NUTRITIVE VALUE OF HONEY AND ITS UTILIZATION

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Summary

The nutritive value of honey has been recognized by doctors and dietitians for centuries. Honey is an excellent stimulent in the medical diet. Honey is suitable as a food for people with retarded digestion and also for the feeding of infants. Increased knowledge of mineral elements in body function has brought the attention of scientists to the mineral content of honey and their nutritive values. Honey contains all essential trace elements. Inclusion of honey in the daily diet helps eliminate deficiencies of these elements. Honey is an energy producing food. By combining honey with dairy and other products, a variety of new delicious products can be manufactured.

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Honey was of great importance as an article of diet to the ancients, being almost their only available source of sugar. In India and other eastern countries, honey was used for the preservation of fruit, for making cakes, sweetmeats and other foods.

Dietitians and medical men have recognized, long ago, the nutritional value of honey and that honey has certain properties which ordinary sugar does not have. Doctors have recognized honey as a food especially suitable for people with retarded digestion. Experiments conducted in the United States have shown that honey is a valuable food for the feeding of infants. Dr. M. W. O'Gorman, Chief of the Division of Hygiene of Jersey City, used honey for twenty-five years as a valuable additive to milk used for infant feeding and in the growing child's dietary (BECK, 1938).

Old people have been capable of building up their strength by using honey. The ability and strength lost during life can be restored to a certain degree, by honey. Therefore, honey has been called "the milk for the old". What cows give to youth, the bees give to old people (SIMONS, 1965). Both cows and bees are suppliers of a special nutrititon which helps mankind enormously at the beginning and the end of the life span.

Besides proteins, carbohydrates, fats and vitamins, babies for normal growth and adults for normal body function, require a variety of minerals. The mineral elements which the body needs, in what might be called substantial quantities, are calcium, magnesium, sodium, potassium, sulphur, chlorine and iron. The body also needs in smaller or "trace" amounts, copper, iodine, manganese, cobalt, zinc and molybdenum. Inorganic elements play various roles in the body: as components of skeletal structures, as cellular constituents, as regulators of body acidity and in association with enzymes system (DAVIDSON and PASSMORE, 1963). Mineral elements such as copper, iron and manganese have important blood building functions (BECK, 1938). If there is not enough iron in the food, the body cannot build haemoglobin (red pigment in blood cells). Iron is also essential for the haem-containing enzymes such as catalase, peroxidases and cytochromes. The deficiency of iron is a very common cause of anaemia.

Manganese is involved in the activation of several enzymes such as peptidase, phosphatase, arginase, cozymase, carboxylase and choline esterase. A normal human diet contains 5-10 mg of manganese per day. Zinc is also an essential element for the human body. It is a constituent of insulin and the enzymes anhydrase.

Cobalt is an essential nutrient for man. Cyanocobalamine (Vitamine B_{12}) contains 4% cobalt. The quantity of cobalt needed to maintain the body in good health is extremely small, since the total amount of cyanocobalamine in the whole body is about 2 mg. Dark honey contains 6.0 mg of cobalt per 6 kg of honey. Cobalt is a component of vitamin B_{12} which is essential for a large variety of animals and even some micro-organisms. The following table shows the daily requirements of various minerals (HARROW and MAZUR, 1962).

Daily requirements of some minerals

Element	Daily requirements
Calcium	0.8 g
Phosphorus	1.3 g
Magnesium	0.3 g
Potassium	-
Sodium	10 to 20 g of sodium
Chlorine	chloride
Iron	12 mg
Copper	2 mg
Manganese	1.5 mg
Zinc	12 mg
Cobalt	15 mg

The increasing knowledge of the function of the mineral content in the human body has brought the attention of scientists to the mineral constituents of honey and their nutritive value. A high ash content increases the nutritive value of honey (B. FEINBERG, 1951). The analysis of Australian dark and light honeys as determined by atomic absorption spectrophotometry (PETROV, 1970) showed some significant difference.

It can be seen from the analysis that the amount of potassium, calcium, iron, aluminium, magnesium, manganese and cobalt is higher in dark honeys than in light honeys. Similar results have been published by workers in other countries (SCHUETTE and REMY, 1932; VARJU, 1970).

Although the lighter colored honeys are more popular with the consumer, it would seem that the darker variations have a greater nutritive value due to their higher mineral content. This analysis also showed that honey contains all essential trace elements. By studying the mineral requirements of the human body and the composition of the mineral constituents of honey, it can be seen that honey contains most of the essential elements needed by the human body. Therefore, in cases where a deficiency of trace elements exists, including honey in the daily diet may help to eliminate this deficiency. The deficiency of essential trace elements exists, not only in under-developed countries (World Health Organization Report, 1959), but also in developed countries of Europe and North America (DAVIDSON and PASSMORE, 1963; page 461-2). The deficiency of some essential nutrients or elements is not necessarily due to insufficient food supply but o consequence of an unbalanced diet.

Constituents	mg/kg honey	
	Stringy bark (dark)	Clover (light)
Silicon	23	136
Aluminium	111	9
Iron	37	9
Calcium	227	107
Magnesium	132	40
Sodium	23	251
Potassium	1,241	441
Manganese	10	0.8
Copper	0.6	0.8
Chromium	<0.6	<0.3
Nickel	<0.06	<0.03
Zinc	2.0	3.0
Cobalt	6.0	0.2
Antimony	<2.0	<1.0
Lead	0.2	0.1
Phosphorus	123.0	129.0

Experimental work done by Drs. KNOTT, SCHUKERS and SCHULTZ (1941) showed that the retention of calcium and magnesium in the body from food was higher when honey had been included in the diet of infants.

