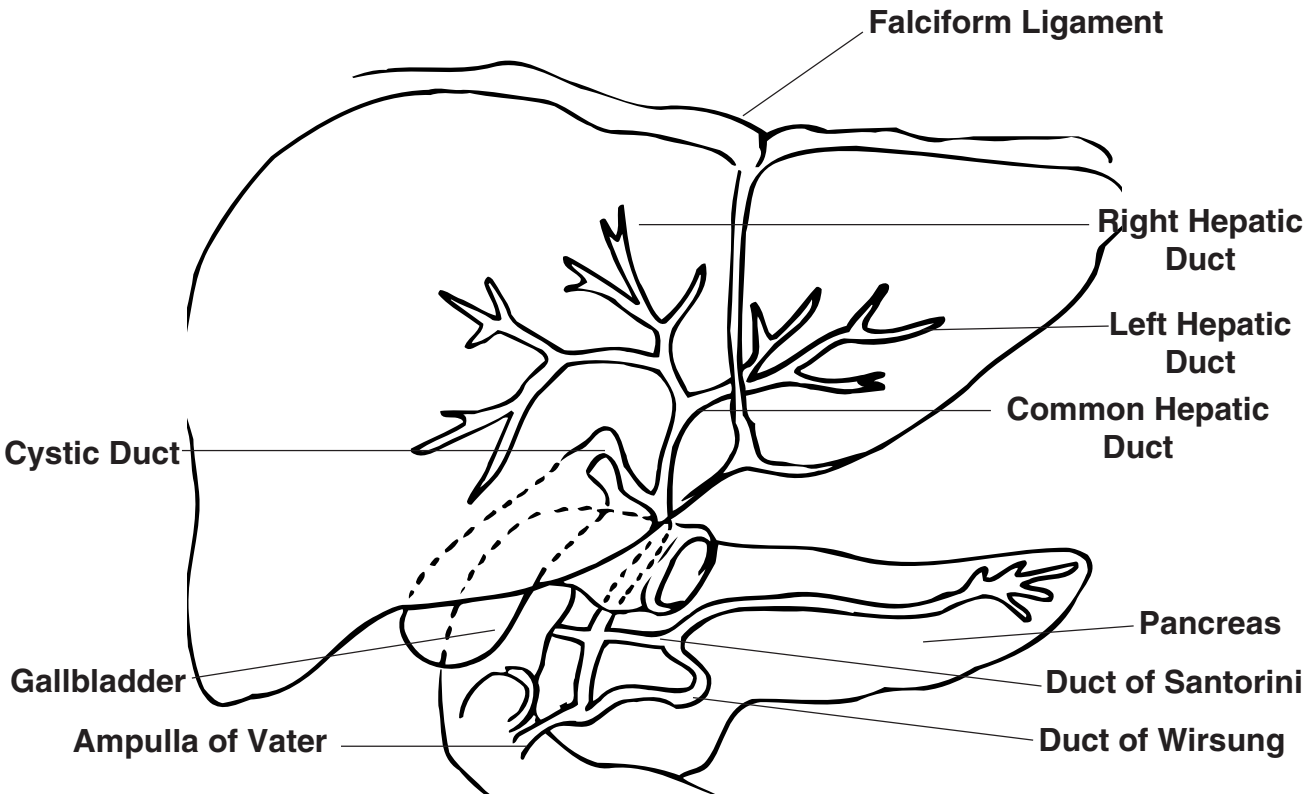
## The Liver and Pancreas: Blood Sugar Regulators



# BLOOD SUGAR

## Rudimentary Metabolic Physiology

- Blood sugar is the amount of glucose available as fuel for cells at any given time. Glucose is obtained from breakdown of carbohydrates; if these are in short supply, glucose is obtained from stored glycogen (body starch), proteins (dietary or muscle tissue), and fats (dietary or adipose tissue).
- When glucose becomes *phosphorylated* (bound to a phosphorus and oxygen molecule–$PO_4$– as glucose-6-phosphate), it is further catabolized into pyruvate, then to acetate in *aerobic respiration* or to lactate in *anaerobic respiration.*
- Aerobic respiration is the most desirable and efficient pathway for *glycolysis* (conversion of glucose to energy).
- Glucose-6-phosphate is converted to pyruvic acid, then to acetic acid (acetate). Acetate is transformed through several intermediate steps, into oxaloacetate, citrate, ketoglutarate, and oxaloacetone. At each step in conversion, simple energy molecules called ATP (adenosine triphosphate), ADP (adenosine diphosphate), and AMP (adenosine monophosphate), are released to be used by cells as fuel. Energy for cells is produced each time a phosphate molecule ($PO_4$) splits off.
- In anaerobic respiration, glycolysis results in lactate (responsible for those stiff, sore muscles after over-exercising), which can be converted back to pyruvate and then to acetate. In effect, lactate can make a metabolic "U-turn."
- Conversion of acetate to ATP transpires with the aid of *coenzymes* composed of several key vitamins and minerals. Instrumental in metabolic pathways are niacin (to make NAD–nicotinamide adenine dinucleotide, and lactic dehydrogenase), pantothenic acid (to make coenzyme A, and α-ketoglutarate dehydrogenase), riboflavin (incorporated into FMN–flavin mononucleotide, FAD–flavin adenine dinucleotide), pyridoxine (pyridoxal-5'-phosphate), thiamine (TPP–thiamine pyrophosphate), phosphorus ($PO_4$–phosphate), and iron (cytochrome in electron transport system). Many other vitamins and minerals play lesser but still important roles in conversion of glucose to energy.
- About 25–43% of glucose energy is captured in ATP. The remaining 57–75% of available energy is given off as body heat.
- When glucose production exceeds the needs for immediate use, *glycogenesis* occurs whereby glucose is converted to glycogen (body starch), which is stored in the liver and muscles for future energy requirements.
- *Glycogenolysis* (breakdown of glycogen) occurs when immediately available blood glucose is in short supply. The liver and muscles, through stimulation of the *adrenal glucocorticoids,* convert stored glycogen into glucose.
- When glycogen stores are depleted, muscle tissue and adipose tissue are broken down and converted to glucose as required during heavy energy demand. This process is called *gluconeogenesis* ("creation of new sugar").
- *Lipogenesis* (fat creation) occurs when glycogen stores are filled to capacity; glucose then becomes converted to triglycerides and stored as adipose tissue.

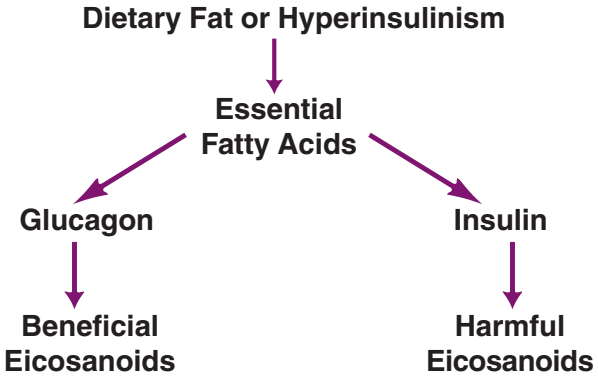
# Hyperinsulinism: The National Epidemic

## A Destructive Response

An exaggerated insulin response to dietary carbohydrates is called *hyperinsulinism.* Not all carbohydrates are handled by the body equally. Some carbohydrates are absorbed quickly, initiating a rapid and pronounced release of insulin; other carbohydrates cause an attenuated release of insulin.

- Hyperinsulinism is at the root of glycemic dysfunction and lipid metabolism, and therefore eicosanoid production. Grains such as wheat, rice, corn (especially the refined variety), cooked root vegetables (such as potatoes, beets, carrots), and sugars such as glucose, sucrose, and maltose cause hyperinsulinism. Vegetable and fruit sugars such as fructose do *not* cause hyperinsulinism. Fiber and fat also regulate carbohydrate absorption and reduce insulin response.
- Hyperinsulinism *always* translates to increased serum lipids (triglycerides and cholesterol). Increased serum lipids mean increased synthesis of arachidonic acid and harmful eicosanoids. Hyperinsulinism activates hydroxymethylglutaryl coenzyme-A (HMG CoA), an enzyme that actuates hepatic cholesterol production.
- Lipid synthesis is positively influenced by insulin. Insulin dysregulation in carbohydrate metabolism occurs in non–insulin-dependent diabetics due to an imbalance between insulin sensitivity of tissue and pancreatic insulin secretion.
- Excessive dietary fat (especially saturated) as well as chronic hyperinsulinism causes *insulin resistance,* a condition in which cells become resistant to the sugar-clearing/storing effects of insulin, and blood sugar remains high (diabetes). Hyperglycemia in turn causes hyperlipidism and proinflammatory eicosanoid production.

