Review Article

Embalming with honey: Quest for an eco-friendly and non-toxic museum

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Abstract

According to Codex Alimentarius, 'Honey is the natural sweet substance, produced by honeybees from the nectar of plants or from secretions of living parts of plants, or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature'. It can also penetrate deep into the tissue and can prevent autolysis and putrefaction. This paper highlights the usefulness of honey as an embalming agent.

Keywords: Embalming, honey, museum

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INTRODUCTION

Bee's honey is one of the most valued natural substances, which has been used for both nutritional and medical purposes in most of the ancient cultures as early as the Stone Age.[1] It was the only available natural sweetener for homo sapiens until the production of industrial sugar, which begin after 1800.[2] It is an aromatic viscid sweet natural substance produced by honeybees, which is derived from the nectar of plants (blossoms) or from the exudates of trees and plants, further modified by the honeybees into a denser liquid.[3]

SCIENTIFIC CLASSIFICATION OF BEE[4]

Kingdome	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Hymenoptera
Sub Order	Apocrita
Superfamily	Apoidaea
Family	*Apidae*
Subfamily	Apinae
Tribe	Apini
Genus	Apis

HONEYBEE SPECIES[4]

Most of the beekeeping textbooks still declare that there are just four species:

Apis mellifera	Apis florea
Apis cerana	Apis dorsata (Ruttner, 1988)

Since past 15 years, new species of honeybee have been discovered, and Michener has named eleven species in the genus Apis.

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Apis andreniformis	Apis koschevnikovi
Apis binghami	Apis laboriosa
Apis breviligula	Apis nigrocincta
Apis cerana (Asia)	Apis mellifera (Asia)
Apis dorsata	Apis nuluensis
Apis florea	

SYNONYMS OF HONEY[4]

Honey in Sanskrit is known as Madhu, Madhvika Mashika, Saragha Kshaudra, Makshikavanta, Varti, Bhrungavanta, Vanta and Pushparasodbhava.

AYURVEDIC CLASSIFICATION OF MADHU[4]

Latin Name	*Mal depuratum*
Rasa	Madhura, Kashaya
Guna	Guru, Ruksha
Virya	Sheeta
Vipaka	Katu
Doshghanta	Tridoshahara

TYPES AND QUALITY OF HONEY ACCORDING TO AYURVEDA

According to the Charak Samhita, honey is of four types, that is, Makshika, Bhramara, Kshaudra and Paittaka.[4]

Types of honey	Properties
Makshika	Produced by the reddish variety of honey bee Resemble colour of Tila Taila (Sesame oil)
Bhramara	Best type It is Guru (Heavy to digest) White colour
Kshaudra	Produced by a small type of honey bee Brown in colour
Paittaka	Produced by a large bee Resembles colour of ghee

According to Sushruta Samhita, honey is of eight types.[4]

Pauttika	Ksaudra	Chatra	Oudalaka
Bhramara	Makshika	Arghya	Dala Madhu

According to Bhavprakash, honey is of eight types.

Types of honey	Properties
Makshika	Collected by large honey bees Best Variety It is Laghu (lighter than Kshaudra), Ruksha (Dry) It is useful in Kamala (Jaundice), Arsha (Piles), Kshata (Phithis) Kasa (Cough) Beneficial in diseases like Asthma
Bhramara	Collected by large bees This honey is Guru (heavy - not easily digested) because of its Picchila (Slimy) and Ati Swadu (excessively sweet) properties It is Rakta Pitta shamak
Kshaudra	Collected by medium sized honey bees It is Sheeth (Cold), Laghu (light – easy to digest) and Lekhana (Anti-obesity) It is the best and especially beneficial in diseases like Prameha (Diabetes)
Pauttika	Collected by very large bees from the nectar of poisonous flowers. It is Ruksha (Dry), Ushna (Hot) it increases Vata, Rakta and Pitta, and this is also Chedana (liquefaction) Produces burning sensation in the chest Sedative and reduces fat Useful in disease like Diabetes and Dysuria
Chatra	Madhura (Sweet after digestion), Guru (heavy), Sheetha (Cold) and Picchila (Slimy) Cures bleeding disorders, leucoderma (Shwitra), urethritic discharges and worm infestations
Arghya	Beneficial for eyes, eliminates vitiated Kapha and Pitta Dosha, Kashaya (Astringent in taste), Katu Vipaka (Pungent after digestion) and Balya (Strengthening)
Oudalaka	Useful in skin diseases and helps in modulation of voice. It is Kashaya (Astringent) and Amla Rasa (Sour), Katu Vipaka (Pungent after digestion) and aggravates Pitta
Dala Madhu	Ruksha (Dry) It mitigates vomiting and diabetes mellitus

HISTORY

In Neolithic, paintings found in Caves of Cueva de la Araña, near Bicorp, Valencia, Spain shows evidences of the beekeeping. These paintings depict collection of honey by prehistoric man using a makeshift beehive.[5]

The first written reference of honey was described way back in 2100–2000 BC in a Sumerian tablet mentioning its use as a drug and an ointment. King Solomon in the holy Bible, said 'Eat honey my son, because it is good' (Old Testament, proverb 24:13). Aristotle in 384-322 BC, referred honey being 'good as a salve for sore eyes and wounds'.[6,7]

