

**EFFECT OF SAMSKARA (PROCESSING TECHNIQUES) ON HONEY – A
CONTEMPORARY REVIEW**

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ABSTRACT

Honey is the sweet yellowish liquid produced by honey bees. It is one of the most valued and appreciated natural substance known to mankind since ancient times. Honey is considered synergistic, which can be compared to *yogavahi* property explained in classics. *Samskara* is one of the important concepts of Ayurveda and its significance has been elaborated even with food as one among the factors of *Ashta ahara-vidhi-vishesha-ayatanas*. Concept of honey turning into poison due to heating is highlighted in Ayurvedic literature and therefore needs careful evaluation for its safety and efficacy. *Madhu-Samskara* is being explained in classics for specific outcomes in particular condition. Researches carried out on honey so far is primarily based on dosage, pharmacological activities and analytical procedures have thrown some light on physico-chemical changes and related influence on efficacy. This review article aims at substantiating the concept of *Samskara* of *Madhu* (Honey).

KEYWORDS: Samskara, Yogavahi, Hydroxy methyl furfural, Maillard reaction, Poly phenols

INTRODUCTION

Honey, a natural food product, is a sweet, viscous substance that is formed from the nectar of flowers by honeybees (*Apis mellifera*; Family: *Apidae*)¹. Both ancient as well as modern science has accepted honey as medicine and food. Honey has had a valued place in traditional medicine for centuries^{2, 3}. The ancient Egyptians, Assyrians, Chinese, Greeks and Romans employed honey for wounds and diseases of the gut. Honey was the most popular Egyptian drug being mentioned 500 times in 900 remedies⁴. Honey is produced by bees from plant nectars, plant secretions and excretions of plant-sucking insects. According to nutrient profile, it represents

an interesting source of natural macro and micro-nutrients, consisting of a saturated solution of sugars, of which fructose and glucose are the main contributors, but also of a wide range of minor constituents, especially phenolic compounds^{5, 6}. Apitherapy has become a major focus of research involving alternative medicine because a wide variety of well-known preventive or curative methods from folk medicine use honey to treat different ailments and the therapeutic properties of honey have been increasingly documented in the modern scientific literature^{7, 8, 9}. For a long time, it has been observed that honey can be used to overcome liver,

cardiovascular and gastrointestinal problems¹⁰.

Ayurvedic literature emphasizes great importance to *Madhu* for its use as *ahara* and *aushadha*. It is well understood that the success of the treatment lies in *yukti-pramana* of the physician, who should decide specific medicine in suitable conditions by considering various factors of both patient and medicine. *Samskara* is one such procedure greatly employed in altering/modifying qualities of *ahara* and *aushadha* according to the need. Processing of honey is much debated topic today as there are contradictory statements made in different texts regarding its after effects. Present review is based on various findings observed as well as documented so far in public domain.

Sources of data collection:

Details of present study were collected from different *Ayurvedic* treatises and bio-medical lexicon, research works, articles published in various journals and from few search engines.

Physical and chemical properties

Depending on the type of floral origin (Table 1), temperature, moisture content and proportions of specific sugars, physical properties of honey varies. Honey in fresh state is translucent, thick, syrupy liquid. The colour is pale yellow or reddish-brown and it possesses pleasant odour and sweet taste which is dependent upon the floral source of the product. The specific composition, colour, aroma and flavour of honey depend on the flowers foraged by bees that produced the honey¹¹.

Nutritious content in honey

Honey, which comprises predominantly monosaccharides and oligosaccharides, contains at least 181 bio active constituents¹². It is composed of 17% water and 82% carbohydrates; honey has low content of fat, dietary fibre and protein¹³. In a 100-gram serving, honey provides 304 kilocalories with no essential nutrients in significant content.¹⁴ Honey is a mixture of sugars and carbohydrates mainly fructose (about 38%) and glucose (about 32%), with remaining sugars including maltose, sucrose, and other complex carbohydrates¹³. The glycemic index ranges from 31 to 78, depending on the variety¹⁵. The specific composition, colour, aroma, and flavour of any batch of honey depend on the flowers foraged by bees that produced the honey¹⁶.

