Development of a Glycemic Index Database for Dietary Assessment

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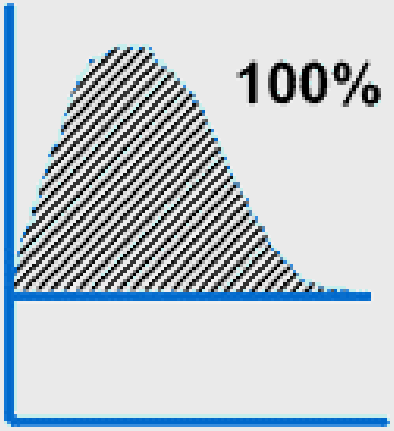
What is glycemic index?

- Applies only to carbohydrate foods.
- Ranks foods based on their effect on postprandial glycemia.
- Determined *in vivo.*
- Measures glucose response of a reference food (e.g. glucose or white bread). By definition, GI = 100.
- Measures glucose response of test food.
- Ratio of the area under the curve of the test food to the reference food X 100 = GI.

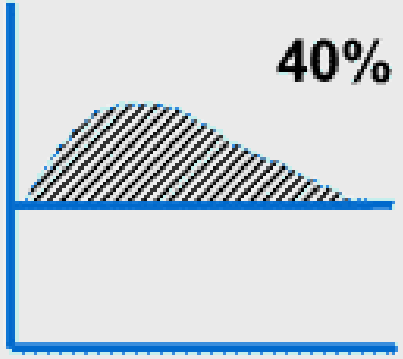
The two hour blood sugar response of a reference food vs a test food

Reference food



Glucose, GI score = 100

Test food



Lentils, GI score = 40

The amount of carbohydrate (starch & sugars) in the reference and test foods must be the same.

Factors Affecting Glycemic Index

- Higher GI
  - Starch gelatinization
  - Moist cooking methods
  - Refined grains
  - Amylopectin starch
- Lower GI
  - Amylose starch
  - Resistant starch
  - Intact grains
  - Fermentation
  - Dairy protein
  - Fructose

Classifying Foods

- **High GI = 70 or more**
  - White Bread
  - Processed Cereals
  - Potatoes
  - White Rice (low amylose)
- **Medium GI = 56 to 69**
  - Rye bread
  - Banana
  - White rice (high amylose)
  - Sweet corn
- **Low GI = 55 or less**
  - Milk
  - Apple
  - Legumes
  - Pasta
  - All Bran cereal

Carbohydrate Intake and Chronic Disease

- Diabetes
- Coronary Heart Disease
- Obesity
- Cataracts
- Cancer

Nutrition Data System for Research (NDSR)

- Standardized collection of food intake data
- Database of 18,000+ foods based on 2258 core foods
- Core foods determine nutrient values for other foods
  - Similar foods
  - Recipes
  - Commercial product formulations

Database Preparation for Addition of Glycemic Index

- Added two fields for GI.
  - Glucose reference
  - Bread reference
  - GI (bread) = 1.43 X GI (glucose)
- Added field for available carbohydrate.
  - acho = total carbohydrate – total dietary fiber

Determining GI Values for NDSR Foods

- Match core foods to published GI.
- Estimate GI from a similar food.
- Use a default GI for low carbohydrate foods.
- Assign GI = 0 for foods with no available carbohydrate.
- Calculate GI for multi-component foods from available CHO and GI of ingredients.

Matching to Published GI Values

- Select data sources.
  - **International Table of Glycemic Index and Glycemic Load Values: 2002 (Foster-Powell et al)**
  - **Other current journals**
- Match by description, type of carbohydrate, preparation or processing method.
- Select North American foods, healthy subjects, 2 hr glucose response.

Estimating GI from Similar Foods

- Average GI for similar food group
  - Starchy root vegetables
  - Legumes
  - Tropical fruits
  - Berries
  - Nuts
- Cheese = GI of milk
- Refined white flour = GI of white bread
- Luncheon meats with cereal fillers = GI of sausage

Default and Zero Values

- Foods with low carbohydrate content
  - Default GI = 50 (glucose reference)
  - Midway between 0 and 100
  - Diet GI is not affected appreciably by the default value
- Foods with no available carbohydrate
  - GI = 0

Calculating GI for Multi-component Foods

Ingredient	ACHO (g)	Proportion of total ACHO	Ingredient GI	Proportional GI (proportion of total ACHO X ingrd GI)
Figs, dried	14.12	0.2119	61	12.9
Flour, white, all-purpose	17.79	0.2670	70	18.7
Corn syrup	12.92	0.1939	105	20.4
Sugar, white, granulated	16.81	0.2523	61.4	15.5
High fructose corn syrup	4.95	0.0743	73	5.4
Shortening, soybean	0	0	0	0
Eggs, whole	0.03	0.0005	0	0
Salt	0	0	0	0
Total for Food	**66.62**	1.0000		**72.9**

The GI Database in

- Carbohydrate-containing foods
  - 22% direct matches
  - 23% similar matches
  - 17% default GI
  - 38% calculated from ingredients
- Major carbohydrate contributors
  - 60% direct matches
  - 19% similar matches
  - 1% default GI
  - 20% calculated from ingredients

Evaluation of Calculation Method

	Median	Mean	S.D
Calculated GI	66.0	64.3	9.9
Analyzed GI	64.5	61.3	16.2

Evaluation of Calculation Method

- Calculation underestimates GI.
  - Unsweetened RTE cereals
- Calculation overestimates GI.
  - Sweetened dairy products

GI Database Limitations

- Limited GI values for U.S. foods.
- Unable to account for variation in cooking times, storage, fruit ripeness.
- Lack of GI values for ingredients used in commercially processed foods.

Future GI Database Modifications

- Addition of more GI values from U.S. foods.
- Addition of “gelatinized cereal grains” for RTE cereal calculations.
- Addition of “low-GI sugars” for use in dairy food calculations.
- Addition of more core foods to increase GI specificity.

Uses of the GI Database

- Determine diet GI.
- Rank high carbohydrate foods.
- Substitute low-GI foods for high-GI foods.
- Couple GI with nutrient density to assess food quality.

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