



# KARBOHIDRAT

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# Apa yang Anda Ketahui tentang Karbohidrat?

Apakah ada karbohidrat baik dan karbohidrat jahat?

- Apakah sebetulnya karbohidrat itu?
- Sumber makanan apa saja yang mengandung karbohidrat?
- Apakah menghilangkan karbohidrat dari diet sehari-hari menyehatkan?
- Apa yang dimaksud dengan indeks glikemik makanan?

# Karbohidrat

- Tiap gram karbohidrat menghasilkan energi 4 kcal
- Membentuk glycogen
- Antiketogenic
- Energi penting untuk otak
- Serat yg terkandung mrp - bulking agent

# Struktur kimia karbohidrat

- Terdiri atas Carbon (C), Hydrogen (H), dan Oxygen (O).
- Sebagian besar mempunyai perbandingan rasio 1 molekul carbon 1 molekul air (CH<sub>2</sub>O).
- Carbo = carbon
- Hydrate = with water

# Apa saja yg termasuk karbohidrat?

- Roti, biji-bijian (termasuk beras), pasta, legumes -25 g/serving
- Buah – menyediakan 12 g/serving
- Susu & produk olahannya – 12 g/serving
- Sayuran – menyediakan 5 g/serving
- Daging & lemak/minyak – 0 g/serving

# Rekomendasi karbohidrat

- RDA karbohidrat: 130 g/hari;
- 45%-65% intake energi total harian.

# Jenis Karbohidrat

- Karbohidrat sederhana: Monosakarida & Disakarida
- Karbohidrat kompleks: Polisakarida → amilum (starch), serat, & glikogen



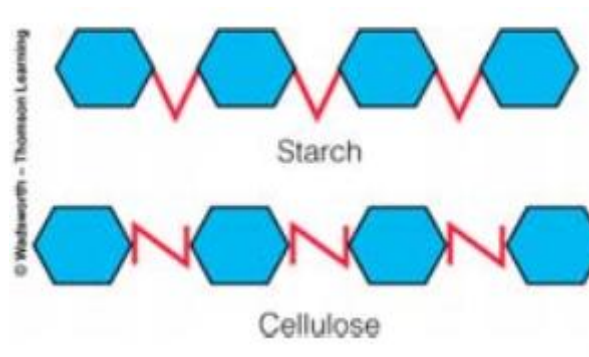
# Jenis Karbohidrat

- Monosakarida: glukosa, fruktosa, galaktosa
- Disakarida:
  - Maltosa: glukosa + glukosa
  - Sukrosa: glukosa + fruktosa
  - Laktosa: glukosa + galaktosa
- Polisakarida: strach, serat, glikogen



# Serat

- Cellulosa, hemicellulose, lignin, pectins, gums, mucilages



# Apa yg terjadi dg gula sederhana setelah diabsorpsi?

- Glukosa, galaktosa, & fruktosa beredar di dalam darah dari usus halus ke hati
- Hati mengubah semua fruktosa & galaktosa menjadi glukosa
- Glukosa digunakan sbg sumber energi
- Kelebihan glukosa disimpan sbg glikogen

# Glukosa di dalam tubuh

- Fungsi utama glukosa dalam tubuh adalah sbg sumber energi (otak, saraf, sel drh merah memilih glukosa sbg sumber energi utama)
- Glukosa yg tidak digunakan oleh tubuh akan diubah mjd glikogen di dalam hati. Jika simpanan glikogen penuh, kelebihan glukosa akan digunakan utk membuat asam lemak & disimpan dalam jaringan adiposa.

