

SCIENTIFIC HEALTH RESEARCH AS A PLATFORM FOR A MARKETING STRATEGY

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The National Honey Board of the United States shifted its scientific research focus from one oriented around product development, to one that is more basic in nature. While product development never ceases to be important, the goal of the research effort is to learn more about the compositional and health-related properties of honey. As with research on other foods currently underway, the objective of the Board's research is to find the scientific basis for the folklore surrounding honey and the use of honey in traditional medicine. By finding these characteristics, food manufacturers and pharmaceutical companies alike have more compelling reasons to include honey in their formulations for their consumers, in addition to the sweet, pleasant flavor enjoyed by many people worldwide.

Some of the scientific research undertaken by the Board focuses on the unique properties of varieties of honey found in the United States. The topics include antimicrobial activity of honey, characteristics of antioxidant compounds found in honey, the effect of honey ingestion on athletic performance, the effect of honey on growth and viability on *Bifidobacteria* and the sensory characteristics of honeys available in the United States.

Antimicrobial Properties

Honey possesses inherent antimicrobial properties, some of which are 1) high osmotic pressure/low water activity, 2) low pH and 3) hydrogen peroxide the end product of the glucose oxidase system¹⁸. Low concentrations of this known antiseptic are effective against infectious bacteria and can play a role in the wound healing mechanism¹³. The antimicrobial activity of honey varies by variety of honey and handling¹³.

Research around the world is proving honey to be helpful in the treatment of various types of wounds by stimulating the healing process, increasing the rate of healing, clearing infection, stimulating tissue regeneration, reducing inflammation and decreasing discomfort caused by dressing changes¹². There are also indications that honey can be helpful in treating peptic ulcers, gastritis and diarrhea^{12,13}. The Board is currently investigating the antimicrobial activity of honey varieties found in the United States. While skepticism of the medical establishment is a hurdle to be overcome, honey is approved for topical use by the Therapeutic Goods Administration of Australia.

Antioxidant Characteristics

The antioxidant activity of honey also varies by variety. Generally, the darker the honey the greater the activity⁴, however, that is not a hard and fast rule. Researchers at the

University of Illinois are continuing to examine the antioxidant properties of various honey varieties (acacia, fireweed, clover, soybean, tupelo, Hawaiian Christmas berry and buckwheat)⁵. Honey contains various flavanoids and phenolic compounds (including quercetin, pinocembrin, kaempferol, chrysin and galangin), which also vary in quantity and type present in each variety. Investigation continues on the other potential water-soluble antioxidant compounds and antimutagenic effects³.

The Board is currently sponsoring a project which was recently started at the University of California at Davis. The objective of this study will be to determine the bioavailability of phenolic antioxidants — whether honey can convey a measurable increase in human blood plasma antioxidant capacity¹⁶. This work is similar to that which has been done for red wine, chocolate and purple grape juice.

It has been shown that honey is an effective antioxidant in meat products. The Board sponsored two research projects at Clemson University on poultry meat products. The latter showed that ground poultry meat containing 15% honey: 1) significantly reduced the rate of oxidation compared to 0% and 5% honey, 2) has the highest cook yield, 3) allowed the addition of more water without a loss in quality or yield and 4) had no bacterial growth for total plate count detected over 11 weeks of refrigeration^{2,10}. The details of this work can found on the National Honey Board's technical Web site www.nhb.org/foodtech/.

University of Illinois researchers also investigated the role honey can play in the inhibition of lipid oxidation in ground poultry meat¹¹. They looked at four varieties of honey with different antioxidant contents (buckwheat, clover, soy and acacia). A range of responses, based on the antioxidant content of the honeys (buckwheat<clover<soy<acacia), was found. Buckwheat at 5% (w/w) reduced 2-day thiobarbituric acid reactive substances about 50%, where acacia honey reduced these values by about 20%⁹.

The University of Illinois research group investigated honey as an inhibitor of enzymatic browning that builds upon earlier work by other researchers in this area. By testing seven different types of honey with crude extracts of fresh fruits and vegetables, they found decreased browning, based on the antioxidant content of the honey tested¹. Of the seven honey varieties tested, buckwheat, with the highest antioxidant content, showed the greatest inhibition of polyphenol oxidase and acacia the least on both counts. Interestingly, soy honey, while not as high in antioxidant content as some of the other honeys, was as effective in decreasing browning as some of those with the higher content.

The area of antioxidant research is not only new to honey, it is relatively new to foods in general. Research is showing, that honey is not only effective as an antioxidant in food systems, but may also be effective as an antioxidant in the human system.