## Insulin-Glucagon Axis and Eicosanoid Pathways




- Hepatic insulin resistance results in the inability to suppress hepatic glucose production; in muscle, in impaired glucose uptake; and oxidation in adipose tissue, in the inability to suppress release of free fatty acids. This lack of appropriate sensitivity towards insulin action leads to hyperglycemia which in turn stimulates compensatory pancreatic insulin secretion leading to hyperinsulinemia. Ultimately, the pancreas may fail to compensate, hyperglycemia worsens and diabetes develops. These effects are probably genetically determined.
- In addition to effects in carbohydrate metabolism, hepatic insulin resistance results in hypertriglyceridemia, leading to high levels of plasma fatty acids which accentuates insulin resistance in other target organs. Insulin is a hepatic lipogenesis stimulator. There is also a strong correlation between chronic hyperinsulinemia and VLDL overproduction.
- Insulin resistance is associated with hypertriglyceridemia and elevated free fatty acid (FFA) concentrations in obese and diabetic individuals. It is unclear to what extent this relationship is independent of obesity and is present in healthy individuals. The most insulin-resistant group has more central body fat distribution (abdominal fat).

## The Medical Establishment Gets Enlightened: Syndrome X

- Syndrome X (sometimes called "metabolic" or "insulin-resistance" syndrome) is a group of indicators directly related to the American refined-carbohydrate/processed-fat diet. Though diabetes and/or obesity may be present, this syndrome is *not about either* of those conditions, as the syndrome is typically expressed *without* diabetes or obesity.

## Common Parameters

- Non-Caucasian
- Age >40
- Weight >25% normal
- Fasting glucose 110–126
- Blood pressure > 130/85
- Triglycerides >150
- 2-hour blood sugar, post-75 g glucose load >140
- HDL <40–male; <50–female
- *Acanthosis nigricans* infections in armpits, groin, fat flaps
- LDL–APO-b marker
- Decreased leptin titer
- Increased brachial artery reactivity (positive cold-pressor test suggestive)
- Increased postprandial lipids (blood fats following a meal)
- Increased homocysteine levels (directly related to heart disease)
- Decreased microalbumin levels
- Increased thrombus formation
- Only 5% of Syndrome X sufferers per year develop diabetes, but 90% of diabetics have Syndrome X.
- Most obese people do not have Syndrome X, but obesity is a risk factor.
- It takes fewer calories for those with Syndrome X to gain weight.
- Waist >40 inches–male; >35 inches–female (a valid marker only in white males).
- Non-Caucasian (AmerIndian, Asian, Hispanic) people may have more visceral fat–a risk factor for Syndrome X.
- Sedentary
- Sodium retention
- Family history of Type II diabetes, cardiovascular disease, coronary artery disease

## Other Factors

- Regarding vascular inflammation, hyperglycemia may actually begin at about 90 fasting; this may translate to a 2.8x risk of cardiovascular disease.
- Refined carbohydrates (white flour, sugar) and processed oils (polyunsaturated and hydrogenated fats) are the major culprits in this syndrome.
- Hydrogenated fats raise LDLs and lower HDLs.

## Other Symptoms of Syndrome X may include:

- Mood shifts
- Lethargy, lack of motivation
- Tiredness
- Sleepiness
- Cravings
- Increased heart rate

## Influences

- Humans are not biologically designed for *consistent* rich food intake.
- The industrialization of the food supply is the major offender.

- Excessive caloric intake is nearly unavoidable with processed foods.
- Caloric intake has increased 350 cal/day since the 1980s; 500 cal/day since the 1950s–all from processed food.
- Refined carbohydrates and processed fats raise insulin and triglyceride levels.
- Polyunsaturated fats increase vascular inflammation.

## Who Profits from Syndrome X?

- Medicine
- Pharmaceutical companies
- Fast-food and snack industry–$33 billion annually
- Food processors (General Mills, Best Foods, Kraft Corporation, etc.)
- Grocery stores
- Fitness and diet industry
- Publishing industry

## Implications

- Obesity adds 36% to medical services and 77% to medical needs.
- Over $1 billion is spent on food safety (mad cow disease, *salmonella, E.coli)* per year, but the health damage from processed foods and food excess costs $18 billion annually.

## Treatment

- There are no FDA-approved modalities for treatment.
- A near-raw, natural diet devoid of processed food is the first line of defense.
- A 5% reduction in body weight and walking 25 minutes per day will reduce Syndrome X risk by 60%.
- The human body is designed to walk long distances at 3 mph; an increase to just 4 mph is taxing and will raise metabolism.
- An increase in muscle mass may be even more effective than reducing body fat.
- Two alcoholic drinks per day increase insulin sensitivity and stabilize blood glucose levels.
- Low-dose niacin (<50 mg/day) assists carbohydrate tolerance.
- There is a renewed medical interest in high-dose niacin (>500 mg/day); high niacin doses may reverse or prevent atherosclerosis (may cause a slight transient increase in blood glucose–incidental, of no concern).
- Increased dietary omega-3 oils reduce thrombotic risk (clot formation).
- Baby aspirin may help prevent thrombosis.
- Emergency medical intervention involves treatment with beta-blockers, thiazide diuretics, statins, and fibrates, which assist in controlling advanced symptoms and medical problems associated with Syndrome X until a healthier life-style can be adopted.

## Lipid Profile in Hyperinsulinism

- Hypertriglyceridemia can result in a saturated fat-removal system and a buildup of chylomicrons, which can lead to life-threatening pancreatitis.
- Alcohol and excess weight gain are the most common causes of hypertriglyceridemia; hypothyroidism and nephrotic syndrome are the most common secondary causes of hyperlipidemia.
- Glucocorticoids and estrogens elevate triglycerides. In those with hypertriglyceridemia and associated obesity, estrogenic medications can depress triglyceride removal mechanisms, leading to chylomicronemia syndrome and pancreatitis.
- Short-term thiazide usage raises cholesterol and triglycerides. Alpha-blockers may cause a rise in HDL-c; beta blockers raise

triglycerides and lower HDL-c. Retinoids can increase LDL-to-HDL ratios and may occasionally cause elevations in triglycerides. Cyclosporine raises LDL-c.

- Triglycerides and/or plasma glucose influence circulating hormones, such as insulin, which might themselves be involved in cancer development. Triglycerides and/or plasma glucose might be indicators of energy available through the circulation for neoplastic cells.
- Colorectal cancer is positively associated with serum triglycerides and plasma glucose. Triglycerides and/or plasma glucose may be associated with fecal bile acids, which are positively associated with colorectal cancer.
- Offspring of hypertensive parents present significantly higher serum insulin levels.
- Fish oil concentrates decrease hepatic triacylglycerol levels. In the diet containing arachidonic acid, peroxisomal fatty acid oxidation and carnitine palmitoyltransferase I activity were markedly depressed.

## Insulin Response, Diet, and Eicosanoids

- *Eicosanoids* are a class of 20-carbon polyunsaturates that include prostaglandins, prostacyclins, leukotrienes, lipoxins, hydroxylated fatty acids, and thromboxanes. All of the eicosanoids are synthesized from arachidonic acid, a fatty acid found in saturated fats (fatty meats, organs, eggs), and produced by the body from saturated and polyunsaturated fats.
- Arachidonic acid takes two pathways: Cyclooxygenases catalyze the addition of 2 $O_2$ molecules to arachidonic acid to form $PGG_2$–prostaglandins that produce proinflammatory substances; the second and beneficial pathway produces $PGE_1$.
- $PGE_1$ controls the release of lymphokines, protein mediators released from sensitized lymphocytes in response to antigens (allergens), that play a role in macrophage (infection-fighting cells) activation, lymphocyte transformation, and immunity.
- $PGE_1$ also increases neurotransmitter uptake and release.
- In those already at high risk for atherosclerotic vascular disease by virtue of hyperlipidemia, homocysteine is an independent positive predictor of atherosclerotic vascular disease.

### *Renal Disease*

- Nephrotic patients exhibit severe hyperlipidemia, leading to all the symptoms and risks of hyperinsulinism and a high–saturated-fat diet.

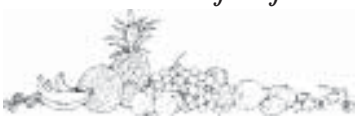
### *Cancer*

- $PGE_2$ inhibits natural killer (NK) cell activity. NK cells scavenge for abnormal cells (cancerous tumors).

## Hormonal Control of Metabolism

The pancreas is often thought of as the dominant organ responsible for regulating blood sugar and metabolism. The pancreas releases insulin, the hormone responsible for initiating movement of glucose into cells. This has a *hypoglycemic* (blood–sugar-lowering) effect. Insulin also inhibits catabolism (breakdown) of adipose tissue, and aids the transport of amino acids and fatty acids into cells for synthesis, but not for energy production.

- The pancreas has many kinds of cells that have different functions:
  - **Exocrine cells**: produce large quantities of alkaline enzyme-rich fluid containing sodium bicarbonate, which regulates the pH level of chyme. Cholecystokinin (CCK) controls the production and secretion of pancreatic enzymes necessary for the digestion of sugars,



starches, proteins, and lipids.

- **Endocrine cells**: clustered in islets of Langerhans (about 1% of all pancreatic cells). Each islet contains several cell types, with three of the most important being *alpha cells,* which produce the hormone *glucagon* (raises blood glucose); *beta cells,* which secrete *insulin* (lowers blood glucose and is vital for absorption of glucose into cells)*;* and *delta cells,* which release somatostatin (inhibits the release of glucagon and insulin).

