

# Honey—more than Just a sweetener, naturally

by Ronald Fessenden, M.D., M.P.H.

For centuries honey has enjoyed a positive image as nature's sweet substance. Biblical references refer to its sweetness. Culinary schools and chefs consider it an alternative to sugar. Grocery stores and health food outlets stock it on the "sweetener" shelves. To most people, honey is simply a sweetener, in a market flooded with sweeteners and sugar substitutes.

However, to include honey in the category of "sweeteners" risks missing a more significant message. To be sure, honey is sweet. But *honey is more than just a sweetener*. It is a wonderful, natural, historic food containing secrets that have been hidden or ignored for too long in the United States. Soon, honey will be in the cover stories of women's magazines, culinary publications and health journals across the country, and its secrets will be out.

Honey is what the marketing industry refers to as a "functional food," also known as a *nutraceutical*—a natural food that delivers a health benefit. The past ten years have witnessed an emergence of a major marketing trend focusing on these foods. The impact of these marketing trends on consumption has been impressive for foods such as tea, almonds, brown rice, dark chocolate, tomatoes, dairy products, and eggs.

The success of these marketing campaigns is due not just to slick advertising, though that plays a big part. Behind the campaigns is solid scientific research uncovering what many natural food enthusiasts (and mothers and grandmothers) have known for decades. Certain natural foods are beneficial because they contain nutrients not found in processed foods and refined sugars. These nutrients provide numerous benefits, including, to name a few, lowering blood pressure and cholesterol, reducing the risk of cardiovascular disease, fighting cancers, improving the immune system, and controlling blood sugar.

## **Fructose and glucose**

Welcome honey to this growing list of functional foods. Thanks to the honeybee, nectars from plant and tree blossoms are converted to a concentrated mixture of fructose ("fruit sugar") and glucose in an almost equal ratio. (The actual ratio of fructose to glucose concentrations varies depending on the varietal.) Also contained in honey: a small amount of other sugars, amino acids, phyto-nutrients (or plant nutrients), bioflavonoids, antioxidants (at least 16 of them!), small amounts of vitamins, organic acids, and mineral elements, plus a few enzymes added by the bee. When honey is consumed, the best of the nutrients concentrated from plant blossom nectar is available for immediate absorption into the body for food and energy.

This average 1:1 ratio of fructose to glucose found in commonly available honey is the key to one of its most significant health benefits. Fructose derivatives in the liver activate the release of glucokinase from the liver mitochondria. Glucokinase is necessary for the conversion of glucose to glycogen in the liver. In other words, the presence of fructose facilitates or accelerates the conversion of glucose to glycogen. Insulin becomes in effect a fat-storing hormone that rapidly ushers glucose out of the bloodstream and into the cells. Depending on the immediate energy needs of muscle cells, some of the glucose is converted to glycogen to be used for fuel. Most of the glucose from a typical high-carbohydrate meal (excluding one with honey) is stored in the cells as fat. With fructose present, as in honey, glucose is stored as glycogen in the liver, where it is available for use by the brain, the heart, the kidneys, and the red blood cells during periods of rest and recovery.

To illustrate this point, consider a parallel situation that occurs in the metabolism of infants. Infants are not good at processing fructose as found in fruits and vegetables (and honey), but the mother's breast milk provides a solution. Breast milk contains lactose, a duo-saccharide that consists of glucose and galactose. Galactose is in effect the infant version of fructose. Galactose is taken into the liver by virtue of the enzyme galactokinase and is converted to glucose, and is then, like fructose,

stored as liver glycogen. Galactose is the accelerator for glucose uptake and conversion to glycogen. In other words, galactose facilitates the uptake of glucose into the liver and its utilization as an energy source. *Infants who lack the enzyme that metabolizes galactose fail to thrive.*

Adults who over the years consume large quantities of carbohydrates and store large amounts of fat run the risk of failing to thrive, in a metaphoric sense. However, like infants, adults who are provided with the proper “accelerator” in their diet to facilitate glucose-to-glycogen conversion produce adequate stores of liver glycogen and reduce their risk of developing many disease states or conditions associated with metabolic stress.

Fructose consumed by itself (as in foods containing high fructose corn syrup, or HFCS) presents the body with a different set of challenges. Whereas every cell in the body can metabolize glucose, it is the liver that is the primary location for fructose metabolism. Dr. William J. Whelan, a biochemist at the University of Miami School of Medicine, stated it this way: “When fructose reaches the liver, the liver goes bananas and stops everything else to metabolize the fructose.” Studies that have compared HFCS with refined sugar or sucrose find that they have essentially identical physiological effects in the body with regard to elevated blood sugar and insulin levels. Other studies have indicated that fructose consumption over time can lead to insulin resistance, obesity, and elevated LDL cholesterol and triglycerides. (There is disagreement regarding the long-term effects of fructose consumption on the body; observational studies have produced conflicting results. This may be due in part to the relatively short duration of the trials, the lack of dietary control, and the lack of non-fructose-consuming control groups, all of which are confounding factors in human experiments.)

With its ideal combination of fructose and glucose, honey minimizes or avoids many of the results of consuming refined sugar in sugary sweets or HFCS in soft drinks. Honey does not produce the high insulin spike that follows the ingestion of sugar (sucrose) or other simple carbohydrates. The fructose in honey facilitates the uptake of glucose into the liver: glucose is converted to glycogen and stored for later use. Blood sugar swings are modulated, preventing the metabolic stress that typically occurs from insulin spikes following the ingestion of high glucose loads and the subsequent hypoglycemia.

