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Indian Melghat Honey: A Prospective Antibiotic

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Abstract: Honey is acceptable in the medical profession as an antibacterial agent for the treatment of some diseases and infections resulting from wounds and burns. Antibacterial and antifungal properties of honey are well documented against a number of Gram positive and Gram-negative bacteria and vary with origin and processing. In this study, we attempted to assess the Melghat honey as therapeutic agent and recorded high quality broad-spectrum antimicrobial properties. The bacterial pathogens, *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Salmonella typhimurium*, *Salmonella typhi* and *Proteus vulgaris* were highly sensitive to Melghat honey. Thus, the Melghat honey can be used as an alternative to antibiotics as well as a dressing for burns and other wounds.

Key words: Melghat honey, antibacterial properties, *E. coli*, *Salmonella typhi*, *Staphylococcus aureus*

Introduction

Honey is acceptable in the medical profession as an antibacterial agent for the treatment of some diseases and infections resulting from wounds and burns (Jeddar *et al.*, 1985; Zumia and Lulat, 1989). In many cases, it is used with success on infections not responding to standard antibiotics and antiseptic therapy (Molan, 1992). Antibacterial and antifungal properties of honey are well documented against a number of Gram positive and Gram-negative bacteria and vary with origin and processing (Allen *et al.*, 1991; Subramanyam *et al.*, 2001). The antibacterial activity of honey has been attributed both to physical factors e.g., osmolarity and chemical factors e.g., hydrogenperoxide, cecropin-A and mellitin, methyl 3,5-dimethoxy-4-hydroxybenzoic acid (syringic acid), tetracycline, nectar, volatiles and unidentified substances from certain floral sources (Al Somal *et al.*, 1994; Bogdanov, 1984).

The honey enhances the healing of wounds and pressure sores (Bardy *et al.*, 1997; Cooper and Molan, 2002; Lansdown and Silver, 2002; Gupta *et al.*, 1992; Molan, 1999). Tambekar and Rathod (2005) showed antibacterial activities of Indian honey against *Staphylococcus aureus*, *Salmonella typhi*, *Escherichia coli* and *Klebsiella pneumoniae*. Honey has been reported to inhibit the growth of bacteria such as *Bacillus cereus*, *Staphylococcus aureus*, *Salmonella dublin* and *Shigella dysenteriae* (El-Sukhon *et al.*, 1994; Ceyhan, 2001). Kumar (2005) reported antibiotic resistant *Staphylococcus epidermidis* was highly sensitive to honey collected from hilly region. These reports indicated that the honey is antibacterial but there are no reports on the antibacterial properties of Melghat honey, which is a local product produced in Satpuda ranges of Amravati district. Therefore, studies were performed to optimise the antibacterial use of Melghat honey in clinical practice and to combat infections produced by bacterial pathogens.

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Table 1: Varieties of honey and bacterial pathogens used in the study

Processed Melghat (PM) honey	Non-processed Melghat (NPM) honey from various villages	Other Branded Processed Indian (OBPI) honey	Bacterial pathogens (From IMTECH Chandigarh)
Melghat honey (5 samples)	Bhond (2 samples) Chendo (2 samples) Ghugarda (1 samples) Herabebai (2 samples) Susarda (1 sample) Zhimpri (2 samples)	Asaram Bapu Baidyanath Dabur Himalaya Kiran Sandu Sanjeevani	<i>E.coli</i> 390 <i>E.coli</i> 739 <i>Enterobacter aerogenes</i> 111 <i>Klebsiella pneumoniae</i> 109 <i>Proteus vulgaris</i> 426 <i>Pseudomonas aeruginosa</i> 424 <i>Salmonella typhi</i> 733 <i>Salmonella typhimurium</i> 98 <i>Staphylococcus aureus</i> 96 <i>Staphylococcus epidermidis</i> 435
Standard/control antibiotic: Rosacillin (Ampicillin 500 mg mL ⁻¹)			

Materials and Methods

The antibacterial properties of Melghat and other branded honey were studied at Postgraduate Department of Microbiology, S.G.B. Amravati University, Amravati (India). The standard bacterial pathogens used in the study were procured from IMTECH, Chandigarh (India) and maintained on nutrient agar and stored in freezing temperature. The ten samples of non-processed varieties of Melghat honey were purchased directly from villagers collecting the honey in the deep forest areas of Melghat. The five samples of processed Melghat honey was collected from Melghat honey processed unit and seven varieties of other branded processed Indian honeys from medical shops (Table 1).

Antibacterial Activities of Honey

The Whatman paper No. 1 punch disc (10 mm) soaked in various concentrations/dilutions (100 to 5% in sterile distilled water) of varieties of honey placed on the previously prepared lawn of each bacterial species on nutrient agar. The antibacterial activities were studied by disc diffusion method against the various bacterial pathogens and after incubation of 24 h at 37°C zone around the disc was measured as inhibition of growth.