Honey and Athletic Performance

A series of three trials in this area were executed at the University of Memphis. In the first phase of this work^{8,14}, 71 subjects were given one of seven types of carbohydrates after an eight-hour fast. The carbohydrates tested were dextrose, sucrose, fructose, maltodextrin, honey, Powergel® or a placebo. Honey appears to have a relatively mild effect on blood sugar as compared to other carbohydrates. The lower glycemic index of honey is important to athletes because when carbohydrate is ingested just prior to exercise, higher glycemic index carbohydrates may promote fatigue faster due to the corresponding release of insulin and faster muscle glycogen (stored carbohydrate source) utilization.

The second phase⁷ showed that combining honey with a protein supplement may boost post-workout recuperation and favor better blood sugar maintenance after exercise.

Thirty-nine weight-trained athletes underwent an intensive lifting workout and then consumed a protein supplement with sucrose, maltodextrin or honey. The group that consumed honey was the only group to maintain optimal blood sugar levels for two hours after the workout.

The objective of the third phase of this work⁹ was to determine if honey is an effective source of carbohydrates for endurance athletes. In this part of the study, nine competitive bicyclists participated in three weekly 64 km time trials on a racing bicycle attached to a calibrated computerized race simulator. The subjects consumed 15 g of a placebo, dextrose gel or honey with 250 ml of water at the beginning and at every 16 km mark of the time trial. Results showed no statistical difference between honey and dextrose. Honey and dextrose produced a statistically significant reduction in race times and a significant increase in the average power of the athletes.

Thus, this series of experiments show honey to be an effective carbohydrate source for endurance athletes. With the sports and fitness category being a large market segment in the United States, this can be especially attractive to those athletes who prefer to use natural carbohydrate products.

Effect of Honey on *Bifidobacteria*

Another aspect of research undertaken by the Board was to investigate the effect of honey on the growth and viability of *Bifidobacteria*. Typically, dairy products are the favored food for introducing lactic acid bacteria and bifidobacteria into the human digestive tract²⁰. The purpose for doing this is to improve the microbial balance of the intestine. *Bifidobacteria*, however, are fastidious microorganisms. Keeping their numbers large enough to be meaningful can be a challenge to food manufacturers. Honey contains a small percentage of oligosaccharides that could serve as a food source for these beneficial bacteria, thereby, making honey a “prebiotic” for the “probiotic” dairy food.

A research project undertaken at Michigan State University tested the effect clover honey had on five strains of *Bifidobacteria* versus inulin, fructooligosaccharide (FOS) and galactooligosaccharide (GOS)⁶. Just as with commercial oligosaccharides, the

effect of honey was strain specific. Honey did enhance the growth of three of the strains better than inulin or FOS, but not as well as GOS, was not as effective as inulin with another strain, but better than FOS and GOS and with a fifth strain, honey was as effective as inulin, but less than that for FOS or GOS. The overall conclusion of this research is that honey showed effects similar to commercial oligosaccharides on the activity and growth of *Bifidobacteria*. A more detailed report on this research can also be found on the Board's technical Web site, www.nhb.org/foodtech/.

Elimination of *Clostridium botulinum* Spores

Because *Clostridium botulinum* spores can be present in honey, a project was initiated at the University of Georgia in an attempt to eliminate them from honey. These spores are found widely in the environment, but cannot be removed by conventional methods due to the heat resistance of the spores¹⁸. The experimental method currently under scrutiny is a continuous flow, high-pressure system modified to handle a viscous product like honey¹⁹. The honey is heated and diluted, pressurized, held briefly and instantaneously cooled by flash evaporation in a vacuum¹⁸. The amount of water added to the honey at the beginning of the process is removed during the evaporative cooling process to restore the honey to its original solids content. In addition to the inactivation of both yeasts and spores, it appears that the antioxidant compounds in honey are not adversely affected by this technique. If this process proves feasible, this provides possible new product areas for honey, such as infant foods and certain pharmaceutical applications.

Sensory Characteristics

In addition to finding the more "scientific" properties of US honey varieties, research is also being devoted to developing a "language" to describe the flavor and aroma characteristics of specific varieties of honey. Too often, "honey flavor" is used as a general term. The task was to describe, in words, the unique sensations produced by each variety. So far, the varieties examined have been avocado, blueberry, eastern (US) buckwheat, clover, eucalyptus from California, Florida orange blossom, California black-button sage and tupelo¹⁵. The honeys were tested at r-tech laboratories, commercial laboratory, whose specialty is sensory science. In this case, 13 trained panelists evaluated the different varieties in three replications using a process called descriptive analysis. The information compiled is available to food and sensory scientists for use in product development, also be found on the Board's Web site at www.nhb.org/foodtech/. In addition to the more "technical" form of this information, a simpler version was developed for use by chefs and consumers. Testing of more varieties is planned in 2001.

The ongoing scientific research sponsored by the U. S. National Honey Board is adding and will continue to add to the continuing body of knowledge about honey. This information will be useful in making verifiable claims for emerging uses for honey in the nutraceutical and medicinal areas, as well as for promotion of unique varieties.

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