# Glycemic index and Glycemic load

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Lecturer

- The glycemic index (GI): The Glycemic Index (GI) is a ranking system that measures how quickly a carbohydrate-containing food raises blood glucose levels compared to pure glucose.

**Effects of nutrients on blood glucose over time**

Carbohydrate
Protein
Fat

Blood glucose

0   1 hr   2 hrs   3 hrs   4 hrs   5 hrs   6 hrs

Time (hrs)
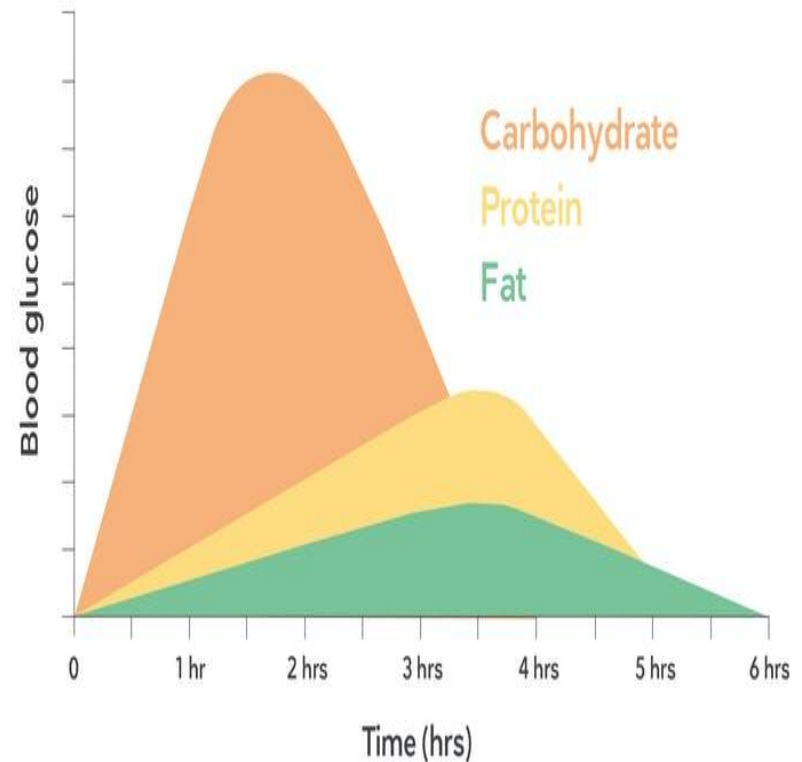
Foods are classified as:

- **Low GI (≤ 55):** Digested and absorbed slowly, leading to gradual increases in blood glucose (e.g., lentils, whole grains, most vegetables).

- **Medium GI (56–69):** Moderate impact on blood glucose levels (e.g., brown rice, sweet potatoes, honey).

- **High GI (≥ 70):** Rapidly digested and absorbed, causing sharp spikes in blood glucose (e.g., white bread, sugary cereals, potatoes).