- The pancreas is not the only organ that regulates blood sugar through hormone release.
- **Liver:** converts glycogen to glucose through stimulation of glucagon from the pancreas. Glucagon also allows for the conversion of amino acids and fats to energy. The effect is *hyperglycemic* (blood–sugar-raising).
- **Anterior Pituitary (adenohypophysis):** releases HGH (human growth hormone), ACTH (adrenal corticotropic hormone), and TSH (thyroid stimulating hormone). HGH in particular is responsible for protein anabolism (buildup or lay-down) and accelerated catabolism of fats for energy release. The effect is *hyperglycemic.*
- **Thyroid:** TSH from the pituitary stimulates the release of thyroxine, which increases glucose metabolism and protein synthesis, thereby having a *hypoglycemic* effect.
- **Adrenals:** ACTH from the pituitary stimulates release of glucocorticoids (especially epinephrine), which prompts release and breakdown of glycogen to glucose. Accelerated catabolism of amino acids from protein, as well as fat breakdown for energy are initiated as well, contributing to an overall *hyperglycemic* effect.
- **Gonads:** testosterone and progesterone both influence protein anabolism. This may or may not have an effect on blood glucose.

**Normal Blood Glucose Levels (mg/dl)**

| Time | Normal | Probably Safe ‡ |
|---|---|---|
| Fasting | †60–100 | 120 or less |
| 1 hour after eating | 100–150 | 185 or less |
| 2 hours after eating | 90–150 | 165 or less |
| Pre-meal, bedtime | 80–130 | 150 or less |

† Some individuals may experience symptoms of hypoglycemia at 70, others may still be alert with a blood sugar in the 40s.

‡ figures for non–insulin-dependent diabetics

## Hyperglycemia (Diabetes)

- Diabetes is generally described as insufficient insulin required to allow entrance of glucose into cells, therefore circulating glucose remains high. Hyperglycemia may be controlled with diet alone, or with oral hypoglycemic medications or insulin injections.
- Diabetics may or may not produce insulin, the hormone required to utilize sugar in the blood. Type I diabetes (juvenile–occurs before age 30) usually requires insulin injections. Type II diabetes (adult-onset) sometimes requires insulin injections, but is usually treated with oral hypoglycemics. Obese Type II diabetics produce insulin, but cells are resistant to it, so cells remain starved while blood sugar remains high.
- Symptoms of hyperglycemia include constant hunger (especially three to four hours after a large meal), excessive thirst with no exogenous cause, acetone odor in breath and sweat (indicative of *ketosis*–a condition of accelerated fat breakdown, producing ketone "ashes"), increased urination, night sweats, nausea, faintness, rapid heart rate after eating, blurred vision, unusual weight loss or gain, confusion, irritability, weakness, and fleeting pains and numbness in limbs. While none of these symptoms alone indicate

hyperglycemia, a battery of them is suggestive. Some individuals may not notice symptoms, but still be hyperglycemic. Test your blood often if you have a history, or familial tendencies, toward blood sugar disease. Consult with your doctor if you find abnormalities.

- Hyperglycemic episodes in normal individuals may occur during stressful periods. Dehydration can also give false high urine and blood glucose readings. These fluctuations in blood glucose do not necessarily indicate diabetes. Sustained hyperglycemia can cause life-threatening complications such as vascular, kidney, retina, and nerve damage. Heart disease is common among diabetics.
- In designing a diet for the non–insulin-dependent diabetic, concern for total caloric intake, as well as limitations on high-glycemic carbohydrates and dietary fats, is paramount.
- The body does not treat all carbohydrates the same. Of utmost importance in controlling blood sugar is the absorbability of starches and their blood–sugar-raising effects.
- The *glycemic index* lists the blood–sugar-raising effects of some common foods. The glycemic index is a ratio number. The blood–sugar-raising effects of carbohydrates are assessed by comparing the blood-sugar rise from ingesting pure glucose with the blood-sugar rise from other carbohydrates. The index number is obtained in the formula below.
- Use of the glycemic index is very important in controlling blood-sugar problems. As indicated in the table, *some starches have a higher index number than sucrose*–the common table sugar diabetics are told to avoid!
- If you have diabetes that can be controlled with diet alone, avoid carbohydrates above a glycemic index of 45.
- The glycemic index of foods is for the single food only: Combining foods changes the index number. Combining high-index foods with fats, such as a baked potato with butter, lowers the index number because fats slow absorption of sugars and starches.
- Diabetics are unusually deficient in chromium, a mineral required for synthesis of insulin. Supplementation of this mineral in doses above 200 mcg. can lower insulin requirements.
- Because the liver and pancreas are synergistic in their functions, diabetics suffer from liver abnormalities that do not allow them to convert beta carotene–vitamin A from vegetables and fruits–to retinol, the fat-soluble vitamin A required by tissues. Supplementation of retinol is *mandatory*. Diabetics are also vitamin C deficient.
- Factors predisposing one to diabetes include: family history of the disease, a long history of *hypo*glycemia, long-term processed sugar intake, and obesity–especially if the majority of fat is carried around the abdomen.

## Hypoglycemia (Low Blood-Sugar)

- Hypoglycemia may be described as reactive or chronic. Reactive hypoglycemia can be a short-term stress response and is usually of little consequence. Chronic hypoglycemia is an ongoing battle for the sufferers of this disorder.
- Hypoglycemia may also be referred to as hyperinsulinism, whereby the pancreas produces too much insulin and blood sugar

$$\text{glycemic index of food} = \frac{\text{blood sugar rise from compared food}}{\text{blood-sugar rise from glucose}}$$

falls as glucose is rapidly forced into cells or converted to adipose tissue before it can be used by hungry tissues.

- Stress greatly affects production of insulin, as the adrenal glands are responsible for "turning off" the pancreas when normal blood sugar is attained. Prolonged stress can slow this adrenal response considerably, thereby allowing overproduction of insulin to go unchecked (see "Stress" section). Storage of adipose tissue may be accelerated because of this. *Insulin is a fattening hormone.*
- Causes of low blood sugar are partly hereditary, but is greatly influenced by life-style. A typical scenario may go like this:

  Eating refined carbohydrates increases blood sugar, which increases insulin release, which then decreases blood sugar, which prompts adrenals to break down liver glycogen. This is repeated several times daily. The adrenals become more and more sluggish and don't break down glycogen as quickly as before, symptoms occur (described below), more refined carbohydrates are eaten, which raises blood sugar, which increases insulin release, which then lowers blood sugar, and so on....
- Sufferers of hypoglycemic episodes will typically "whip" the adrenals with overuse of caffeine-containing beverages, which then forces the adrenals to act more quickly in releasing epinephrine, stimulating the liver to release glycogen, thereby increasing blood glucose. It's a nonending roller coaster ride, unless refined carbohydrates, caffeine, and stress are reduced significantly. Frequent small meals, high in protein and restricted to carbohydrates below 45 on the glycemic scale, also limit the number and intensity of hypoglycemic episodes.
- Symptoms of hypoglycemia may occur an hour to six hours (depending on severity) after a meal and may include headaches, sudden fatigue, irritability, insomnia or pronounced sleepiness, nervousness, anxiety, forgetfulness, confusion, depression, faintness, weakness, tingling or numbness in fingers, night sweats, dizziness, hunger, heart palpitations, coldness, shortness of breath, sugar or alcohol craving, convulsions, euphoria, stupor, and coma.

## Glucose Tolerance Tests

- The general criteria for a "normal curve" 6-hour test is that the final reading be within 5% of the fasting blood sugar level. In addition, the first-hour reading should be no higher than 50% above the fasting level, and no reading should descend below the fasting (baseline) level.

### Blood Sugar Table

| Time | Normal | Hypo | Hyper | Hyper-Hypo† |
|---|---|---|---|---|
| fasting | 60–100 | 50–70 | 110–130 | 110–120 |
| 1 hour | 100–150 | 130–160 | 180–210 | 180–210 |
| 2 hours | 90–150 | 80–120 | 220–300 | 220–300 |
| 3 hours | 80–130 | 60–80 | 160–180 | 160–180 |
| 4 hours | 80–100 | 50–70 | 120–140 | 50–70 |
| 5 hours | 70–100 | 40–60 | 110–130 | 40–60 |
| 6 hours | 60–100 | 40–60 | 110–130 | 40–60 |

† Hyper-Hypo refers to the difficult-to-manage blood glucose of the "brittle" diabetic.