Results and Discussion

The indiscriminate use of antibiotics has developed many antibiotic resistance microorganisms, which created immense clinical problems in the treatment of infectious diseases. Therefore, there is a need to develop alternative antimicrobial agents for the treatment of infectious diseases. A non-antibiotic approach to the treatment and prevention of infection includes the application of honey. Honey may prove to be important source of nutrition and for protection against microbial infection. The good control of infection by honey is attributed to the high osmolality and additional antibacterial activity because of its content of hydrogen peroxide (H₂O₂), lysozyme and other indefinite substances from certain floral sources (Ali, 2005; Adebolu, 2005).

In this study, we attempted to assess the antibacterial activities of processed Melghat (PM) and Non-Processed Melghat (NPM) and Other Branded Processed Indian (OBPI) honey against common bacterial pathogens. The study showed that MP honey was more antibacterial (score 73) as compared to NPM honey (score 61) and OBPI honey (score 60.7). The *Staphylococcus epidermidis* was highly sensitive to MP honey whereas *Staphylococcus aureus* and *Enterobacter aerogens* to NPM honey (Table 2). The *Klebsiella pneumoniae*, *Salmonella typhimurium*, *Salmonella typhi*, *Proteus vulgaris* were also highly sensitive to PM honey whereas *Pseudomonas aeruginosa* and *Enterobacter aerogens* were least sensitive (Fig. 1). In an average, the OBPI honey was comparatively low antibacterial as compared to PM and NPM honey.

Table 2: Scoring of antibacterial activities of Indians honey against human pathogens

Type	Honey from villages/brand names	<i>Staph. aureus</i>	<i>Sal. typhimurium</i>	<i>Staph. epidermidis</i>	<i>Ent. aerogenes</i>	<i>Pr. vulgaris</i>
Processed Melghat (PM) honey	Melghat honey	9.0	8.0	10.0	5.0	8.0
Non-Processed	Bhond-1	11.0	12.0	2.0	9.0	7.0
Melghat (NPM) honey	Bhond-2	8.0	5.0	6.0	7.0	5.0
	Chendo-1	9.0	4.0	9.0	11.0	6.0
	Chendo-2	12.0	8.0	5.0	9.0	4.0
	Ghugarda	11.0	10.0	8.0	9.0	7.0
	Herabebai-1	10.0	10.0	9.0	10.0	4.0
	Herabebai-2	10.0	4.0	10.0	9.0	6.0
	Susarda	10.0	8.0	8.0	10.0	8.0
	Zhimpri-1	11.0	11.0	7.0	9.0	9.0
	Zhimpri-2	9.0	7.0	11.0	7.0	5.0
	Average score	10.1	7.9	7.5	9.0	6.1
Other Branded Processed Indian (OBPI) honey	Asaram bapu	7.0	5.0	5.0	4.0	6.0
	Baidyanath	10.0	8.0	5.0	4.0	10.0
	Dabur	10.0	9.0	8.0	6.0	10.0
	Himalaya	6.0	6.0	7.0	3.0	7.0
	Kiran	8.0	8.0	5.0	6.0	8.0
	Sandu	9.0	3.0	7.0	5.0	7.0
	Sanjeevani	7.0	6.0	8.0	5.0	8.0
	Average score	8.1	6.4	6.4	4.7	8.0

Type	Honey from villages/brand names	<i>Sal. typhi</i>	<i>E. coli</i>	<i>Kleb. pneumoniae</i>	<i>Ps. aeruginosa</i>	Total
Processed Melghat (PM) honey	Melghat honey	8.0	9.0	9.0	7.0	73.0
Non-Processed	Bhond-1	11.0	7.0	5.0	4.0	68.0
Melghat (NPM) honey	Bhond-2	8.0	2.0	4.0	6.0	51.0
	Chendo-1	4.0	3.0	6.0	4.0	56.0
	Chendo-2	5.0	1.0	5.0	5.0	54.0
	Ghugarda	3.0	2.0	6.0	6.0	62.0
	Herabebai-1	9.0	11.0	4.0	9.0	76.0
	Herabebai-2	6.0	1.0	4.0	5.0	51.0
	Susarda	8.0	5.0	2.0	4.0	63.0
	Zhimpri-1	8.0	7.0	8.0	3.0	73.0
	Zhimpri-2	5.0	2.0	7.0	3.0	56.0
	Average score	6.7	4.1	5.1	4.9	61.0
Other Branded Processed Indian (OBPI) honey	Asaram bapu	5.0	11.0	4.0	6.0	53.0
	Baidyanath	4.0	10.0	8.0	4.0	63.0
	Dabur	8.0	6.0	10.0	8.0	75.0
	Himalaya	6.0	7.0	4.0	6.0	52.0
	Kiran	7.0	12.0	9.0	5.0	68.0
	Sandu	3.0	7.0	5.0	5.0	51.0
	Sanjeevani	8.0	8.0	6.0	7.0	63.0
	Average score	5.9	8.7	6.6	5.9	60.7

