James L. Holly, M.D.

The Science of Appetite
By James L. Holly, MD
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No diet has ever been able to defy the laws of thermodynamics. Old-wives tales have argued against this foundation principle of nature. Supposedly, grapefruit is a key to a successful diet because, "it takes more calories to metabolize grapefruit, than are in the grapefruit itself." This is not true or else it would be easy enough to lose weight just by eating enough grapefruit.

New research indicates that where on your body you pack on extra pounds may provide a clue to determining which diet will work best for you. Even the most rigorously adhered-to diet will not produce the same results from person to person. Some people are simply genetically predisposed to burn more calories more efficiently than others.
Restricting calories will lead to differing results.

The key to which diet works for you may be related to your insulin levels. All food you eat is broken down into simple sugars which provide the energy for breathing, walking, talking and for all other bodily functions, some of which we are conscious and others which are not. Insulin is the hormone of feast. In times when food was scarce, insulin helped preserve all of the nutrients and calories we could find. Now, with food so plentiful, insulin stores the excess carbohydrates we pour into our system from candy bars or fruit juice or starchy foods like pasta.

Sometimes insulin can do such a good job of responding to a spike in blood sugar that it causes sugar levels to quickly drop. This in turn can lead to feelings of hunger shortly after a big meal. For this reason, many scientists think insulin may be a stimulus for overeating and, as a result, weight gain.

Apple and Pears

In a study of 73 obese adults researchers looked at high- and low-insulin secretors. People who rapidly secrete a lot of insulin after eating a little bit of sugar tend to carry

their excess weight around their waist — the so-called “apple shape.” People who secrete less insulin carry their excess fat around their hips — the “pear shape.”

The study found that high-insulin, apple-shaped people will not lose as much weight on a diet that restricts fat calories as they will on a low-glycemic-load diet. The glycemic level of a food is a measure of how rapidly that food turns to sugar in the bottom. Glycemic load is a combination of the glycmic level of all of the foods eaten at one meal multiplied by the amount of each food in grams. Low-secreting, pear-shaped people will do equally well on either type of diet. Over the course of six months:

- high- insulin-secreting, apple-shaped people lost an average of 6 kg on a low-glycemic diet and just 2.3 kg on a low-fat diet
- Low-insulin-secreting, pear-shaped people lost about 4.5 kg on both diets.

A large report published in J.A.M.A. showed that regardless of body shape, Atkins produces the greatest short-term weight loss. But adherents tend to fall off the low-carb wagon and quickly gain back unwanted kilograms. What's more, the Atkins diet allows only a small fraction of calories to come from carbs, compared with 40% on the new study's low-glycemic regimen. The more balanced diet encourages people to eat whole-grain cereals and other complex carbs that take longer to digest and thus don't cause the rapid fat production that accompanies spikes in blood sugar. Atkins' more restrictive regimen may reduce fat even faster, but people lose weight on both diets.

Apple-shaped people should probably not choose low-fat diets, because the white rice or other types of simple carbs they are still allowed to eat may have a yo-yo effect on blood-sugar levels, making them hungrier sooner. For apple-shaped people hunting for the right diet, a blood test to determine insulin levels may help confirm which regimen will work best for them. But for pears, it remains a toss-up. So until scientists find out more about their body shape, they'll have to lose the old-fashioned way: eating less.

Visual stimulation of appetite

As children, we develop the taste for certain types of foods, particularly sweets. When you got your first taste of something which was “good,” the mesolimbic region in the center of your brain—the area that processes pleasure— was activated. The vagus nerve flashed signals to the stomach, which began to secrete digestive acids. The pancreas

began producing insulin. The liver processed the sugar and fat and starch that were being eaten. As all those complex processes were unfolding, your midbrain filed away a simple, unconscious idea: that tasted good.