# Glycolysis (simplified)

**First Stage Glycolysis**

(Glucose) $C_6H_{12}O_6$ → (Glucose-6-phosphate) $C_6H_{12}O_6 + 2PO_4$ → (pyruvate) $2C_3H_4O_3$

(2 ATP → 2 ADP)

(4 ADP → 4 ATP)

(2 NAD → 2 $NADH_2$)

***Accounting:***

2 pyruvates
2 $NADH_2$
2 ATP

## Anaerobic Respiration

(pyruvate) $2C_3H_4O_3$ ⟷ (lactate) $2C_3H_6O_3$

(1 $NADH_2$ → NAD)

***Accounting:***

4 $NADH_2$ (x2)
1 $FADH_2$ (x2)
1 ATP (x2)

## Aerobic Respiration

(pyruvate) $C_3H_4O_3$ + $CO_2$ → Krebs (carboxylic acid) Cycle

(NAD → $NADH_2$)

## Kreb's Cycle

**1)** (pyruvate) $C_3H_4O_3$ → ($CO_2$) (acetate) $C_2H_4O_2$ + Coenzyme A = Acetyl CoA, + (oxaloacetate) $C_4H_4O_5$ → ($CO_2$) (citrate) $C_6H_8O_7$

**2)** (citrate) $C_6H_8O_7$ → (ketoglutarate) $C_5H_6O_5 + O_2$ → (oxaloacetone) $C_4H_4O_7$

***Accounting:***

2 NAD → $NADH_2$
1 ADP → ATP
1 FAD → $FADH_2$

## Electron Transport System

$NADH_2$ → NAD → cytochrome (x3) (ADP → ATP)

+2H

$+O_2$ → $H_2O$

***Accounting:***

1 $NADH_2$ = 3 ATP
1 $FADH_2$ = 2 ATP

***Total:***

38 ATP
3 electron transport

## LEGEND

| | |
|---|---|
| **AMP** | adenosine monophosphate |
| **ADP** | adenosine diphosphate |
| **ATP** | adenosine triphosphate |
| **NAD** | nicotinamide adenine dinucleotide |
| **$NADH_2$** | nicotinamide adenine dinucleotide + 2 $e^-$ in H bonds |
| **NADPH** | nicotinamide adenine dinucleotide + $PO_4$ and 1 H bond |
| **FAD** | flavin adenine dinucleotide |
| **$FADH_2$** | flavin adenine dinucleotide + 2H ($e^-$) |

## BLOOD–SUGAR-RAISING EFFECTS of FOODS

The glycemic index measures how much a given food raises blood sugar compared with glucose as a standard. The blood–sugar-raising effects of simple and complex carbohydrates often determine how much of these macronutrients may be consumed without disturbing blood-glucose homeostasis. Foods high on the list are absorbed readily and raise blood sugar higher than those lower on the list. Foods with a low index number are less likely to cause wide swings in blood-sugar. Fats can appreciably slow the absorption of foods with a high index number.

**Glycemic Index**

| | | | |
|---|---|---|---|
| Peanuts | 13 | Spaghetti, enriched | 50 |
| Soybeans | 15 | Pasta, enriched | 50 |
| Fructose | 20 | Potato chips | 51 |
| Cherries | 23 | Yam | 51 |
| Plum | 25 | Cereal, All Bran | 51 |
| Grapefruit | 26 | Peas, green, frozen | 51 |
| Sausage | 28 | Buckwheat | 54 |
| Lentils | 29 | Pastry | 59 |
| Peach | 29 | Sucrose | 59 |
| Beans, kidney | 29 | Corn | 59 |
| Milk, skim | 32 | Banana | 62 |
| Peas, black-eyed | 33 | Beets | 64 |
| Pear | 34 | Raisins | 64 |
| Milk, whole | 34 | Rice, brown | 66 |
| Ice cream | 36 | Cereal, Swiss muesli | 66 |
| Beans, Garbanzos | 36 | Cereal, Shredded Wheat | 67 |
| Beans, lima | 36 | Chocolate bar, Mars | 68 |
| Yogurt, plain low-fat | 36 | Bread, white | 69 |
| Fish sticks | 38 | Potato, white rose | 70 |
| Soup, tomato | 38 | Rice, white | 72 |
| Apple | 39 | Bread, whole wheat | 72 |
| Orange | 40 | Cereal, cornflakes | 80 |
| Beans, baked | 40 | Potatoes, instant mashed | 80 |
| Bread, whole rye | 42 | Honey | 87 |
| Pasta, whole wheat | 42 | Carrots, cooked | 92 |
| Grapes | 45 | Parsnips | 97 |
| Sponge cake | 46 | Potato, russet, baked | 98 |
| Orange juice | 46 | Glucose | 100 |
| Potato, sweet | 48 | Maltose | 110 |
| Oatmeal | 49 | | |

# FOOD EXCHANGE LISTS
# (for Diabetic and Weight Reduction Plans)

## Milk List

*(12 gm carb, 8 gm pro, 0–8 gm fat, 90–150 cal)*

### *Nonfat Dairy*

1 c Skim or nonfat milk
1 c Buttermilk from skim milk
1 c Nonfat yogurt
⅓ c Nonfat dry milk powder
½ c Canned evap. skim milk mix

### *Low-Fat Dairy*

1 c 1% fat Low-fat milk *(add ½ fat exchange)*
1 c 2% fat Low-fat milk *(add 1 fat exchange)*
1 c 2% fat Low-fat yogurt *(add 1 fat exchange)* (plain)

### *Whole Dairy*—add 2 fat exchanges

1 c Whole milk
1 c Buttermilk from whole milk
1 c Whole milk yogurt (plain)
½ c canned evap. whole milk mix

### *Fast Foods*

Chocolate shake *(½ milk exchange, 3½ bread, 2 fat, 365 cals)*
Vanilla shake *(½ milk exchange, 3 bread, 1½ fat, 325 cals)*
Strawberry shake *(½ milk exchange, 3½ bread, 1½ fat, 345 cals)*

## Fat List: *Unsaturated*

*(5 gm fat, 45 cal)*

1 tsp Margarine, soft
⅛ medium Avocado
1 tsp Oil–corn, cottonseed, olive, peanut, safflower, soy, sunflower
5 large or 10 small Olives
6 whole Almonds
2 whole Pecans
20 Peanuts, Spanish

## Vegetable List

*(5 gm carb, 2 gm pro, 25 cal)*
*(½-cup cooked, 1 cup raw)*

½ c Asparagus
½ c Bean sprouts
½ c Beets
½ c Broccoli
½ c Brussels sprouts
½ c Cabbage
½ c Carrots
½ c Cauliflower
½ c Celery
½ c Cucumbers
½ c Eggplant
½ c Green pepper
½ c Greens
½ c Mushrooms
½ c Okra
½ c Onions
½ c Rhubarb
½ c Rutabaga
½ c Saurkraut
½ c Spinach
½ c String beans
½ c Summer squash
½ c Tomatoes
½ c Tomato juice
½ c Turnips
½ c V8 cocktail
½ c Zucchini

## Fat List: *Saturated*

*(5 gm fat, 45 cal)*

1 tsp Margarine, stick
1 tsp Butter
1 tsp Bacon grease
1 strip Bacon, crisp
2 T Cream, light
2 T Cream, sour
1 T Cream, heavy
1 T Cream cheese
1 tsp Lard
2 tsp Bleu cheese dressing

## Fruit List

*(15 gm carb, 60 cal)*

1 small Apple
½ c Apple juice
½ c Applesauce
4 medium Apricots, raw
7 halves Apricots, dry
½ small Banana
¾ c Blackberries
¾ c Blueberries
⅓ small Cantaloupe
12 large Cherries
½ c Cider
2½ Dates
2 Figs, raw or dried
½ Grapefruit
½ c Grapefruit juice
15 Grapes
⅓ c Grape juice
1 medium Guava
⅛ medium Honeydew
3 medium Kumquats
½ small Mango
1 small Nectarine
1 small Orange
½ c Orange juice
1 c Papaya
1 medium Peach
1 small Pear
2 medium Persimmon
½ c Pineapple
½ c Pineapple juice
2 medium Plums
3 medium Prunes
⅓ c Prune juice
1 c Raspberries
2 T Raisins
1¼ c Strawberries
2 medium Tangerine
1¼ c Watermelon

### ***Unsaturated Fats,*** continued

10 Peanuts, Virginia
2 whole Walnuts
1 T Nuts, other
1 T French dressing
1 T Italian dressing
2 tsp Mayonnaise

## Bread List

*(15 gm carb, 3 gm pro, 80 cal)*

### *Breads*

1 slice White (including French and Italian)
1 slice Whole grain
1 slice Rye or pumpernickel
1 slice Raisin bread
½ small Bagel
½ English muffin
1 Roll, plain dinner
½ Hot dog or hamburger bun
3 T Bread crumbs, dry
1–6" Tortilla

### *Cereals*

½ c Bran flakes
¾ c Cold cereal, unsweetened
1½ c Puffed rice, wheat or corn
½ c Cooked cereal
½ c Grits, cooked
⅓ c Rice or barley, cooked
½ c Pasta, cooked
3 c Popcorn, popped
2½ T Cornmeal
1½ tsp Flour, wheat
¼ c Wheat germ

### *Crackers*

3 Arrowroot
2 Graham (2½")
½ Matzoh (4" x 6")
20 Oyster crackers
25 Pretzels
Rye wafers (2" x 3½")
6 Saltines
4 Soda (2½")