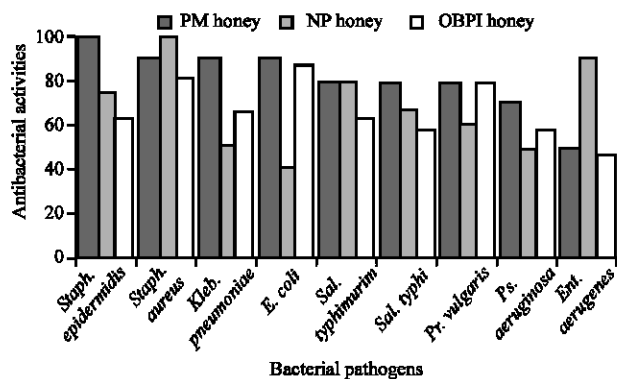


Fig. 1: Antibacterial activities of honey against bacterial pathogens

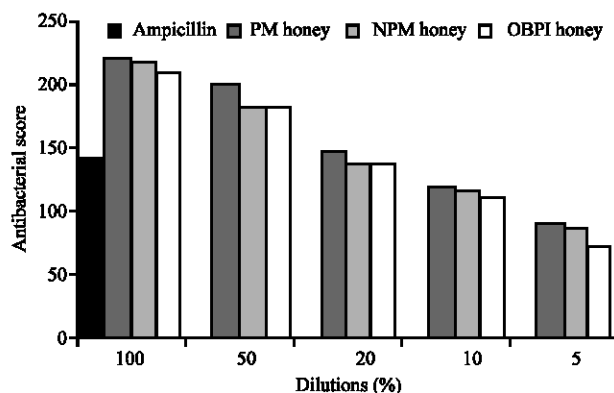


Fig. 2: Antibacterial activities of various diluted honey against bacterial pathogens

The seven commercially branded honeys showed variable antimicrobial activity against test organisms. The Dabur branded honey showed maximum activities (score 75) followed by brands of Kiran (score 68), Baidyanath (score 63) and Sanjeevani (score 63). PM honey followed by NPM and OBPI honey showed the maximum antibacterial activities. The antibacterial activities were decreased with dilutions and it was reasonably good at 20% dilution as compared to standard antibiotic, ampicillin (Fig. 2). The PM honey is mixed; content varieties of floral nectar, hence it showed good quality of antibacterial activities against all tested pathogens as compared to NPM honey or OBPI honey.

Among the bacterial pathogens *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Salmonella typhimurium*, *Salmonella typhi* and *Proteus vulgaris* were highly sensitive than other tested bacterial pathogens to test honey varieties (Fig. 1). Cooper and Molan (2002) has suggested that, the antibacterial activities must be due to redox potential of ascorbic acid present in the honey. The *Pseudomonas aeruginosa* was resistant to most of honey varieties; it may be due to presence of drug resistant plasmid in it (Efem, 1988). The reason for *Staphylococcus aureus* being sensitive to honey is not understood it may be due to its high acidic content, tetracycline derivatives, peroxides, fatty acids, phenols, ascorbic acids and amylases. The difference in antibacterial activities of honey has been contributed to the sources of the nectars (Kumar, 2005). The NPM honey was somewhat more superior in antibacterial activities against *Staphylococcus aureus* than PM as well as OBPI honey. It may be due to retention of some of the heat labile antibacterial components in NPM honey. The experiments showed that the PM and OBPI honey were till high antimicrobial indicating that most of the antibacterial substances in honey can withstand refrigeration and high temperature and antibacterial activities may not be contributed alone on its heat unstable tetracycline derivatives, ascorbic acids, peroxidases or amylase as claimed by other researcher but heat stable phenolic contents (Fig. 1).

The Melghat honey is cheap, cost effective and easily available which made it a favorable medicine for several ailments as well as a dressing for burns and other wounds. PM and NPM honey can be safely used in an unprocessed and undiluted condition without any risk. From the present study, it is clear that PM and NPM honey possesses considerable antibacterial potential and can be used to treat infections and acts as a remedy for burns, cataracts, ulcer and wound dressing due to its soothing during its initial application to open wounds. In near future, Melghat honey can be used as therapeutic for treating bacterial infections.

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