice have low GI due to the presence of fibre.

**Acidity:** An increase in the acidity of a meal can greatly lower its GI. Increasing the amount of vinegar in a meal, for instance, affect the glucose response. The addition of sour dough bread to a meal can result in different GIs, depending on its content of organic acids. These foods apparently affect the glucose response at least partially by slowing gastric emptying.

Phytic acid, usually contained in cereals and pulses may have a more dominant role in decreasing the blood sugar rise than fibre.

### **Food processing**

GI is dependent on the history of processing, storing, ripening, cutting and cooking of the food. The more processed a food is, the higher the glycaemic response. New methods such as extrusion cooking, explosion puffing and instantisation appear to make the starch in these foods more readily digested. Conditions which are known to increase the digestibility of starches are those which produce obvious hydration of the granules (gelatinisation), distinct changes in chemical nature or disruption of the organised granule structure. Such conditions increase the availability of the starch to amylose and are more likely to occur during factory processing because of the higher temperatures and pressures involved. Cornflakes produced from maize grits which are thoroughly cooked at elevated pressure, rolled and then toasted. In contrast, conventional cooking methods such as boiling involve less physical disruption and only moderate heat and are therefore less likely to cause starch damage or complete gelatinisation. The heat and the amount of water utilized and the time of cooking affect GI.

White rice has higher glycaemic response compared to brown rice. Polishing the rice increases glycaemic index. Rice varieties belonging to sona masuri, ponni and surti kolam have high GI, according to the studies conducted at International Diabetes Federation Centre of Education, Chennai. Wheat which is normally eaten as rotis probably has lower GI compared to refined cereals. Higher amount of protein and fibre and the mode of eating makes wheat preferable cereal. Multi-grain atta has better GI values. Presence of acarbose in wheat may also influence GI.

Parboiled rice has lower GI compared to non parboiled rice. During parboiling retrogradation of starch and formation of resistant starch formation occur. When starch undergoes retrogradation it becomes insoluble and not available to hydrolysis in the small intestine. Starch also forms insoluble complexes with proteins such as browning- Maillard-reaction, making it unavailable to digestion and absorption. Pasta products have different GIs depending on its type. The GIs of macaroni, star pasta and spaghetti are 68, 54 and 45.



## Physiological effects

Digestion of dietary carbohydrate in the upper gastrointestinal tract provides glucose, fructose and galactose for intestinal absorption. The presence of nonabsorbable oligosaccharides and viscous dietary fibres such as pectins,  $\beta$ -glucans and gums in fruits, vegetables and cereals reduce the efficiency of enzyme hydrolysis and slow the rate at which glucose enters the blood stream.

Starch encased in its seed coat or coarsely ground is not efficiently hydrolysed to glucose because digestive enzymes are prevented from reaching the starch.

Starch granules subjected to moist heat and subsequent cooling become dense and less available to enzyme action. Thus the physical form as well as food processing and cooking methods influence the energy availability of dietary carbohydrate.

Acarbose, present in wheat, is a competitive inhibitor of sucrose and pancreatic amylase. It lowers post prandial blood glucose rise.

## Classification of glycaemic foods

Foods are classified according to the GI.

High glycaemic foods 65-75 GI—Sugars, refined cereals processed breakfast cereals, sticky and waxy rice, banana, root vegetables, white bread

Intermediate glycaemic foods 45-55 GI—Fruits, unrefined cereals

Low glycaemic foods 30-40 GI—legumes, nuts.

According to the studies conducted at Dr. Mohan's diabetes specialities centre and Madras diabetes research foundation. GI values of rotis can be reduced when whole wheat flour is mixed with roasted bengal gram flour, psyllium husk powder and debittered fenugreek powder.

**Table 11.1 Glycaemic Index of Different Foods**

Foodstuff	Glycaemic index	Foodstuff	Glycaemic index
White wheat bread	75 $\pm$ 2	Mango (raw)	51 $\pm$ 5
Whole wheat bread	74 $\pm$ 2	Watermelon	76 $\pm$ 4
Wheat roti	62 $\pm$ 3	Potato (boiled)	78 $\pm$ 4
Chapatti	52 $\pm$ 4	French fries (potato)	63 $\pm$ 5
White boiled rice	73 $\pm$ 4	Carrots (boiled)	39 $\pm$ 4
Brown boiled rice	68 $\pm$ 4	Milk (Full fat)	39 $\pm$ 3
Barley	28 $\pm$ 2	Milk (skim)	37 $\pm$ 4
Instant oat porridge	79 $\pm$ 3	Ice cream	51 $\pm$ 3
Rice porridge/congee	78 $\pm$ 9	Chick peas	28 $\pm$ 9
Millet porridge	67 $\pm$ 5	Soya beans	16 $\pm$ 1
Sweet corn	52 $\pm$ 5	Lentils	32 $\pm$ 5
Cornflakes	81 $\pm$ 6	Chocolate	40 $\pm$ 3
Apple (raw)	36 $\pm$ 2	Popcorn	65 $\pm$ 5
Orange	43 $\pm$ 3	Soft drinks/soda	59 $\pm$ 3
Banana	51 $\pm$ 3	Honey	61 $\pm$ 3
Pineapple	59 $\pm$ 8	Glucose	103 $\pm$ 3

*Cited from:* Dietary guidelines for Indians - A manual, 2011, National Institute of Nutrition, Hyderabad.