In Egypt, honey and its products (e.g. beeswax, honey, pollen, propolis and royal jelly) were utilized as medicine and as a ceremonial material. These have been found in the jars found in the tombs of several pharaohs, such as that of Tutankhamun.[8,9] Even in Greece and Rome, honey was used as medicine and as a source of energy food. For centuries in India, its great relevance was also described in Ayurvedic Medicine and Unani Medicine.[10] The therapeutic significance of honey was also identified in Persia. Avicenna, a scientist, philosopher and physician, delineated implications of honey in his book 'Canon of Medicine' approximately 1000 years ago.[5]

In Medieval Europe, beekeeping inspired the Florentine painter Piero di Cosimo who authored 'The Discovery of Honey'. Later, in the 17th century, the Tratado Breve sobre la Cultivación de las Colmenas was recorded in Spanish. It was one of the initial works on beekeeping, which was written in Spanish.[5]

COMPOSITION OF HONEY

The composition of honey (variable and primarily) chiefly depends on the floral source. However, certain external factors like environmental factors (seasonal) and processing may also play an important role. It consists of approximately 200 constituents; while others await further studies. It is a supersaturated solution chiefly composed of sugars (79.6%), that is fructose (38.19%), glucose (31.28%) and water (17.2%).[3,11,12]

It also consists of a wide range of minor constituents having antioxidant properties, that is phenolic acids and flavonoids, amino acids and certain enzymes (catalase, glucose oxidase).

Average composition of honey (data in g/100 g)[13-15]

Component	Average (%)
Water	17.2
Fructose	38.19
Glucose	31.28
Sucrose	1.31
Disaccharides, calculated as maltose	7.31
Higher sugars	1.5
Free acid as gluconic	0.43
Lactone as gluconolactone	0.14
Total acid as gluconic	0.57
Ash	0.169
Nitrogen	0.041
Minerals	0.2
Amino acids, proteins	0.3
pH value	3.9

According to the geographical and climatic conditions, there is a considerable difference in the composition and content of phytochemicals (polyphenols and phenolic acids) found in the honey.[11] Some of these phytochemicals are terpenes, benzyl alcohol, 5-dimethoxy-4-hydroxybenzoic acid (syringic acid), methyl, 5-dimethoxy-4-hydroxybenzoate (methyl syringate), 5-trimethoxybenzoic acid, 2-hydroxy-3-phenylpropionic acid, 4-dihydroxybenzene acid and 2-hydroxybenzoic attributes for the antimicrobial activity in honey.[11]

The colour of the honey also varies from water white to dark amber depending on the floral sources and its mineral content. Flavours are usually stronger in darker colour, and the quality of honey significantly depends on its composition and botanical origin.[16]

HONEY AS AN EMBALMING AGENT

Since ancient times, honey is known to be a good preservative for meat and fruits and used as an embalming agent in antiquity. Utilization of honey by ancient Egyptian was considered controversial until recent scientific research using modern techniques (gas chromatography, mass spectrometry, thin layer chromatography, infrared spectroscopy, x-ray fluorescence, etc.) unfold this mystery, and confirm the practice of beeswax in mummification, especially from 5th century B.C. onward.[3]

Various properties of honey that contributes to preservation and mummification are as follows:[3]

- Honey is a hypertonic concentrated solution mostly consisting of sugar, which preserve the tissue by gradually dehydrating it by osmosis.
- Honey comprises of inhibin which is a thermolabile bactericidal substance (hydrogen peroxide). The antibacterial effect of honey is also attributed to the hypertonic nature of honey and other constituents.

Hypertonicity of honey is responsible for the movement of water molecules out the tissue (low solute to high solute) leading to dehydration of the tissue, and inhibin and other enzymes present in the honey leads to the formation of hydrogen peroxide (H_2O_2), which assists in keeping the environment sterile free from any microorganisms, which are the most critical aspect of embalming.[3]

Egyptians had also used honey for mummification.[17] After the death of Alexander the Great in Babylon, he was transported to his home country in a coffin filled with honey.[3] King of Judea, Herod I (40-4 B.C.), executed his beautiful wife Marianne's body, and preserved it in honey for 7 years. Arabs still preserve eatables like meat in the honey.[17]

Sharquie KE and Najim (2004) conducted a study to demonstrate the embalming potential of unprocessed honey at room temperature by utilizing mice and human foetuses. They studied the morphological changes in these specimens for a period of 3 years and observed that the colour of these specimens turned darker with time along with shrinkage and reduction in the weight. Thus, concluding that naturally obtained unprocessed honey can be employed successfully as an embalming agent.[3]

CONCLUSION

Ancient civilizations have used honey for both nutritional and medical purposes. Literature search revealed that the natural unprocessed honey was successful utilized as an embalming agent for preservation of human bodies for longer duration. Embalming with honey can assist in generating a non-toxic anatomical specimen, which can be utilized in museum for long-term educational purposes.

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Conflicts of interest

There are no conflicts of interest.

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