high GI

medium GI

low GI

Blood Sugar Levels

Time
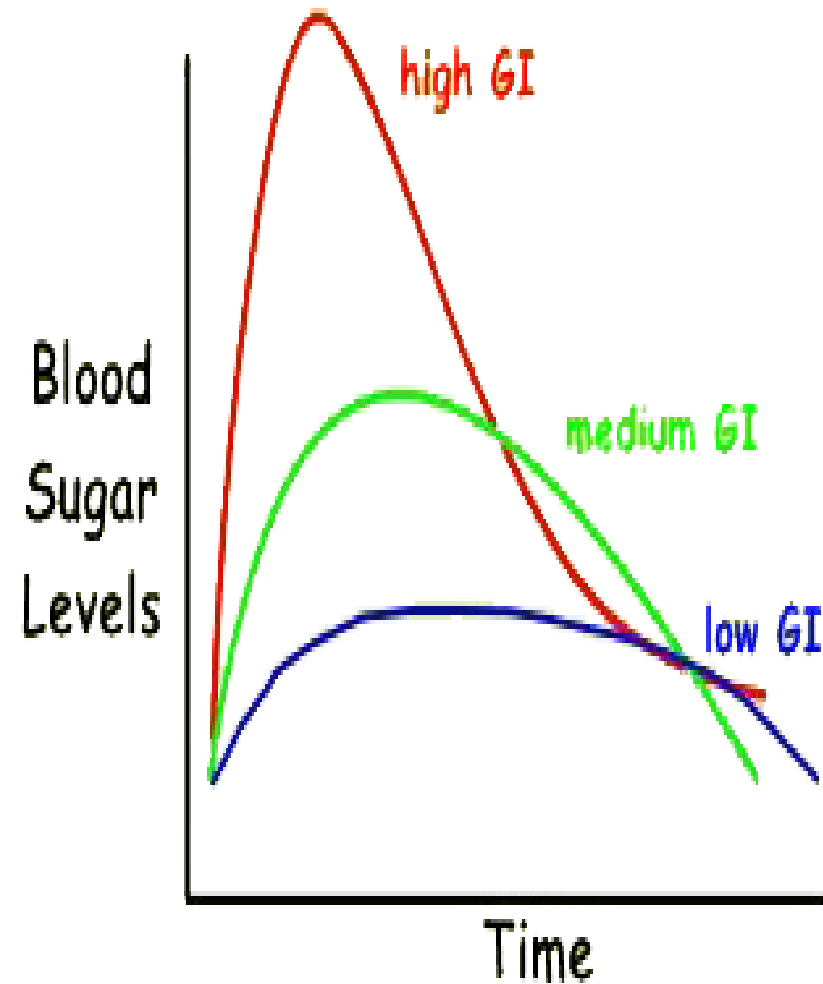
- Consumption of high-GI foods causes a sharp increase in [postprandial](#) blood glucose concentration that declines rapidly

- Consumption of low-GI foods results in a lower blood glucose concentration that declines gradually.
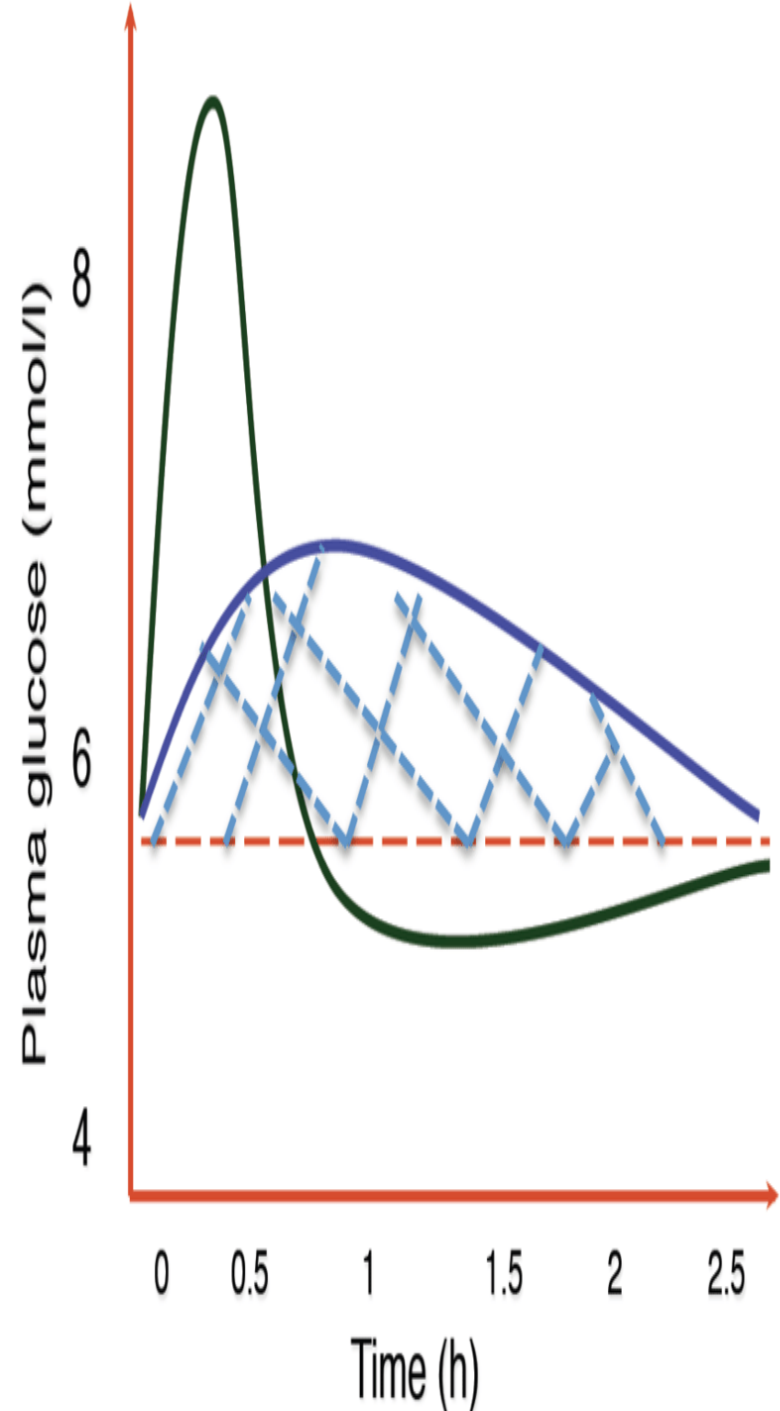
Factors Influencing GI:

- **Food Processing:** More processed foods tend to have a higher GI.

- **Fiber Content:** High-fiber foods slow digestion, lowering GI.

- **Cooking Method:** Boiling generally lowers GI, while baking or frying can increase it.

- **Fat and Protein Content:** These components slow carbohydrate absorption, lowering GI.

What is Glycemic Load (GL)?

• While GI measures the quality of carbohydrates, Glycemic Load (GL) considers both the quality and quantity of carbohydrates in a serving. It is calculated as:

$$\text{Glycemic Load} = \frac{\text{Carbohydrate content (g)} \times \text{Glycemic index}}{100}$$

The carbohydrate content may apply to an individual food or the sum of all foods in a meal, or even in a day

Dividing by 100 returns the glycemic index to a ratio, rather than a percent

Classification:

- **Low GL (≤ 10):** Minimal impact on blood sugar (e.g., nuts, non-starchy vegetables).

- **Medium GL (11–19):** Moderate impact (e.g., oatmeal, brown rice).

- **High GL (≥ 20):** Significant increase in blood sugar (e.g., white rice, sugary drinks).

- [Prospective cohort studies](#) found high-GI or -GL diets to be associated with a higher [risk](#) of adverse health outcomes, including type 2 [diabetes mellitus](#) and [cardiovascular disease](#).

Measuring the glycemic index of foods

- To determine the glycemic index (GI) of a food, healthy volunteers are typically given a test food that provides 50 grams (g) of carbohydrate and a control food (white, wheat bread or pure glucose) that provides the same amount of carbohydrate, on different days
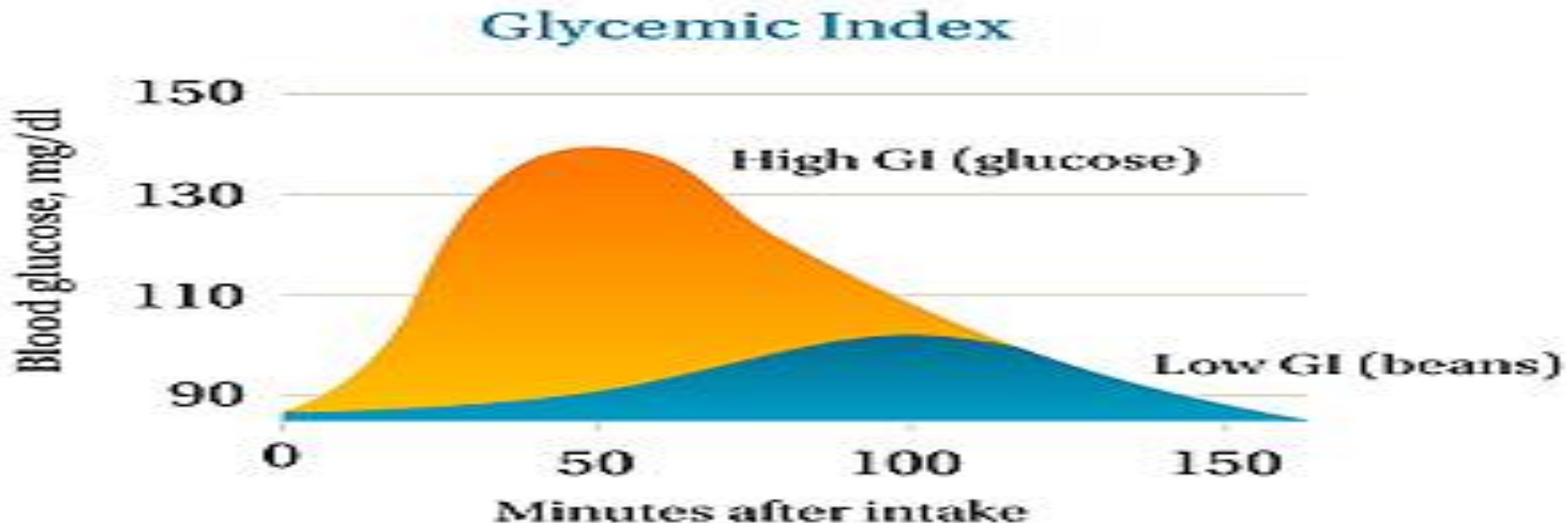
- Several dietary [intervention studies](#) found that low-GI/GL diets were as effective as conventional, low-fat diets in reducing body weight. Both types of diets resulted in beneficial effects on metabolic markers associated with the risk of type 2 diabetes mellitus and cardiovascular disease.