In Ayurveda, *Madhu* is classified into eight types on the basis of type of honeybee which secretes nectar among which *Makshika Madhu* is considered best. The classification along with their *guna karma* and *roghagnatha* are mentioned in (Table No; 2). *Madhu* is having *Madhura* rasa with *Kashaya anurasa* and is *Guru*, *Rooksha*, *Sookshma*, *Vishada*, *Sheeta Veerya* and *katu Vipaka*. *Susruta* opines is *tridosha shamaka*. The other properties of *Madhu* are *Deepana*, *Grahi*, *Lekhana*, *Balya*, *Sandhana*, *Srotovishodhana*, *Swarya*, *Varnya*, *Vrshya*, *Hrdya*, *Prasadajanaka*, *Soukumarya*, *Medhya* and *Ruchikaraka*. It is good in alleviating the ailments of *Netra*, *Chardi*, *Visha*, *Hikka*, *Shwasa Kasa*, *Shosha*, *Atisara*, *Raktapitta*, *Krimi*, *Trshna*, *Moha*, *Medoroga*, *Kushta*, *Arshas*, *Kshata* and *Kshaya*¹⁷.

Madhu differs in its qualities based on the duration of storage as storage has effect on

the properties of *Madhu*. The details have been mentioned in (table 4). *Samskara* is the process to modify the natural properties of the substances. It is interesting fact that when honey is processed its pharmacological activity changes. *Samskara* is one of the important concepts of Ayurveda. *Samskara* as transformation of inherent attributes of a substance. The concept of *Samskara* according to Acharya *Charaka* emphasizes increasing useful *gunas* and removing harmful *dosha*. *Kala* can also be considered as one of the *samskara* explained in Ayurveda¹⁸.

kaiyadeva nighantu, *rajanighantu* and contemporary sciences have supported the view of *samskara* of *Madhu*. In *kaiyadeva nighantu*, under *ausadha varga*, honey is explained to be beneficial in different condition if it is used in different forms and also advises *Madhupaka* (processing of honey) in which processed honey is used along with different substances in different conditions. Along with cows urine in *Durmamsa* (tumours), with *triphalakwatha* in *sthoulya* (obesity), with milk for *Vrana ropana*, with turmeric juice for *Vranashodhana* and finally along with *jala* it is advised in all diseases¹⁹. The concept of *yogavahi* which is explained in Ayurveda can be correlated to the concept of bioavailability enhancers^{20,21}. On the basis of traditional use, honey is considered the best *Yogavahi* by many authors in Ayurveda. Honey is considered as one of best *yogavahi* dravya²². It is regarded to be having synergistic activity when used along with other substances as per earlier studies conducted. In case of diabetes, various experimental studies have proved that usage

of honey along with anti-diabetic agents will prevent the complications of disease and modern drug²³⁻²⁶. This synergistic activity can be attributed to the concept of *Yogavahitwa* of *Madhu*²⁷. *Yogavahi* property of honey is because it is produced from different varieties of *dravyas* (*Kaiyadeva nighantu*)²⁸. This may be the reason for usage of *Madhu* with different drugs in different condition, example in case of all types of *prameha*, honey is advised as *anupana* almost with many drugs and preparation as it imbibes the qualities of substance with which it is combined and enhances the action²⁹.

Madhu samskara vidhi³⁰

Eight parts of *Madhu* has to be mixed with one part of water and must be heated/boiled till the quantity of honey is reduced to its original volume. While explaining *madhupaka* with other liquids such as *Triphala kashaya*, *dugdha*, *Haridra jala* and *Gomutra*, specific quantity is not mentioned hence taken in equal quantity.