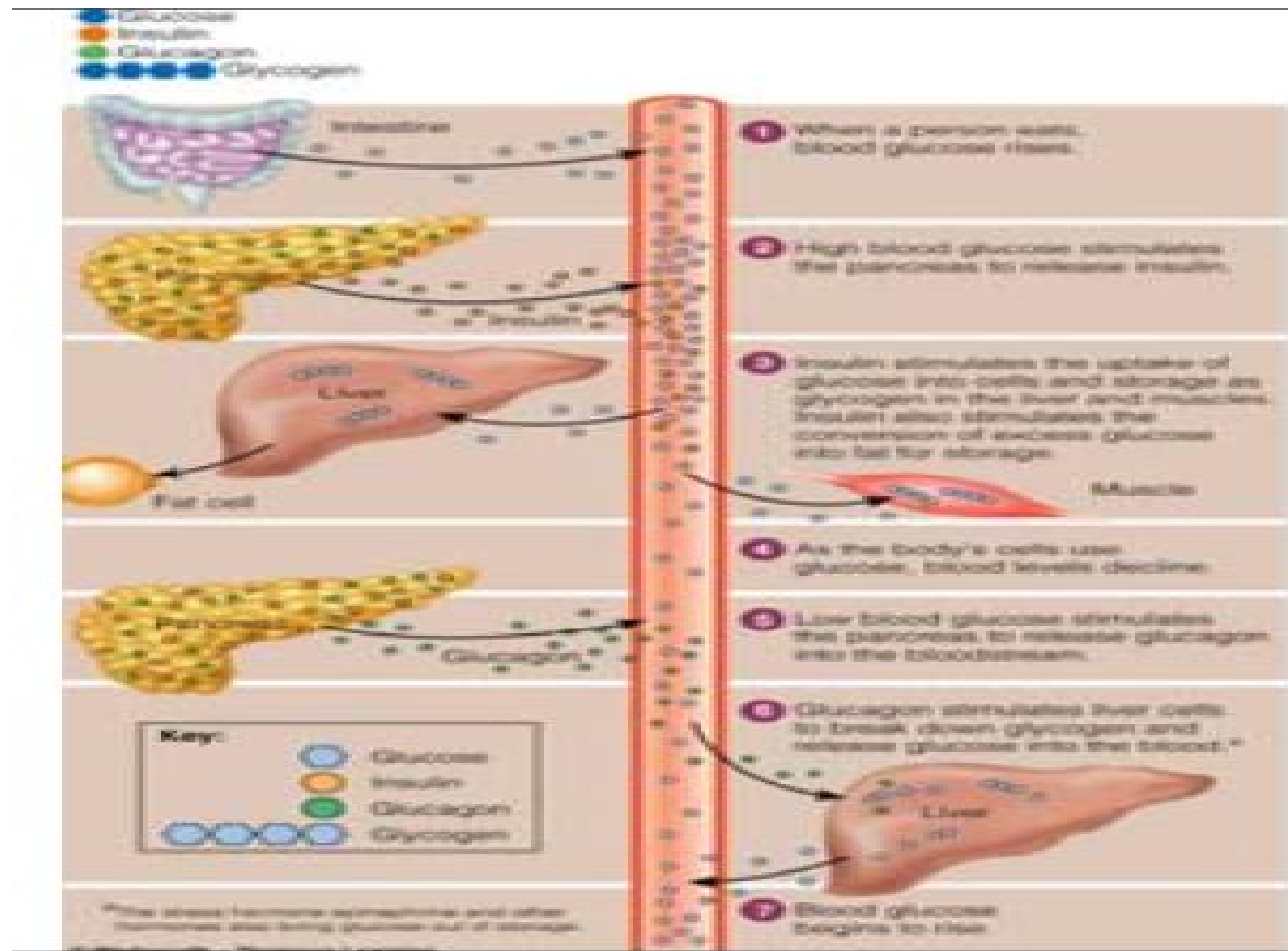
# Apa yg terjadi jika asupan karbohidrat kurang?

- Tubuh akan membuat glukosa dari protein
- Proses ini disebut Glukoneogenesis, terjadi di dalam hati
- Sebetulnya protein mpy tugas tersendiri, yaitu untuk membangun jaringan & memperbaiki sel-sel yg rusak. Jika digunakan sbg sumber energi makan tubuh akan rugi.

