



Abstract

Escherichia coli and *Staphylococcus aureus* are common microorganisms causing gastrointestinal and wound infections respectively. These microorganisms have grown resistant to routinely used antimicrobials. In this study Sunflower, Olive, Orange blossom, Acacia, Granda, Ziziphus, Eucalyptus, Musturd and Bhaiker honey samples from different geographical locations of Pakistan were evaluated for antibacterial activity along with various physicochemical properties including color, pH, total acidity, moisture, ash, electrical conductivity, hydroxymethylfurfural (HMF), total sugars, proline, protein, phenolic content and trace elements. Moreover, different herbs, spices and royal jelly were also tested against above mentioned microorganisms. The color of various honey samples ranged from water white to dark amber. The highest Pfund value of 135 mm was recorded for Ziziphus honey sample. The Garanda and Ziziphus honey were of dark amber color. The pH of the honey samples used in this study ranged from 3.54 - 4.32. The highest moisture content was recorded for sunflower honey, the maximum value of HMF i.e. 20.08±0.5 mg/Kg was obtained for Ziziphus honey. The reducing sugar content of various honey samples were in the range of 67.77±0.2% to 80.72±0.3%.

Aqueous, ethanol and hexane extracts of spices and herbs were used in present study to determine the in vitro antimicrobial activity by agar well diffusion method. Serial dilutions were used for determination of minimal inhibitory concentrations (MIC) and minimum bactericidal concentrations (MBC) of the honey samples as well as spices and herbs essential oils (EOs).

Ziziphus honey sample showed the largest zones of inhibition i.e. 37.7±0.4 against *S. aureus* and 28.4±0.5 against *E. coli*. Against *E. coli* hexane extract of cinnamon (*Cinnamomum zeylanicum*) showed maximum zone of inhibition (14.1±0.9) while against *S. aureus* maximum zone of inhibition (23.2±0.2 mm) was observed for hexane extract of mint. Honey is equally effective alone or in combination with botanical extracts extracted from clove, ginger, mint and cinnamon against *E. coli* and *S. aureus* when applied in vitro. Although honey and other herbal products are being used to treat various diseases from the ancient times however their role for in vitro utilization is not fully established and must be the next milestone.