Pasteurization

Processing is carried out in temperature 161 °F (72 °C) or higher. Pasteurization destroys yeast cells and liquefies any micro crystals in the honey, which delays the onset of visible crystallization. Heating of honey is done at particular temperature however; excessive heat exposure also results in product deterioration, as it increases the level of hydroxyl methyl forfurool (HMF) and reduces enzyme (e.g. diastase) activity. Appearance (darkens the natural honey colour), taste and fragrance are all affected by heat³¹.

Effect of heat on honey:

Honey is thermally treated for several reasons. Viz.,

1. Heating eases the processing of bottling by reducing the viscosity of honey³², but also reduces the water content in honey to prevent fermentation³³
2. Dissolves the sugar crystal nuclei to retard granulation³⁴
3. Homogenizes honey colour for the preference of consumers³⁵
4. Destroys the sugar tolerant osmophilic yeasts to prolong the shelf life of honey³⁶
5. Both diastase and invertase activities are commonly used in Europe as an indicator for honey freshness³⁷. Processing exhibited higher invertase activities than diastase activities.

Maillard reaction - It is a non-enzymatic interaction between reducing sugar and amino acid, peptide or protein, resulting in a variety of by-products, intermediates and brown products (melanoidins), which contribute markedly to the aroma, taste and colour, as well as to the antioxidant potential of stored and processed foods³⁸. Maillard reaction-like products, phenolic content and honey colour may suggest that these compounds represent the same chemical entity and exert their antioxidant activity while being part of a higher molecular mass structure³⁹. Natural nutrients can be lost to a significant degree during thermal processing due to the fact that most of the bioactive compounds are relatively unstable at higher temperatures. However, heat treatment sometimes causes no change or it increases the antioxidant activity of selected food. Moreover, novel compounds having an antioxidant property, such as Maillard reaction products, can be formed as a result

of heat treatment⁴⁰. However, high-molecular-mass melanoidins have also been identified as the main components responsible for radical scavenging capacity of unheated and heat-treated honey⁴¹.

Hydroxymethylfurfural (HMF): Hydroxymethylfurfural (HMF), also 5-(hydroxymethyl) furfural, is an organic compound formed by the dehydration of certain sugars⁴².

Hydroxymethylfurfural is a marker of poor or overlong storage of foods such as honey. The less HMF in honey is better honey quality⁴³. HMF is practically absent in fresh food, but it is naturally generated in sugar-containing food during heat-treatments like drying or cooking. Along with many other flavor- and colour-related substances, HMF is formed in the Maillard reaction as well as during caramelization. In these foods it is also slowly generated during storage. Acid conditions favour generation of HMF⁴⁴. HMF can be found in low amounts in honey. Here HMF can be used as an indicator for excess heat-treatment. fresh honey contains less than 15 mg/kg—depending on pH-value and temperature and age⁴⁵. The codex standard requires that honey have less than 40 mg/kg HMF to guarantee that the honey has not undergone heating during processing, except for tropical honeys which must be below 80 mg/kg. HMF content and enzymatic activity are the indicators for honey freshness³³. The HMF content will increase, whereas the diastase activity of honey will decrease for over-heated, aged and poorly stored honey samples HMF, a compound found in heated honey has been found to possess antitumor properties. Thus,

overheated honeys could potentially compensate the loss of quality by winning anti-cancer properties⁴⁶. Heating honey above 90° C could result in caramelization of sugar⁴⁷. Since the effect of heating duration was found to be more adverse than heating temperature. The water content less than 20% is required in order to reduce the rate of fermentation and to increase the stability of honey³³. The results found that honey samples was reduced to less than 20% of water content after 30 min of heating at 90° C⁴⁷.

Antioxidant capacity can be increased by thermal treatment. This may be due to occurrence of some other compounds at higher temperatures other than flavonoids or other phenolic compounds, which are known to be susceptible to thermal degradation. Based on different research it can be concluded that changes in the antioxidant activity commonly depend on two important factors: chemical composition of the honey and temperature and duration of heat treatment. Heating honey at 95°C for 5 min does not affect its antioxidant activity and total phenolic content has been established from studies⁴⁸. Honey seems to potentiate the antioxidant action of herbs, thus making

it an ideal sweetener of herb infusions. The antioxidant activity of honey was not influenced after digestion⁴⁹.