The body’s response to low blood sugar or hypoglycemia (a condition that follows, within an hour and a half to two hours, eating carbohydrates high on the glycemic index) is to release adrenalin and cortisol, “stress hormones” that force the breakdown of muscle protein for conversion to glucose for fuel. Over time, this repeated overdosing on sugar and high fructose corn syrup (both refined sugar and HFCS are “toxic sweeteners” in the dosages currently consumed\*), the chronic over-secretion of insulin, the resultant wide swings in blood sugar levels, and the release of adrenalin and cortisol result in what is termed insulin resistance (IR), which leads to impairment of glucose metabolism and type 2 diabetes.

### ***Honey’s advantages over sugar***

Honey does not force the body into these wide blood sugar swings. In fact, *honey stabilizes blood sugar levels and reduces metabolic stress.* Honey, it may be logically argued, will decrease the occurrence of insulin resistance, which, when uncorrected, is a precursor of, results in, or is related to, a whole host of disease states plaguing Americans of all ages, including:

- Type 2 diabetes
- Obesity
- Childhood obesity
- Cognitive memory impairments from inadequate glucose metabolism in the brain
- Neuro-degenerative diseases (Alzheimer’s disease, parkinsonism)
- Depressive disorders
- Vascular changes, cardiovascular disease
- Polycystic ovary syndrome (PCOS) in adolescent girls

- Chronic liver disease

Could it be that the answer to these health problems is as simple as eating honey and eliminating much of the refined sugar and high fructose corn syrup in our diets?

Animal research studies have already shown that a diet of honey results in less weight gain than a diet of sugar or HFCS. The same studies have shown that a honey diet results in lower HAI C (a marker used to indicate elevated blood sugar levels) and triglyceride levels. Some unpublished studies (results to be published later this year) have indicated that the consumption of honey actually results in weight loss as compared with diets of sugar or HFCS.

But that is not all. *Eating honey ensures an adequate supply of liver glycogen at all times throughout the day.* Because honey, and its ideal ratio of fructose to glucose, is rapidly incorporated into glycogen in the liver, it becomes the ideal food for quick morning starts. It is perfect as a pre-, mid-, and post-exercise energy source. And taken before bedtime, it is a great way to get a good night's sleep.

Honey's effect on sleep is one of the more exciting and promising focuses of research yet to be conducted. We already know that *honey promotes restorative sleep in two ways.* First, it ensures an adequate supply of liver glycogen for the night fast. The average adult liver can store only about 75 to 100 grams of glycogen, with differences between men and women and according to body size. The body will consume about 10 grams of glycogen per hour (6.5 grams by the brain and 3.5 grams by the heart, kidneys, and red blood cells). When one eats dinner at 6:00 PM and goes to bed at 11:00 PM, the body will have utilized up to half of the liver's supply of glycogen, leaving less than needed for eight hours of rest. Eating honey before bedtime re-stocks the liver with glycogen and ensures getting through the night before the brain triggers a crisis search for fuel (the metabolic stress, described earlier, that occurs when the liver runs out of glycogen).

Second, honey facilitates restorative sleep by contributing to the release of melatonin in the brain. Honey triggers a small spike in insulin levels (the glucose in honey stimulates a small insulin release), and insulin stimulates the release of tryptophan in the brain. Tryptophan is converted to serotonin, which in the dark is converted to melatonin. Melatonin in return inhibits the release of insulin, thus further stabilizing blood sugar levels during the night. Melatonin is necessary for restorative sleep. Often called the "wellness hormone," it helps to enhance immunity and facilitate the rebuilding of tissues during rest.

Recent research is discovering that poor-quality or inadequate sleep is a risk factor for hypertension and is related to obesity, with the secondary complications of insulin resistance and type 2 diabetes, hyperlipidemia, cardiovascular disease, hypertension, stroke, cancer, and arthritis. What we cannot declare with certainty at present is the direct role that honey may have in the reduction in these conditions or diseases. Still, common sense suggests that because honey facilitates restorative sleep, it may well have a role in reducing the incidence of the diseases and conditions for which poor quality or inadequate sleep are risk factors.

Despite the need for more research, there is already a growing body of evidence indicating that honey will help us sleep better, exercise better, and even think better and be more creative. Eating honey improves immune response, which means that it may play a huge role in preventing and ameliorating certain diseases. The staggering costs of health care in the United States are driving a change towards an emphasis on prevention rather than curative medicine. What if we just start with redesigning the lunch programs in our public schools and begin to eliminate those four pounds of sugar a week that each person consumes? Eating a little honey (about a pound a week is enough) will produce enormous individual health benefits. The public health benefits, including the financial impact across a generation, would be astronomical.

Some skeptics will say that reducing the intake of refined sugar and adopting a lifestyle of exercising and eating a balanced diet will produce the same results without adding honey to the diet. What they forget is that *honey is more than just a sweetener!* It is a pure, natural food with healthful benefits that extend well beyond its qualities of sweetness. Its reputation is known throughout history. Its message is timely and carries great national significance for this generation and the next.

*\*The current per capita consumption of refined sugar in the United States is more than 150 pounds a year. Another 62 pounds of high fructose corn syrup is consumed per person each year. This means that every man, woman, and child in America consumes an average of four pounds of sugar and HFCS each week. Try that intentionally some time! By comparison, the per capita consumption of honey per year is only about than one pound!*

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