- Lowering dietary GL can be achieved by increasing the consumption of whole grains, nuts, legumes, fruit, and non-starchy vegetables, and decreasing intakes of moderate- and high-GI foods like potatoes, white rice, white bread, and sugary foods.

Clinical Significance of GI and GL

- **Diabetes Management:** Low GI/GL diets help control blood sugar levels and reduce insulin spikes.

- **Weight Management:** Foods with a lower GI promote satiety and reduce overeating.

- **Cardiovascular Health:** High-GI foods are linked to increased risk of heart disease.

- **Athletic Performance:** High-GI foods provide quick energy for athletes, while low-GI foods support sustained endurance.

Body energy

- Food provides the necessary energy for the body to function, grow, and repair itself. This energy is measured in calories or kilocalories (kcal).

What is Food Energy?

- Food energy refers to the amount of energy released from macronutrients (carbohydrates, proteins, and fats) during metabolism. The body uses this energy for essential functions such as:

- Basal Metabolic Rate (BMR)

- Physical activity

- Thermogenesis (heat production)

- Growth and repair processes

- **Calorie (cal):** A small unit of energy, defined as the amount of heat required to raise the temperature of 1 gram of water by 1°C.

- **Kilocalorie (kcal):** Equals 1,000 calories; used in nutrition to represent the energy content of food. In common usage, "calories" on food labels refer to kilocalories.

Energy Content of Macronutrients

- Macronutrients provide different amounts of energy:
- **Carbohydrates:** 4 kcal per gram
- **Proteins:** 4 kcal per gram
- **Fats:** 9 kcal per gram
- **Alcohol (Ethanol):** 7 kcal per gram (not considered an essential nutrient)
- Thus on an equal weight basis, fat generally yields 2.25 times as many calories as protein or carbohydrate.

Energy Requirements and Expenditure

- Total energy expenditure (TEE) includes:
- **Basal Metabolic Rate (BMR):** Energy required for vital functions at rest (~60–70% of total energy needs).
- **Physical Activity:** Energy burned during exercise and daily movements (~20–30%).
- **Thermic Effect of Food (TEF):** Energy used to digest, absorb, and metabolize food (~10%).

Factors Affecting Energy Needs:

- Age, gender, and body composition
- Physical activity level
- Health conditions (e.g., fever, pregnancy, metabolic disorders)

Clinical Importance in Nursing

- **Nutritional Assessment:** Nurses should evaluate patients' caloric needs based on health conditions and activity levels.

- **Dietary Counseling:** Educating patients about balanced diets and energy intake to prevent malnutrition and obesity.

- **Managing Metabolic Disorders:** Monitoring caloric intake for patients with diabetes, cardiovascular diseases, and eating disorders.

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