## Glycaemic load

Glycaemic index ignores how much of that food a person eats. Walter Willet of Harvard University pioneered the concept of glycaemic load. The glycaemic load is the product of the dietary glycaemic index and total dietary carbohydrate.

$$\text{Glycaemic load} = \frac{\text{Glycaemic index}}{\text{Carbohydrate}} \times 100$$

Glycaemic load assesses the total glycaemic effect of the diet and has proved to be very useful in epidemiologic studies. The emphasis should be on low glycaemic loads as steady blood glucose also helps keep the appetite in check. One need to choose good carbohydrate to be healthy.

A glycaemic load of 10 or less is considered low, 11 to 19 is medium and 20 or more is high. Consistently eating low glycaemic load foods evens out blood sugar peaks and valleys. According to Willet this helps to keep appetite and weight under control. Good carbohydrate means that the food should be rich in fibre and low in GL.

Glycaemic Index has been endorsed by the FAO/WHO and numerous other international health related organisations.

## DIETARY SUPPLEMENTS

Dietary supplements are a group of products intended to supplement the diet. It contains atleast one ingredient that is a vitamin, mineral, amino acid, herb or other botanical or a combination thereof.

Dietary supplements are consumed by apparently normal or diseased individuals with or without prescription by a physician or a dietitian to improve the general well being.

Dietary supplements may contain predigested and easily absorbable nutrients in concentrated form. They may have foods which have nutraceutical properties. Some may be amylase rich foods and some may contain mushrooms, soyabean or milk protein as main ingredient. Some may contain herbs or substances traditionally used for well being but scientifically might not have been proved. Multivitamin and multimineral dietary supplements are the most popular dietary supplements.

A study was conducted by NIN on supplementation of nutritional beverage, additional micro-nutrients in younger school children. The study revealed nutritional supplementation improved physical and mental development of children.

Dietary supplements are required by:

- people who are not taking enough food and have nutrient deficiencies,
- pregnant and lactating women (foliate, iron),
- new born (vitamin K),
- those addicted to alcohol,
- those recovering from surgery, burns, injury or illness,
- vegans,
- people taking medications that interfere with the body's use of nutrient,
- those who have lactose intolerance (calcium),
- chronic drug consumers,
- habitual dieters,
- elderly people,
- patients suffering from infections like AIDS and other wasting diseases.
- to compensate for suboptimal diet
- for medical conditions
- to prevent chronic disease incidence or progression.



Dietary supplements are used more often by non smokers. People who exercise regularly. Those with higher education and incomes and those who report better over all health Adults take supplements for heart health, lower cholesterol and bone health, most common organ specific reasons.

### Type of Supplements

**Herbal supplements:** Garlic, wheat grass, alfalfa, ginseng, aloe vera, spirulina, turmeric.

**Body building products:** Amino acids, anabolic/muscle building.

**Laxative supplements:** Psyllium, wheat bran, weight loss products, lecithin.

**Other biologic and nutrient supplements:** Antioxidants, fish oils, bioflavonoids, combination of cereals, pulses, nuts and milk products, amylase rich foods.

Dietary Supplements which are proven claim are given in Table 11.2.

**Table 11.2 Dietary supplements proven claims**

<i>Dietary supplement</i>	<i>Claim</i>
Arginine	Beneficial in CVD, cancer and for wound healing
Bovine	Colostrum Immune booster for sports persons
Calcium	Prevents osteoporosis Reduces blood pressure
Chromium	Helps control diabetes
Coenzyme Q <sub>10</sub>	Cardio protective
Creatine	Increase in muscular strength
Fish oil	Cardio protective
Folic acid	Prevents birth defects
Fructo oligosaccharides	Healthy digestive system
Glycerol	Improves hydration status
Green Tea Extract	Strong antioxidant
$\beta$ -hydroxy $\beta$ -methyl butyrate	Increases muscle mass and strength
Sodium bicarbonate	Enhances power and strength
Soya protein and isoflavones	Lower cholesterol
Selenium	Anti cancer

To get the most from the supplement of vitamins and minerals, supplements are to be taken with food. An iron supplement should be taken with foods that assist in its absorption such as meats, fish or poultry or foods that contain vitamin C.

Although dietitians should continue to encourage nutrient dense food choices first, dietary supplements may be a useful approach for meeting some micronutrient needs in certain at risk subpopulations.

Most dietary supplements are expensive. For some they may not be required or may not have any impact on health. Supplements need to be taken only on prescription.

## DIET AND INFLAMMATION

It appears that one link between stress and disease is altered immune response that causes inflammation. This is evidenced by an increase in the acute phase response c-reactive protein and proinflammatory cytokines, Interleukin factor-1, Interleukin factor-6 and Tumor Necrosis Factor. Chronic inflammation is caused by life style factors such as poor diet and stress which increases cortisol levels, affecting immune system.