Effect of storage on honey

Factor of time brings about changes in the inherited properties of a *Dravya*, where as the *Kaala Prakarsha* refers to a particular time duration which will be considered as a part of *Samskara* that brings transformation gradually in due course of time¹⁸. Concept of *Purana Aushadhies* (old drugs) described in Ayurveda are usually advised to be used after one year of collection, for example *Vidanga*, *Pippali*, *Jaggery*, *Dhanyaka*, *Ghrita*, and Honey. This indeed leads to enhancement of their potency and when co-administered with other drugs, they might increase the bioavailability of those drugs. The concept of *Purana Aushadhies*, are not applicable to all the drugs which are kept for a long time (for 1 year or more)but are applicable in reference to certain drugs/class of drugs like mentioned above⁵⁰. Honey storage has remarkable influence on increase in invert sugar content⁵¹. Honey diastase activity is a quality factor influenced by storage, heating and thus an indicator of honey freshness and overheating⁵².

Table 1; Types of Honey acc to modern science⁵³

Type of Honey	Description
Blossom honey	Obtained predominantly from the nectar of flowers
Honeydew honey	Produced by bees after they collect “honeydew” (secretions of insects belonging to the genus, Rhynchota), which pierce plant cells, ingest plant sap and then secrete it again
Monofloral honey	In which the bees forage predominantly on one type of plant and which is named according to the plant;
Multifloral honey / polyfloral ⁵³	In which the bees forage from several botanical sources, none of which is predominant, e.g., meadow blossom honey and forest honey.

Table 2; Different types of Honey as well as their guna karma and roghagnatha⁵⁴

SL.No	Types of Madhu	Guna and karma	Rogagnatha
1	MAKSHIKA	Taila varna Madhura rasa; Laghu, Rooksha guna; Sheeta veerya ,Vata Shamaka	Netrarogas, Kamala, Arshas, Vrana, Kshaya and Shwasarogas.
2	BRAHMARA	Shweta- collieries coloured Madhura rasa; Madhura vipaka; Guru, Rooksha, Picchila, Abhishyandigunas and Sheetaveerya.	Raktapitta, Mukhajadya, Mootrajadya and Atyantajadyahara.
3	POUTTIKAM	Ghritam varna Laghu, Rookshaguna; Ushnaveerya Kaphasamaka,Pittavatavardhaka thereby causes Raktapitta and Daha.	Mootrakrchra, Granthi, Kshata and Shosha.
4	KSHOUDRAM	Kapila varna, It has Laghu, Rooksha, Sookshma, Abhishyandi, Picchilagunas ,Sheetaveerya acts as Pitta Vata Shamaka and is lekhaneeya,	pramehahara and netramayahara.
5	CHATRAM	Apeeta Varna, It has Madhura rasa; Madhura vipaka; Guru, Picchila guna;Sheeta veerya; allievates Rakta, Pitta vikaras,	Krimi, Shwitra and Prameha but aggravates Vata dosha.
6	AARGHYAM	Pingala varna, It possess Kashaya, Tikta, Madhurarasa; Katuvipaka; alleviates Kaphaand Pitta.	Balapushtikaraka and Chakshushya.
7	UDDHALAKA	Suvarna varna, It possess Kashaya, Amla, Tikta rasa; Katuvipaka, Ushnaveerya and aggravates Pitta.	Kushta, Visha, Aruchi and Swarya.
8	DALAM	Peetala varna, Katu, Amla, Madhura rasa; Kashaya anurasa; Vatala; Lekhaneeya.	Chardi, Aruchi and Prameha.