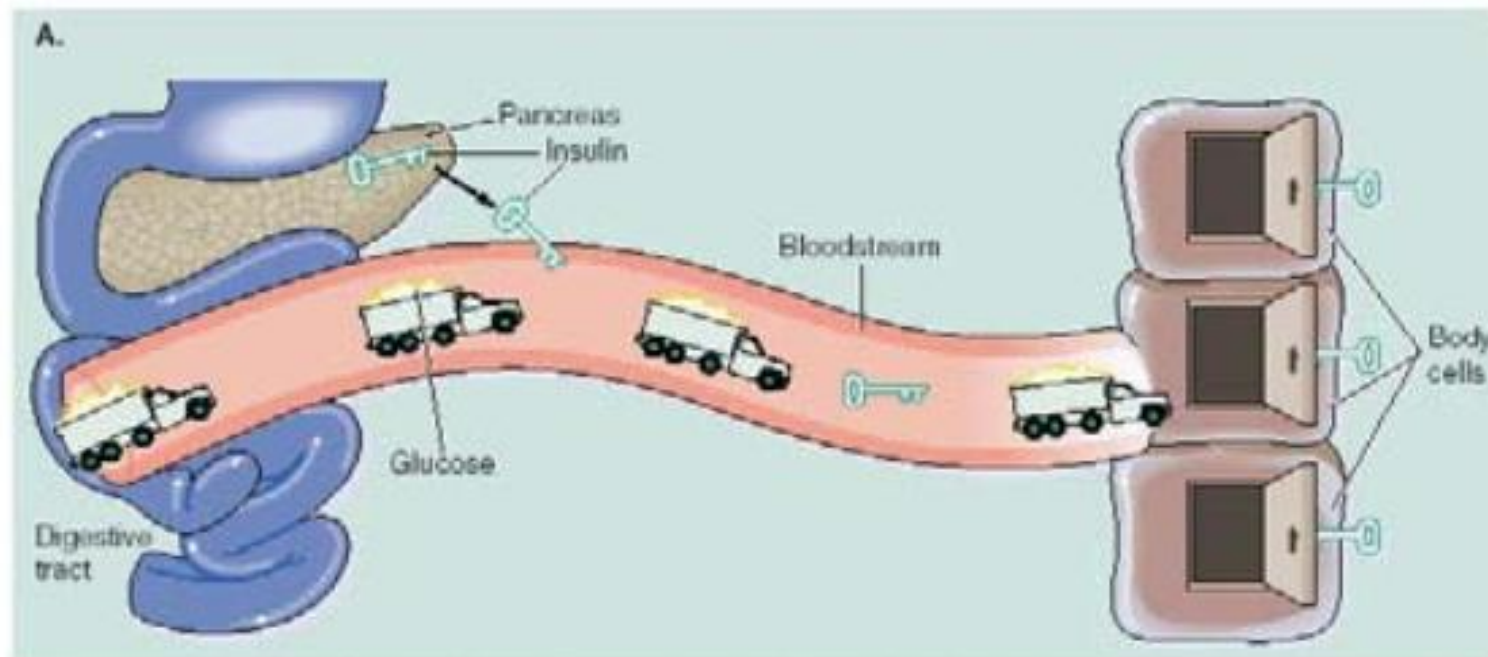
# Pengaturan kadar gula darah

- Insulin → hormon yg membawa glukosa dari darah ke sel-sel utk digunakan sbg sumber energi (menurunkan kadar glukosa darah).
- Glukagon → hormon yg melepaskan glukosa dari tempat penyimpanannya sbg respons turunnya kadar glukosa darah (membantu menaikkan kadar glukosa darah).
- Glikogen → bentuk simpanan glukosa di dalam hati & otot; dilepaskan saat kadar glukosa darah rendah.