The Hunger Hormone

Identified in 1999, ghrelin is produced in the gut in response to meal schedules—and, according to some theories, the mere sight or smell of food—and is designed to give rise to the empty feeling we recognize as wanting to eat. When ghrelin hits the brain, it heads straight for three areas:

- the hindbrain, which controls the body's automatic, unconscious processes
- the hypothalamus, which governs metabolism
- the mesolimbic reward center in the midbrain, where feelings of pleasure and satisfaction are processed

Studies which measured the hormone in people's blood every 20 min. found that levels reliably spike as mealtimes approach. Add or subtract a daily meal, and you soon gain or lose a surge. Grazing animals have little spikes of ghrelin all day long—20 to 30 in the case of a rat. One of the reasons gastric-bypass surgery can work in severely obese people—apart from the fact that it reduces the carrying capacity of the stomach—is that it also appears to decrease the production of ghrelint.

The Balance to Ghrelin

If ghrelin were all there was to it, we and the rats would eat ourselves to death. But even as one system is stimulating our hunger, another slowing it down. The first step in that appetite-taming process occurs in the stomach and upper intestine, where nerves that sense stretching and distension eventually alert the brain that we're getting full. That message is reinforced by three substances that are produced in the the gut.

The first, a peptide released by the upper intestine called cholecystokinin (CCK), is the most fleeting of the three, reaching the brain and increasing the feeling of heavy satisfaction that prods you to push away from the table. But CCK does not last long, certainly not long enough to prevent you from eating again well before your body needs more fuel.

Following CCK are two hormones, GLP-1 and PYY, that reduces hunger. Produced in the lower gut, they not only tell your brain you've had enough but also tell your stomach to stop what it's doing and not move anything further along into the intestines—where the real business of digestion takes place—until what's there has been broken down some.

If you've ever finished a heavy meal at 8:30 p.m., and realized that you still feel stuffed when you climb into bed at 11,, that's why. What's more, GLP-1 adjusts blood chemistry, stimulating the pancreas to release more insulin, which soaks up sugars released into the blood by the inrushing food and stores them in the body's fat deposits.

Leptin Suppresses Appetite

If despite all those obstacles in the path of overeating you still pack in too much food—and as a result pack on too much fat—the body has one other substance which slows down your appetite: leptin. An appetite-suppressing hormone discovered in 1994, leptin is produced by body fat itself, usually in direct proportion to how much of the tissue you're carrying. The fatter you are, the more leptin you produce. Unfortunately, this is the only positive hormone produced by fat cells. All of the other dozens of fat-cell producing hormones are harmful to your health.

Once in the bloodstream, the hormone travels to the hypothalamus, one of the same brain regions targeted by ghrelin, seeks out a pair of neuropeptides known to stimulate appetite and partly muffles their signals. The result is, or should be, that fatter people want to eat less. Not surprisingly, the discovery of leptin was huge news in the diet community. Maybe obese people were simply suffering from a shortage of leptin; supplement the hormone with periodic injections, and the fat would dissolve away.

There are hundreds of millions of obese people in the world, but even after 13 years of study, researchers have found only a handful—on the order of 10 to 20—with a congenital deficit in leptin production or function. In fact, the leptin system in most overweight people works precisely the way it's supposed to, with hormone levels climbing more or less in lockstep with weight. The problem is, at some point the stuff simply stops working—or at least stops keeping pace with the numbers on the scale.

When the few people born with a leptin deficit are given supplemental injections, they respond to the treatment. But in other obese people—whose systems have been overexposed to the hormone over the years and thus grown resistant to it—the treatments do no good at all. (Some studies show that leptin sensitivity can be improved by dieting and losing body fat, making supplements a little bit more effective.)

Conclusion

There are many gimmicks sold to and many billions of dollars spent by people trying to lose weight. It is unlikely that we will ever find a “magic bullet” which will solve the problem for everyone. Nothing will ever substitute for self-discipline, diet and exercise. Understanding the science of appetite will help you know why your food choices can help or hurt your effort to regain or retain your health by working toward your ideal body weight.