Dr. EMRICH (1923), in his experiments with children, established that by including honey in the diet, the haemoglobin content in the blood was increased. This was possibly due to the presence of iron, copper and cobalt in honey which are essential elements in haemoglobin formation.

Dr. PALMER, Division of Biochemistry, University of Minnesota, conducted a series of experiments on the value of honey for the prevention and cure of nutritional anaemia in rats. It was established in these

experiments that by adding dark honey to the rats' food, the haemoglobin formation was increased. The addition of light honey was less effective. These experiments proved that by the addition of dark honey, nutritional anaemia in rats could be cured (ROOT, 1961).

If honey helped to cure anaemia in rats, it could possibly help to cure many cases in humans where the diet fails to meet the nutritional requirements. It has already been shown by Dr. EMRICH (1923) that by the addition of honey to childrens' diets, the haemoglobin content can be increased.

Pernicious anaemia is now treated by the oral administration of Vitamin B_{12}, between 75 and 300 µg per day in place of liver extracts formerly used (BREWERTON, 1952; BLACKBURN, 1952). Vitamin B_{12}, unusual in that the molecule contains an atom of cobalt, occurs widely in nature in small quantities (e.g. fish, milk, sea-waters, etc.) and is synthesized generally by micro-organisms (ROBINSON, 1966).

It is interesting to speculate whether the cobalt found in honeys is present as cobalamin because very few organic compounds of cobalt are known to occur in nature. However, should this postulation be correct, it would mean that the dark honeys formed from eucalypt nectars are a rich source of Vitamin B_{12}. As isolated from livers in a pure crystalline form, Vitamin B_{12} contains approximately 4 percent of cobalt (SMITH, 1948).

It is essential to do more experimental work of a similar nature as has been done by Dr. PALMER, Dr. EMRICH and Dr. FRAUENFELDER, to establish further the nutritive value of other mineral elements found in honey.

In antiquity and all through the Middle Ages, honey was considered as an important medicine. Even today, honey is still used for medicinal purposes among Asiatic races, Egyptians, Arabs and Africans. Honey has a distinct antiseptic property. For this reason, honey is good for sore throats and chaffed skin. Hot milk and honey makes an excellent remedy for husky throats. The literature shows that children suffering from malnutrition, blood deficiency, lung diseases and nerve troubles have been successfully treated with honey in milk by Swiss doctors, P. EMRICH (1923) and FRAUENFELDER (1921).

Dr. SCHUCHT (BECK, 1938) of Wiesbaden (West Germany) claims to have cured many hopeless cases of gastric and intestinal ulcers with honey. This is because the main components of carbohydrates in honey are glucose and fructose which can be taken directly into the blood so quickly that distress from acid stomach or heart burn cannot occur.

Honey is an excellent stimulant in the diet for physical and mental fatigue and over-work. When honey is taken in small amounts, it can act as a source of direct nutrition. This is because the main components of carbohydrates in honey are glucose and fructose which can be rapidly assimilated into the human digestive system. There are about 1,540 calories per pound in honey. It is therefore, an energy producing food.

Honey and milk have some similarities in their composition. Both of them contain minerals, proteins, carbohydrates and vitamins, although in different proportions. The average analysis of these two products shows the proportions as follows:

	Honey	Milk
Minerals	0.2 %	0.7 %
Proteins	0.4 %	3.8 %
Carbohydrates	81.2 %	4.7 %
Vitamins	Several	Several
Fats	-	3.9 %
Calories	326/100 g	67/100 g

From the composition of these two products, it can be seen that both are very nutritious due to the presence of necessary components needed to support life. This is not surprising because both of these products were made as nutritive foods: milk for young mammals and honey as a foodstuff to be used by insects during the winter.

From studies of the composition and nutritive values of honey and milk, it has been established that they are both important for human nutrition. By mixing the two products together, the nutritive value of the products can be increased. The Biblical designation "a land flowing with milk and honey" should be suggestive enough to combine honey with dairy products. Some wholesome combinations of these two products are: honey milk (5 % honey and 0.01 % stabilizer added to the milk), honey yogurt (1 to 2 % honey added to yogurt milk before or after incubation), honey milk bar syrup (half ounce of honey milk bar syrup per pint of milk), honey butter, honey cream cheese and honey ice cream. The cost of honey milk will not be any higher than the present cost of flavoured milk. For example: to produce 1 gallon of chocolate milk, the cost of ingredients is 36.97 cents (Australian currency) per gallon. (To produce 7 gallon of strawberry, 32.15 cents per gallon, caramel, 33.13 cents per gallon and orange, 31,93 cents per gallon.) To produce 1 gallon of honey milk, the cost of ingredients is 31.45 cents per gallon. By combining various flavours with honey, a very pleasant milk drink is obtained. Also, by replacing the ordinary sugar in flavoured milk with honey, the nutritive value of this drink is increased (PETROV, 1970).

Honey is used to sweeten an give special flavour to foods such as breakfast cereals, fruits and candies. Honey is used for commercial baking and wine production. It has also been used as facial pack in beauty parlours, in hand lotions, and gums.

However, lack of uniformity in physical characteristics and chemical behaviour must be taken into account when honey is to be used for industrial purposes. Great care and a through understanding of the behaviour of particular honey types is necessary for complete success in utilization for the production of honey dairy products, candy manufacture, commercial baking and wine production.

To extend the market of honey, more research work on chemical composition, nutritive value and utilization of honey in food and drink preparation must be done. For this research, our industry needs to encourage and support research work in this field.

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