# Pengaturan kadar gula darah



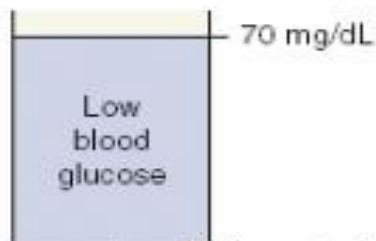
# Pengaturan kadar gula darah



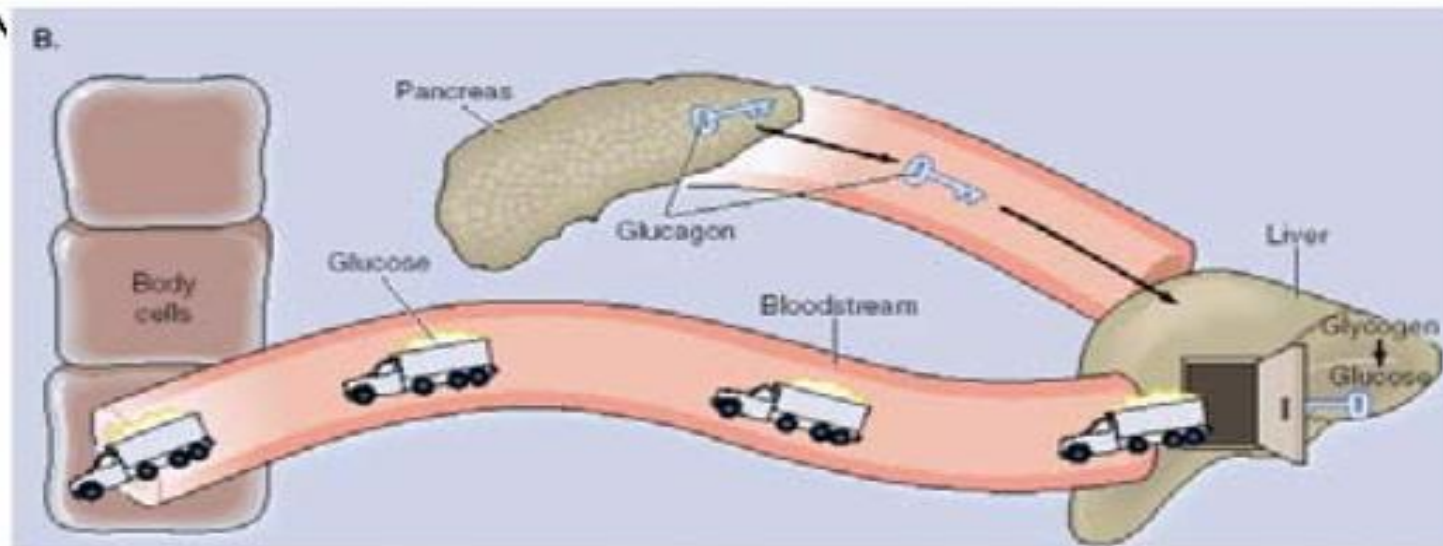
A. When a person eats, blood glucose rises. High blood glucose stimulates the pancreas to release insulin. Insulin serves as a key for entrance of blood glucose into cells. Liver and muscle cells store the glucose as glycogen. Excess glucose can also be stored as fat.

Elevated blood glucose  
110 mg/dL

# Pengaturan kadar gula darah



B. Later, when blood glucose is low, the pancreas releases glucagon, which serves as the key for the liver to break down stored glycogen to glucose and release it into the blood to raise blood glucose levels.





# Serat dalam makanan

- Konsumsi serat saat ini masih kurang.
- Hal ini terpengaruh oleh gaya makan modern (fast food) yg rendah serat ttp tinggi kalori & garam.

# Soluble Fibers

## Fiber Characteristics

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Viscous, soluble, more fermentable

- Gums and mucilages
- Pectins
- Psyllium<sup>a</sup>
- Some hemicelluloses

## Actions in the Body

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- Lower blood cholesterol by binding bile.
  - Slow glucose absorption.
  - Slow transit of food through upper GI tract.
  - Hold moisture in stools, softening them.
  - Yield small fat molecules after fermentation that the colon can use for energy.
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## Major Food Sources

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Whole-grain products (barley, oats, oat bran, rye), fruits (apples, citrus), legumes, seeds and husks, vegetables; also extracted and used as food additives.

## Health Benefits

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- Lower risk of heart disease.
- Lower risk of diabetes.

# Insoluble Fibers

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Nonviscous, insoluble, less fermentable

- Cellulose
- Lignins
- Psyllium<sup>a</sup>
- Resistant starch
- Many hemicelluloses

Brown rice, fruits, legumes, seeds, vegetables (cabbage, carrots, brussels sprouts), wheat bran, whole grains; also extracted and used as food additives.

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- Increase fecal weight and speed fecal passage through colon.
  - Provide bulk and feelings of fullness.