Table 3; Components of Honey⁵⁵

Sl.no	COMPOUNDS	QUANTITY PER 100 gms
1	Carbhohydrates	82.14gm
2	Sugars	82.12gm
3	Dietary fibre	0.2gm
4	Protein	0.3gm
5	Riboflavin (Vitamin B ₂)	0.038mg
6	Niacin(Vitamin B ₃)	0.121mg
7	Panthothenic acid(Vitamin B ₆)	0.068mg

8	Vitamin B ₆	0.024mg
9	Folate(VitaminB ₉)	2µg
10	Vitamin C	0.5mg
11	Calcium	6mg
12	Iron	0.42mg
13	Magnesium	2mg
14	Phosphorous	4mg
15	Pottasium	52mg
16	Zinc	0.22mg
17	Sodium	4mg
18	Energy	300Kcal (1270KJ)

Table 4;Classification of honey on the basis of duration of storage⁵⁶

Type of <i>Madhu</i>	Guna	Karma
Nava <i>Madhu</i> / Fresh honey	<i>Madhura</i> bhooyishta; - Guru, Snigdha, and Sara	Abhisyadi,NatiShleshmahara, Pushtikaraka, Sthoulyakara
Purana <i>Madhu</i> / Stored honey i.e for one year	Rooksha,Laghu	Anabhisyadi, Grahi, Atilekhana Medohara and Sthoulyagna. Tridosha shamaka

DISCUSSION

Every *dravya* has a specific *pancabhautika* composition. At every moment alteration in *pancabhautika* composition is taking place, due to *Agni Mahabhuta* present in it. But rate of transformation or alteration is too slow to identify and can be identified through potency expressed in terms of *karma*.

The factors outside like *desa, kala* etc, are also affecting the *pancamahabhutas* present in a *dravya*. So, it is clear that after change in *dravya* in the form of alteration in *pancabhautika* composition Change in *gunas* takes place, which is called as *gunantaradhana*. Except *Pruthvi* and *akasa* remaining three *Mahabhutas*, namely *Jala*,

Agni and *Vayu* are responsible for transformations or changes taking place in a substance. So, in any *Pancabhautika* substance also, continuous changes or transformations are taking place due to presence of *Agni Mahabhuta* in it. But the rate of transformation may differ according to quantity of *Agni Mahabhuta* present in it and other helpful conditions. By providing *Agni* from outside, one can increase the rate of transformation, Followed by *Vayu* and *Jala Mahabhutas* respectively. That's why in all the process mentioned as a *Samskara*, *Toya Sannikarsa* and/or *Agni Sannikarsa* is Mandatory¹⁸. In *kaiyadeva nighantu*, *samskara* of *Madhu* has been specified in treating various conditions through *paka*

samskara. *Samskara* and *Gunantradhana* are the essentials of ancient ideology. The pharmacological activity of *Madhu* varies when *Madhu* undergoes above different *samskara*. Also *kala* can also be considered as one of the modalities of *samskara* explained in Ayurveda. The extent of processing of *Madhu* can be estimated through both HMF content and enzymatic activities which are the indicators for honey freshness³³. The HMF content will increase, whereas the diastase activity of honey will decrease for over-heated, aged and poorly stored honey samples⁵⁷. Data suggest that honey, administered alone or in combination with conventional therapy, might be a novel antioxidant in the management of chronic diseases commonly associated with oxidative stress^{58,59,60}. In view of the fact that the majority of these data emanate from animal studies, there is an urgent need to investigate this antioxidant effect of honey in human subjects with chronic or degenerative diseases. The authors go on to suggest that honey might be the better antioxidant than accepted antioxidants such as vitamin C and E, as the latter act also as oxidants^{61,62}.

CONCLUSION

Honey being a wonderful gift of nature to mankind needs to be screened for all pharmacological activities. Processing of honey is undoubtedly a matter of debate, but can be used as a tool in achieving specific outcomes. Many researches undertaken so far have established the non-toxic form of processed honey and hence may be considered for regular use for both food and medicinal usage.

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