### ***Saturated Fats,*** continued

¾" cube Salt pork
2½ tsp Coconut, grated
1 T Sesame seeds

## Meat List

*(7 gm pro, 3–8 gm fat, 55–100 cal)*

### *Low-Fat Meat*

1 oz Beef–veal, chipped, chuck, flank, tenderloin, round, rump roast
1 oz Lamb–chops, roast
1 oz Pork–ham, leg roast (without skin)
1 oz Fish, fresh or frozen
¼ c Canned fish
2 oz (5) Clams, oysters, scallops, shrimp
2 Sardines, drained
1 oz Low-fat cheese
¼ c Low fat cottage cheese, dry
½ c beans or peas (add 1 bread exchange)

### ***Medium-Fat Meat***–add ½ fat exchange

1 oz Beef–ground (15% fat), corned, rib-eye
1 oz Pork–loin, picnic, butt, Canadian bacon
1 oz Liver, heart, kidney
¼ c Cottage cheese, creamed
1 oz Cheese–mozzarella, ricotta, farmer's Neufchatel
2 T Parmesan cheese
1 Egg

### ***High-Fat Meat***–add 1 fat exchange

1 oz Beef–brisket, ground (>20% fat), rib roast, ribsteak
1 oz Lamb–breast
1 oz Pork–spareribs, sausage, ground, deviled ham
1 oz Poultry–duck, goose
1 oz Cheese, Cheddar, American
1 slice Luncheon meat
1 Frank
2 T Peanut butter *(add 2½ fat exchanges)*

## Unlimited Foods–low or no calories

Coffee, tea, diet sodas
Bouillon, clear broth
Gelatin, sugar free
Herbs
Lemon, lime

### *Beans, Peas, Lentils*

⅓ c Beans, peas, lentils *(cooked)*
¼ c Baked beans

### *Starch Vegetables*

½ c Corn
1 small Corn-on-the-cob
⅔ c Parsnips
1 small Potato
½ c Potatoes, mashed
¾ c Pumpkin
¾ c Winter squash
⅓ c Yam or sweet potato

### **Unlimited Foods**, continued

Mustard, horseradish, vinegar
Pickles, unsweetened Raw vegetables: Chinese cabbage, cabbage, endive, lettuce,
parsley, radishes, watercress
Spices, unsweetened

### Combination Foods

1 Biscuit *(add 1 fat exchange)*
1 Corn bread, 2" x 2" x 1" *(add 1 fat exchange)*
5 Crackers, Ritz or similar *(add 1 fat exchange)*
1 Muffin, plain *(add 1 fat exchange)*
8 pieces French fried potatoes *(add 1 fat exchange)*
15 Potato or corn chips *(add 2 fat exchanges)*
1 Pancake, 5" x ½" *(add 1 fat exchange)*
1 Waffle, 5" x ½" *(add 1 fat exchange)*

## Diet Plans Using Exchange Lists

***Food Exchanges for Each Level of Calorie Intake***

| | 1200 | 1500 | 1800 | 2200 | 2600 | 3000 |
|---|---|---|---|---|---|---|
| Milk List | 2 | 2 | 2 | 2 | 2 | 2 |
| Vegetable List | 1 | 1 | 1 | 1 | 1 | 1 |
| Fruit List | 3 | 3 | 3 | 4 | 4 | 4 |
| Bread List | 4 | 6 | 8 | 10 | 12 | 15 |
| Meat List | 5 | 6 | 7 | 8 | 10 | 10 |
| Fat List | 1 | 4 | 5 | 8 | 12 | 15 |

# You Know You're Fat When . . .

**Your Waistline**
**Has Become an Equator**

**You Have Begun to Generate**
**Your Own Gravitational Pull**

**Your Friends Hide**
**the Wicker Furniture**
**When You Come Over**

**You Have to File**
**an Environmental Impact Report**
**Before Jumping Into the Pool**

**Your Hips**
**are In Two Zip Codes**

**Someone Always Tries**
**to Roll You Back Into the Sea**
**Whenever You Sunbathe at the Beach**

**You Can't Go to The Beach**
**Because You Affect The Tides**

# WEIGHT MANAGEMENT for a MODERN AGE

## The Physiology of Obesity

- Roughly 30% of adults over age 25 and 70% of adults over age 40 are overweight to some degree. There are almost as many weight-loss schemes, regimens, diet books, and authorities on weight reduction as there are dieters.
- Reasons for gaining weight easily are as varied as the sufferers of this difficult problem. Genetics play a large role, perhaps influencing weight regulation by as much as 80%. Inactivity, salt intake, thyroid irregularities, prescription drugs such as steroids and other anti-inflammatory drugs, vitamin deficiencies, allergies, high caloric intake, inadequate protein intake, kidney damage or delayed kidney filtration (causing salt and water retention), adult-onset diabetes, hypoglycemia, and congestive heart failure are some of the more obvious causes of weight gain.
- The goal of weight loss is *loss of fat*, not merely weight. Body builders are fifty or more pounds overweight, but their total body fat is below average. They cannot be considered "overweight." (Added stress on the lower joints, however, is still a health risk. Gravity is in effect whether your 250 pounds is fat or muscle!)
- About half of total adipose tissue "turns over" daily. The metabolizing brown fat–containing *mitochondria*, the cells' energy producers–is much more active than the non-metabolizing white fat. The *number* of fat cells present in the body is thought to be fixed at a young age, and it is the *size* of these cells that changes with weight.
- The number of fat cells is also implicated in the "Set Point" theory of weight maintenance, which suggests that obesity is programmed by the pituitary and hypothalamus. A higher set point increases hunger and increases conversion of excess food calories to adipose tissue. Increased hunger triggers overfeeding, maintaining the obese status quo. Strict caloric restriction cannot change the set point. What happens instead is that the *metabolism of the dieter during a calorie deficit will fall to meet the intake*, thereby maintaining body weight. Humans have evolved to endure famine and respond in this way to survive; it is inappropriate in an age where food is in oversupply and in unusual, concentrated, unnatural forms as it is in the United States. *The set point can be be changed only with exercise.*
- Larger-framed people have more non-metabolizing connective tissues in ratio to energy-requiring muscle and organ tissues. This may explain why petite individuals, having less connective tissue proportionately, seem to lose weight faster and are able to maintain ideal body weight while consuming the same number or even a higher number of calories than the larger-framed person. In addition, smaller people usually have faster metabolisms.
- During weight loss, serum cholesterol and triglyceride levels are likely to rise temporarily, as adipose tissue is rapidly being broken down and released into the bloodstream to be used as fuel.
- When you break down fat to use it as fuel, you are *essentially on a high-fat diet*. During weight loss, free radicals are produced which can damage tissues and accelerate the aging process, especially if the weight loss is rapid.

Antioxidant therapy is *essential* during weight loss.

## Weight Loss Approaches

- Some of the simplest maneuvers can be employed to promote weight loss. These not only include intelligent dieting, behavior modification, and exercise, but also some little known but very effective life-style changes.
- Weight loss can be effected through controlled loss of body heat. The hot spots of the body are those that are usually covered, especially the head, upper back and thighs, and to a lesser extent, the chest and abdomen. Sweat clothes, popular in many exercise regimens, prevent heat loss; the temperature buildup will serve only to cause a temporary loss of water from the tissues. Promoting heat loss through regulated exposure to cool temperatures can burn a significant number of calories in a very short period. Some ways to accomplish this are:
    - Wear lightweight, loosely-knit, oversized clothing with arms and legs exposed. This is effective in cool weather as well as hot, but shivering should be avoided.
    - Short hair cuts promote heat loss.
    - Take cool showers, swim in cool water.
    - Use fans even in temperate weather (68–75° F).
- Low-calorie diets (500–1200 cals.) longer than 10 days in duration cause a concomitant reduction of metabolic rate through a physiological conservation response. Energy output is decreased and weight loss may be halted. In extreme loss-resistant cases, dieters not only maintain their weight, but actually gain on the same low-calorie diet that initially promoted weight loss. Three ways to prevent this are:
    - Increase protein intake and change ratio to carbohydrates and fats.
    - Decrease or eliminate foods with a glycemic index number higher than 40. Quickly-absorbed carbohydrates are more likely to be stored as fat.
    - Increase exercise.
    - Rotate daily calorie intake:

      Consume 600 calories for 3 days, 900 calories for the next 3 days, and 1200 calories for the last 3 days. Repeat the cycle until ideal weight is attained.