- Alleviate constipation.
  - Lower risks of diverticulosis, hemorrhoids, and appendicitis.
  - May help with weight management.
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# Digestion of Fiber

## FIBER

### Mouth

The mechanical action of the mouth crushes and tears fiber in food and mixes it with saliva to moisten it for swallowing.

### Stomach

Fiber is not digested, and it delays gastric emptying.

### Small intestine

Fiber is not digested, and it delays absorption of other nutrients.

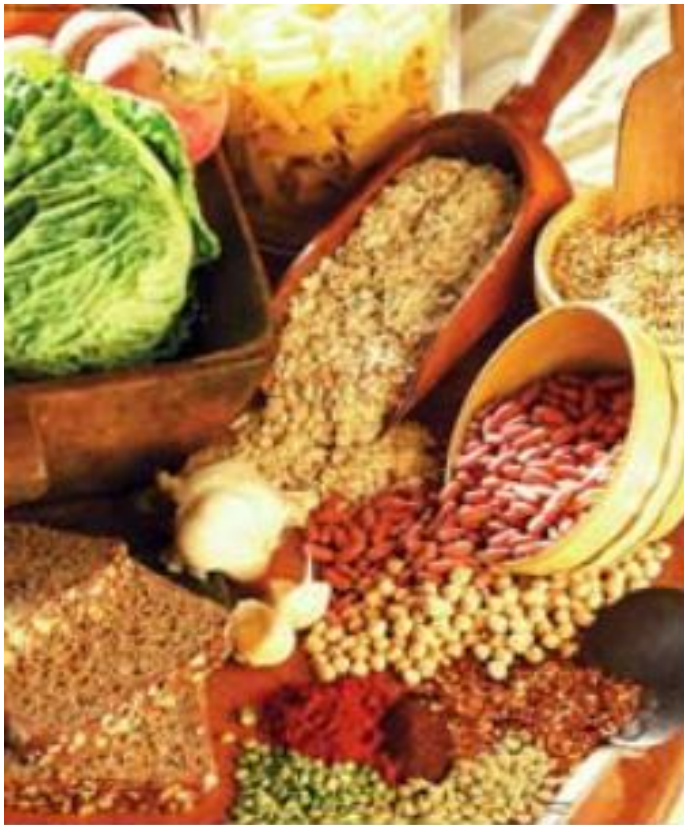
### Large intestine

Most fiber passes intact through the digestive tract to the large intestine. Here, bacterial enzymes digest fiber:

Some fiber  $\xrightarrow{\text{Bacterial enzymes}}$  Fatty acids, gas

Fiber holds water; regulates bowel activity; and binds substances such as bile, cholesterol, and some minerals, carrying them out of the body.

# Manfaat Kesehatan Serat



- Mencegah penyakit jantung, diabetes, gangguan pencernaan, kanker colon.
- Membantu menjaga keseimbangan bereat badan

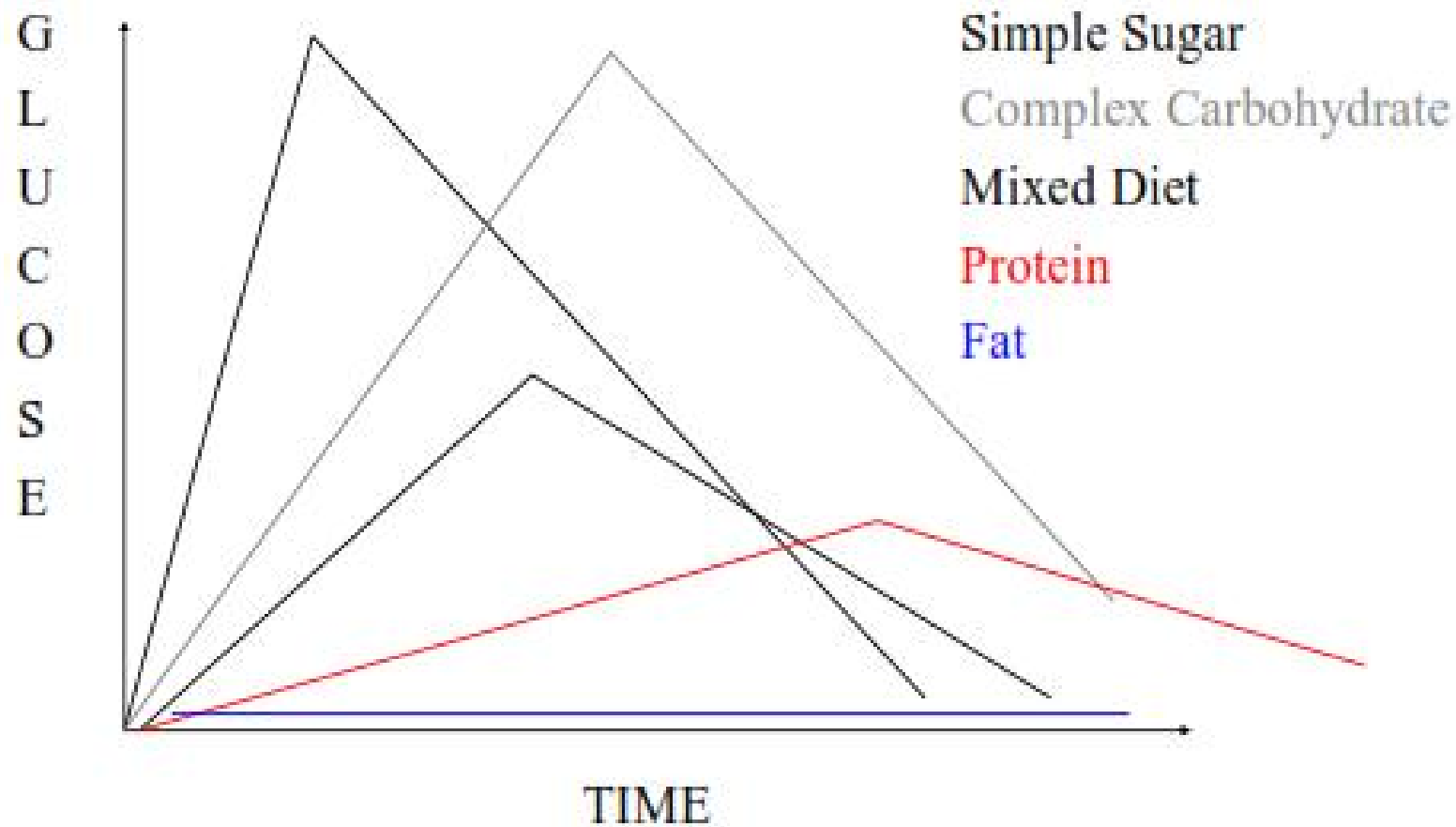
# Masalah yg dapat timbul krn kelebihan konsumsi serat

- Cepat kenyang
- Rasa tidak nyaman di abdomen
- Mengikat mineral
- Mungkin mengikat beberapa obat
- Dapat menyebabkan konstipasi jika kurang minum.

# Efek Glikemik Makanan

- Merujuk bagaimana respons glukosa darah terhadap makanan.
- Seberapa cepat glukosa diserap sesudah dikonsumsi
- Seberapa cepat kadar glukosa naik
- Seberapa cepat glukosa darah kembali normal

# Glycemic Index of Food





# A Look at the Glycemic Effect of Foods

## High Glycemic Index Foods

French, white, and other soft-textured breads or bagels  
Rice (medium-grain white or brown)  
Certain cereals (Cheerios, Corn Flakes, Rice Krispies)  
Waffles  
Mashed potatoes  
Watermelon  
Honey, regular soft drinks, jelly beans  
Pretzels

## Intermediate Glycemic Index Foods

Cream of Wheat, instant oatmeal, Shredded Wheat  
Sourdough and rye breads  
Banana, pineapple, orange juice  
Ice cream  
Popcorn  
Raisins

## Low Glycemic Index Foods

Whole-grain, heavy-textured breads  
Long-grain brown or white rice  
Bran cereals, toasted Muesli cereal, whole oats  
Apples, oranges, peaches  
Baked beans, lentils, other legumes  
Carrots  
Milk, yogurt  
Sweet potatoes  
Tomato soup