- The formulas below give suggestions for altering protein intake/ratios: (P=protein, C=carbohydrate, F=fat)

| | 600 Calories | | | 900 Calories | | | 1200 Calories | | |
|---|---|---|---|---|---|---|---|---|---|
| | **C** | **P** | **F** | **C** | **P** | **F** | **C** | **P** | **F** |
| | 45% | 40% | 15% | 45% | 40% | 15% | 55% | 30% | 15% |
| **Cals** | 272 | 240 | 90 | 405 | 360 | 135 | 660 | 360 | 180 |
| **Gms** | 68 | 60 | 10 | 101 | 90 | 15 | 165 | 90 | 20 |

**Ideal Normal Intake (nondieting)**

| | 1800 Calories | | | 2000 Calories | | |
|---|---|---|---|---|---|---|
| | **C** | **P** | **F** | **C** | **P** | **F** |
| | 60% | 20% | 20% | 60% | 20% | 20% |
| **Cals** | 1080 | 360 | 360 | 1200 | 400 | 400 |
| **Gms** | 270 | 90 | 40 | 300 | 100 | 44.4 |

- Notice that protein ratios are increased as calories are decreased. This ensures an adequate 60–100 grams intake of protein and prevents muscle-tissue loss. Fat ratios are held at an even 15% in the reducing regimens, this level being necessary to ward off hunger, regulate metabolism, and ensure absorption of fat-soluble vitamins.
- Meal composition is important in weight reduction. An acceptable regimen for an average person with no underlying disorders could include a pre-breakfast low-glycemic fruit juice drink, mostly complex carbohydrates and a little protein and fat at breakfast, the largest meal taken at lunch with a bulk of the protein and vegetables, and a light dinner containing less fat than the other two meals.
- Polyunsaturated fat snacks reduce appetite and help burn saturated fat stores (adipose tissue). These may include nuts, sunflower seeds, and peanut butter.
- Popcorn, apples, and eggs are also satisfying snacks.
- Celery, cucumbers, and leafy greens may actually require more energy to digest and metabolize them than is obtained from them, but can increase hunger sensations.
- Coffee and tea are useful as stimulants in moderation, but can cause lowered gastric pH and increased hunger, a problem for the dieter. Caffeine also has a tendency to raise blood sugar by stimulating the adrenals to release stored glycogen from the liver, but these stores are soon depleted and blood sugar drops rapidly as a result (see "Stress"

and "Blood Sugar" sections). It is best to eat something with caffeine-containing beverages.

- Some dieters may feel especially bad (moody, lethargic) in the first few days of caloric restriction or because of a change in usual protein to carbohydrate to fat ratio. Because toxins are stored in adipose tissue and in the fatty deposits of the liver, dieters can expect a release of these into the bloodstream. This effect may last a few days to several weeks, depending on an individual's previous nutritional state.
- Exercise can increase metabolism by 4–5 times and this effect is sustained over a 2–3 day period when exercise is done on a regular basis.
- For adequate aerobic conditioning and to increase metabolic rate necessary for weight reduction, an average 20- to 40-year-old person should maintain a peak heart rate of 120 to 140 beats per minute for 20–30 minutes during each exercise session. Exercise is most effective on an alternating-day basis. The chart below may be used as a simple guide:

**Aerobic Training Table**

| | | ***Age*** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
| | | ***Heart Rate*** | | | | | | | | | |
| ***Output Training Levels*** | 100% | 200 | 195 | 190 | 185 | 180 | 175 | 170 | 165 | 160 | 155 |
| | 85% | 170 | 166 | 162 | 157 | 153 | 149 | 145 | 140 | 136 | 132 |
| | 70% | 140 | 137 | 133 | 130 | 126 | 123 | 119 | 116 | 112 | 109 |

- Over a period of several months, the more "fit" one becomes, the lower the resting heart rate, as the heart becomes more efficient in using oxygen. It also requires more exercise for a fit person to reach peak cardiac output than an unfit person, therefore duration and intensity of workouts must be increased to remain fit at peak output–until a fitness "plateau" is reached that can be easily maintained for life.
- Most people on a society imposed sleep/wake cycle will benefit from a morning workout shortly after a low-glycemic juice drink, and then possibly again in the evening after work to reduce stress. These exercise schedules must be adjusted to individual sleep/wake cycles.
- Recent studies have shown that fidgeting and restlessness is effective in weight loss. Heavy and constant fidgeting may burn up to 800 extra calories a day.
- Growth hormone releasers in the form of free-form L-Ornithine and L-Arginine (amino acids) accompanied by pyridoxine and ascorbate, promote protein lay-down in muscles and accelerate fat-tissue loss. This weight loss strategy is not without risk, as high doses of these amino acids can raise blood sugar significantly–a concern for diabetics and pre-diabetics (see "Free-Form Amino Acids" section).
- Adequate vitamin E and iodine can increase the basal metabolic rate and contribute to

weight loss. Very high doses of vitamin E (> 1400 I.U.) can cause a temporary weight gain.

- Behavior modification is important for some dieters. Eating alone sometimes contributes to overeating, as can going out to eat when someone besides the dieter pays for the meal.
- Other tactics have succeeded for some, including: regimenting specific times to eat, eating in only one room, using smaller plates, drinking ice water and taking fiber tablets before meals, over-spicing the food, keeping only boring bland foods in the house, never eating after 7:00 PM, eating one course every 15 minutes, never eating while doing something else (watching TV, reading a book), eating only one "combo" food–that you love–for an entire week until you get sick of it (enchiladas, sub sandwiches), wearing a rubber band on the wrist that is snapped at first sign of temptation (often called negative conditioning, or aversion therapy), dining in the nude, agreeing to allow a dinner companion to defile your meal if you get caught up in a "feeding frenzy"; and recognizing if food is being used for emotional fulfillment, or one's hostilities are being eaten, as in "swallowing one's anger."
- Therapy, hypnosis, subliminal training, and acupuncture have all had varying degrees of success.
- OTC appetite suppressants are effective for only 10–21 days, after which a tolerance occurs and effectiveness declines. These preparations can cause hypertension and agitation.
- Hang a full-length mirror on the refrigerator door, and visit the refrigerator only in the nude.

### Determining Ideal Weight

| Female (> 25 yr.) | Male (> 25 yr.) |
|---|---|
| **Starting Height (barefoot—medium frame)** | |
| 5'3" | 5'9" |
| **Starting Weight (nude)** | |
| 122 lbs. | 152 lbs. |

- Add or subtract 4 lbs. for each inch over or under starting heights. To this result, add 5 lbs. for a large frame; subtract 5 lbs. for a small frame.
- Acceptable ranges are 7 lbs., higher or lower.

## EVALUATION of POPULAR REDUCING DIETS

### Standard Low Calorie (Weight Watchers, etc.)

- Most low-calorie diets are safe, reasonable, and effective if caloric restriction is not excessive for a prolonged time. Some popular regimens may emphasize an attempt to prevent feelings of "deprivation" by advocating small portions of high-calorie foods, such as lasagna or chocolate cake. Many dieters find the lack of volume uncomfortable, and will tend to increase amounts gradually over a period of time, thereby defeating the purpose of the diet. Many commercial dieting interests package and market dessert foods that are high in sugar, but low in fat which therefore makes them lower in calories than the same "normal" foods. The high sugar content can cause hypoglycemic effects and hyperinsulinism, thereby perpetuating fatigue and sugar-craving symptoms. When calories are restricted, so are vitamins and minerals. Supplementation is recommended.

## High Protein, Low Carbohydrate (Atkins', Ketogenic)

- This diet is based on the theory that protein does not convert to adipose tissue, even in gargantuan amounts, and therefore the dieter can eat as much as is desired. A concurrent severe restriction of carbohydrates forces the system to convert protein to immediate fuel as well as accelerate adipose catabolism through ketogenesis (production of ketones–the by-products of fat breakdown).
- This diet works, but may be hazardous for some individuals. In a healthy system, about 58% of ingested protein is converted to glucose; this is accentuated with a high-protein, low-carbohydrate regimen. The metabolic rate is generally increased, blood sugar is stabilized, blood pressure may be decreased due to water loss. There is a high satiation rate, but the diet may become barely palatable after a time. Muscle-tissue wasting, often observed with low-calorie diets, is prevented with this diet. The initial dramatic weight loss often observed with this diet is due to protein overload (resulting in increased ammonia and urate) and ketone accumulation, forcing the kidneys to work overtime to rid the system of these potentially damaging substances. Water loss is prominent.
- Ketogenesis occurs primarily from breakdown of adipose tissue, and partially from the high-fat content inherent in the standard diet. High levels of serum ketones can cause acidosis in sensitive individuals if the metabolic buffer system (see "Calcium and Related Electrolytes" section) is inadequate. Ketones are disposed of through, and can be measured in the urine, breath, saliva, and sweat. Since the kidneys must bear the burden of ketone flushing almost totally in a sedentary individual, release of ketones through exercise-induced sweating and exhaled air will prevent damage to these hard-working organs.
- This diet is much too high in phosphorus, therefore calcium and magnesium supplementation is absolutely essential. Bicarbonate supplementation may be wise to ameliorate the systemic acidosis of a high-protein intake. Uric acid buildup is also likely if pyridoxine (B6) is not supplemented along with B-complex, otherwise gout is a possible consequence. Because fruits are forbidden, supplements of ascorbate are also necessary.
- Though fresh greens are part of the diet, fiber intake is inadequate and supplemental fiber powders may be required to prevent constipation and other intestinal problems. As the fat content may also be too high, this diet is recommended only for active people with a healthy liver; even they may need lecithin supplements to aid fat emulsification. Generally, use of this diet is wise only while under the care and supervision of a competent health care professional.

## Water-Loading Diet (Stillman, Venus de Milo, etc.)

- High intake of purified water (up to five quarts daily) is the basis for this "toxin and fat flushing" diet. Sodium intake is also severely restricted as part of the regimen. The theory is that most people suffer from water retention due to excessive sodium intake, so flushing the system will create a groundwork for a more healthy life-style.
- Food intake for the first few weeks is very limited. Turkey, eggs, fish, and green vegetables are the main staples of the diet; red meats and dairy products are used sparingly, if at all. The daily caloric intake rarely exceeds 600–800 calories. Potassium and B-vitamin supplements are advocated to accentuate the water-flushing effects of the diet. Weight loss may be quite rapid as serum sodium levels decline and water retention subsides. Many people on this diet feel better, but others may feel worse, even terrible.

- Heavy water intake combined with severe sodium restriction and potassium supplementation may pose a danger to some individuals, especially those who exercise vigorously. Mineral losses (calcium, magnesium, zinc) through perspiration and pronounced diuresis, may be high and cause deficiencies. Sodium depletion through a combination of water loading, exercise, and hot weather may bring about "water intoxication" which resembles heat exhaustion–manifested as fatigue, dizziness, muscle weakness and cramping, rapid and weak pulse, and heart palpitations leading to cardiac arrest.
- Protein intake on this diet during the first week or so is inadequate, thereby promoting weight loss through muscle-tissue cannibalization. This is accelerated with heavy exercise. This diet may be dangerous for more than three days.

## Liquid Protein Diet (Protein-Sparing Diet)

- This diet is a desperate and extreme measure to promote rapid weight loss in the very obese. It consists of little or no solid food, with 15–60 grams of liquid protein administered daily to prevent significant muscle-tissue breakdown. Adipose tissue is rapidly broken down, and it alone provides all of the necessary energy required by the body. Ketosis is expected and marked. Because of the obvious limitations of this reducing method, heavy supplementation of most minerals is mandatory. Supplementation with B-complex vitamins is required to properly convert fat to glucose and then to ATP energy, and to mitigate the incredible physical stress associated with this starvation technique. This reducing regimen can be very dangerous. It is never recommended without the supervision of a physician, as frequent lab tests are critical. Fatalities from cardiac arrest have been reported, even under a doctor's close watch.

## Egg, Rice, Grapefruit, Popcorn Diets

- These diets are based on the faulty assumption that some particular foods are somehow "magical" in promoting weight loss. The only thing really amazing about them is just how boring they can become. In time, dieters find it difficult to gag down another of the "magic food," and elect to restrict intake voluntarily. Vitamin deficiencies are likely and supplementation is suggested.

## One-Food-A-Day Diet

- Eating only one kind of food per day can create deficiency states, as well as unusual nutrient imbalances. Most nutrients are required on a daily basis, and don't sit and "wait" for the synergistic partner to be introduced the next day. Protein utilization is especially sensitive to such restrictions. Arbitrary elimination of macronutrients from the diet may alter the production of enzymes necessary for their digestion.

## Herbal Powder Diets (Herbal Life, etc.)

- Low-calorie weight loss programs used in conjunction with herbal powders are very popular. Most of the herbs in the formulas promote diuresis and intestinal purging. These effects may compromise mineral balance and create serious problems in those predisposed to kidney disease or bowl afflictions, such as colitis. Herbs can be very allergenic or even toxic when combined with prescription drugs. This diet should be undertaken with the counseling of a qualified health professional.

## High Complex Carbohydrate, Very Low-Fat Diets (Pritikin, etc.)

- Though these diets have received much media attention, they do have their drawbacks. Increased complex carbohydrate consumption increases the vitamin and fiber intake, however, high carbohydrate diets cause hyperinsulinism (and associated health problems) in more than 50% who engage in this diet.
- The protein content is minimal and may promote weight loss through muscle tissue cannibalization. Severe fat restriction may create absorption problems with fat-soluble vitamins as well as most minerals. Reduced hormone production in females has been noted with severe restriction of dietary fats. This diet has been used with heart disease patients with some success, but low-glycemic diets have proven even more successful.

## Fruit-Loading Diet (Beverly Hills or Hollywood Diet)

- This diet is based on the false and unfounded claim that certain fruits (mainly pineapple and papaya) contain enzymes that promote their digestion (they do), but don't cause weight gain because they are quickly and fully digested. Furthermore, it is claimed that other foods cause weight gain because they are *not* fully digested, and the undigested residue is stored as adipose tissue. The proponents of this diet also assert that the body will use the massive quantities of sugar for immediate energy only, and that no excess intake of carbohydrates will be stored as fat. Improper food combining is also blamed as a cause for weight gain. All of this could not be further from the truth.
- *Undigested foods pass out of the body as feces.* All-fruit diets will promote diarrhea; sodium restriction coupled with a high potassium intake will promote further water losses from tissues. Muscle-tissue breakdown will be significant if this regimen is maintained for over a week. Calcium, magnesium, zinc, and other micronutrients are all absent. Most fruits contain little B-complex, and the laxative effects of this diet will further aggravate mineral and B-complex inadequacies, eventually causing severe depletion of these nutrients. Blood sugar levels may rise and fall rapidly. Absorption of fat-soluble vitamins is greatly reduced. As a final note, this diet is very dangerous for longer than a week, and may create more problems than it alleviates. The "research" on which it is based has not been scientifically substantiated and the written work for its promotion and application is riddled with blatantly false statements, misinformation, and negligent assertions.

## Injections (hormone shots)

- Injection of gonadotropic hormones had been a popular reducing strategy in the past, but recently has lost favor due to some of the side-effects. A low-calorie diet is used in conjunction with the shots; the diet alone promotes weight loss, while the shots curb the appetite and keep energy levels up. Gonadotropin, a pituitary hormone, can be quite dangerous over extended periods. This hormone affects the pituitary directly and can cause dramatic changes in every other gland/hormone system. Some side-effects are an increase or decrease in thyroid function (changing metabolic rate), and an increase or decrease in sex hormone production, which can affect sex drive and cause aberrations in the menstrual cycle. This reducing technique must be medically supervised. As with all calorie-restricted diets, supplementation of most vitamins and minerals is recommended.

## DETERMINING FRAME SIZE

- In years past (and still practiced today in some health spas), frame size was determined by wrist measurements, with 5"–5¾" being a small frame, 5¾"–6½" a medium frame, and 6½"–7½" indicating a large frame. This method of determining frame size has come under recent scrutiny and is now regarded as invalid. Fat is stored on the wrist as well as the more obvious areas. Water retention and arthritis can also dramatically affect wrist measurements.
- A more accurate and dependable method of determining frame size is the use of elbow-breadth measurements. This area of the body rarely accumulates fat, and unless deformed by injury or disease, remains the same size throughout adult life. The distance between the two bony prominences on either side of the elbow is measured when the arm is held straight out from the shoulder and bent at the elbow 90°. The table below lists average measurements for a medium frame. Higher measurements indicate a large frame; lower measurements indicate a small frame.

| Men | Elbow Measurement |
|---|---|
| 5'1"–5'6" | 2¾"–2⅞" |
| 5'7"–5'10" | 2½"–3" |
| 5'11"–6'2" | 2¾"–3⅛" |
| 6'3"–up | 2⅞"–3¼" |

| Women | Elbow Measurement |
|---|---|
| 4'9"–5'2" | 2¼"–2½" |
| 5'3"–5'10" | 2⅜"–2⅝" |
| 5'11"–up | 2½"–2¾" |

# CALORIC ALLOWANCES CHART (Light Activity)

### Children

| | | | |
|---|---|---|---|
| 0 to 6 mo., 15 lbs.<br>770 cals. | 1 to 3 yr., 30 lbs.<br>1100 cals. | 4 to 5 yr., 45 lbs.<br>1600 cals. | 7 to 10 yr., 65 lbs<br>2200 cals. |

### Females

| | | | | |
|---|---|---|---|---|
| 11 to 18 yr.<br>98 to 120 lbs.<br>2300 cals. | 19 to 50 yr.<br>128 to 135 lbs.<br>2000 cals.<br>1620 cals. (resting) | > 51 yr.<br>128 to 135 lbs.<br>1850 cals. | Pregnant<br>2300 cals. | Lactating<br>2500 cals. |

### Males

| | | |
|---|---|---|
| 11 to 14 yr., 98 lbs.<br>2800 cals. | 15 to 22 yr., 135 to 150 lbs.<br>3000 cals. | 23+ yr., 154 to 160 lbs.<br>2600 cals. |

### Calorie Requirement Adjustments

| | |
|---|---|
| Heavy exercise | 26 cals/lb. body weight |
| Moderate exercise | 21 cals/lb. body weight |
| Sedentary | 16 cals/lb. body weight |

- One pound of adipose tissue yields approximately 4082 calories.
- A 1000-calorie reduction of food intake per day will result in a loss of approximately 1¾ pounds per week. Addition of exercise will increase this loss. Any losses beyond these average figures usually indicate water loss, which may be quite significant at the start of a diet.
- Unconditioned, overweight individuals expend more calories in performing the same tasks as well conditioned, fit persons–as long as the effort remains the same. If the output effort is less than that of a fit person, the calories expended will be less in an unfit person. For example, more calories are burned if a mile is briskly walked rather than slowly shuffled.
- Walking briskly at 3.5–4 miles per hour consumes an average of 5.2 cal/minute.
- Stepping up and down 25 steps per minute consumes an average of 7.5 cal/minute.
- Bicycling on level ground consumes about 8.2 cal/minute.
- Jogging alternated with walking (5 minutes each mode), consumes about 10 cal/minute.
- Swimming with average skill burns about 11.2 cal/minute, but this may be dramatically influenced by water temperature.

## Calories Expended During Exercise (For a 154-Pound Individual)

- The tables on the following pages reflect average weight losses in persons with no underlying metabolic or disease disorders. Individuals will vary.

- Some dieters may find that an increase in activity will cause a temporary, but alarming increase in weight. This is due to metabolic shifts in water balance and does not indicate fat gain. After a time, even though the scale may show no changes, body measurements will decrease.

**Walking**

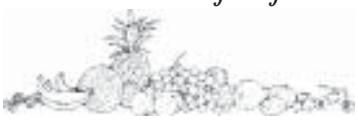
| *Minutes Per Day* | *Reduce Calories by:* | Days Required to Lose: *5 lbs.* | *10 lbs.* | *15 lbs.* | *20 lbs.* | *25 lbs.* |
|---|---|---|---|---|---|---|
| 30 | 400 | 27 | 54 | 81 | 108 | 135 |
| 30 | 600 | 20 | 40 | 60 | 80 | 100 |
| 30 | 800 | 16 | 32 | 48 | 64 | 80 |
| 30 | 1000 | 13 | 26 | 39 | 52 | 65 |
| 45 | 400 | 23 | 46 | 69 | 92 | 115 |
| 45 | 600 | 18 | 36 | 54 | 72 | 90 |
| 45 | 800 | 14 | 28 | 42 | 56 | 70 |
| 45 | 1000 | 12 | 24 | 36 | 48 | 60 |
| 60 | 400 | 21 | 42 | 63 | 84 | 105 |
| 60 | 600 | 16 | 32 | 48 | 64 | 80 |
| 60 | 800 | 13 | 26 | 39 | 52 | 65 |
| 60 | 1000 | 11 | 22 | 33 | 44 | 55 |

Average expenditure: 5.2 calories per minute at 3.5 to 4 miles per hour

**Stepping**

| *Minutes Per Day* | *Reduce Calories by:* | Days Required to Lose: *5 lbs.* | *10 lbs.* | *15 lbs.* | *20 lbs.* | *25 lbs.* |
|---|---|---|---|---|---|---|
| 30 | 400 | 24 | 48 | 72 | 96 | 120 |
| 30 | 600 | 18 | 36 | 54 | 72 | 90 |
| 30 | 800 | 15 | 30 | 45 | 60 | 75 |
| 30 | 1000 | 12 | 24 | 36 | 48 | 60 |
| 45 | 400 | 20 | 40 | 60 | 80 | 100 |
| 45 | 600 | 16 | 32 | 48 | 64 | 80 |
| 45 | 800 | 13 | 26 | 39 | 52 | 65 |
| 45 | 1000 | 11 | 22 | 33 | 44 | 55 |
| 60 | 400 | 18 | 36 | 54 | 72 | 90 |
| 60 | 600 | 14 | 28 | 42 | 56 | 70 |
| 60 | 800 | 12 | 24 | 36 | 48 | 60 |
| 60 | 1000 | 10 | 20 | 30 | 40 | 50 |

Average expenditure: 7.5 calories per minute at 25 steps per minute (one direction only)



## Bicycling

| Minutes Per Day | Reduce Calories by: | Days Required to Lose: 5 lbs. | 10 lbs. | 15 lbs. | 20 lbs. | 25 lbs. |
|---|---|---|---|---|---|---|
| 30 | 400 | 23 | 46 | 69 | 92 | 115 |
| 30 | 600 | 18 | 36 | 54 | 72 | 90 |
| 30 | 800 | 14 | 28 | 42 | 56 | 70 |
| 30 | 1000 | 12 | 24 | 36 | 48 | 60 |
| 45 | 400 | 19 | 38 | 57 | 76 | 96 |
| 45 | 600 | 15 | 30 | 45 | 60 | 75 |
| 45 | 800 | 13 | 26 | 39 | 52 | 65 |
| 45 | 1000 | 11 | 22 | 33 | 44 | 56 |
| 60 | 400 | 17 | 34 | 51 | 66 | 86 |
| 60 | 600 | 15 | 30 | 45 | 60 | 75 |
| 60 | 800 | 12 | 24 | 36 | 48 | 60 |
| 60 | 1000 | 10 | 20 | 30 | 40 | 50 |

Average expenditure: 8.2 calories per minute (non-competition speeds, no hill grades)

## Jogging

| Minutes Per Day | Reduce Calories by: | Days Required to Lose: 5 lbs. | 10 lbs. | 15 lbs. | 20 lbs. | 25 lbs. |
|---|---|---|---|---|---|---|
| 30 | 400 | 21 | 42 | 63 | 84 | 105 |
| 30 | 600 | 17 | 34 | 51 | 68 | 86 |
| 30 | 800 | 14 | 28 | 42 | 56 | 70 |
| 30 | 1000 | 12 | 24 | 36 | 48 | 60 |
| 45 | 400 | 18 | 36 | 54 | 72 | 90 |
| 45 | 600 | 14 | 28 | 42 | 56 | 70 |
| 45 | 800 | 12 | 24 | 36 | 48 | 60 |
| 45 | 1000 | 10 | 20 | 30 | 40 | 50 |
| 60 | 400 | 15 | 30 | 45 | 60 | 75 |
| 60 | 600 | 12 | 24 | 36 | 48 | 60 |
| 60 | 800 | 11 | 22 | 33 | 44 | 55 |
| 60 | 1000 | 9 | 18 | 27 | 36 | 45 |

Average expenditure: 10 calories per minute (alternate jogging, walking, jogging, etc.)

## Swimming

| *Minutes Per Day* | *Reduce Calories by:* | Days Required to Lose: *5 lbs.* | *10 lbs.* | *15 lbs.* | *20 lbs.* | *25 lbs.* |
|---|---|---|---|---|---|---|
| 30 | 400 | 20 | 40 | 60 | 80 | 100 |
| 30 | 600 | 16 | 32 | 48 | 64 | 80 |
| 30 | 800 | 13 | 26 | 39 | 52 | 65 |
| 30 | 1000 | 11 | 22 | 33 | 44 | 55 |
| 45 | 400 | 17 | 34 | 51 | 68 | 85 |
| 45 | 600 | 14 | 28 | 42 | 56 | 70 |
| 45 | 800 | 11 | 22 | 33 | 44 | 55 |
| 45 | 1000 | 10 | 20 | 30 | 40 | 50 |
| 60 | 400 | 14 | 28 | 42 | 56 | 70 |
| 60 | 600 | 12 | 24 | 36 | 48 | 60 |
| 60 | 800 | 10 | 20 | 30 | 40 | 50 |
| 60 | 1000 | 9 | 18 | 27 | 36 | 45 |

Average expenditure: 11.2 calories per minute for average skill in heated pool. Cool water can accelerate calorie expenditure by 400% or more.

## Minutes of Activity Required to Expend Calories in Selected Foods

| Food | Minutes Of Activity | | | | |
|---|---|---|---|---|---|
| | *Walking* | *Stepping* | *Bicycling* | *Jogging* | *Swimming* |
| Bacon, 2 slices | 19 | 13 | 12 | 10 | 9 |
| Banana, 1 medium | 24 | 17 | 16 | 13 | 11 |
| Beer, 12 oz. can | 33 | 22 | 21 | 18 | 15 |
| Bread w/butter, 1 slice | 18 | 13 | 12 | 10 | 9 |
| Cake, white ⅙–9" | 48 | 33 | 31 | 25 | 22 |
| Cheese pizza, 2 slices | 36 | 25 | 23 | 19 | 17 |
| Cheese, Cheddar 1 oz | 22 | 15 | 14 | 11 | 10 |
| Cookie, chocolate chip | 10 | 7 | 6 | 5 | 5 |
| Doughnut, glazed | 24 | 17 | 15 | 13 | 11 |
| Fried chicken breast | 90 | 62 | 54 | 46 | 42 |
| Fried shrimp, 3.5 oz. | 43 | 30 | 27 | 23 | 20 |
| Fruit pie, ⅙–9" pie | 77 | 53 | 49 | 40 | 36 |
| Hamburger | 67 | 47 | 43 | 35 | 31 |
| Ice cream, 6 oz. | 36 | 25 | 23 | 19 | 17 |
| Mayonnaise, 1 T | 19 | 13 | 12 | 10 | 9 |
| Milk, whole, 1 cup | 36 | 21 | 20 | 16 | 14 |
| Pancake, w/2 T syrup | 39 | 27 | 25 | 20 | 18 |
| Pecan pie, ⅙–9" pie | 129 | 89 | 82 | 67 | 60 |
| Potato chips, 20 | 40 | 28 | 28 | 20 | 20 |
| Spaghetti/sauce, 2 cups. | 76 | 53 | 48 | 40 | 35 |
| TV dinner, chicken | 104 | 72 | 66 | 54 | 48 |

## FAT ALLOCATION CHART *(humor)*