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Book of Abstract

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Virág Angyán: Honey and essential oil combination versus bacterial biofilm

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Many bacterial strains are able to form biofilms that provide optimal conditions and protection for the whole bacterial community. Extracellular polysaccharides (EPS) play an important role in biofilm formation, as they can prevent the antibiotic from reaching the bacterial DNA. Pathogens embedded in biofilms are more resistant to adverse environmental conditions and to anti-bacterial agents, including antibiotics. Honey has been consumed and used for thousands of years as a natural anti-inflammatory, antibacterial and antioxidant agent. There is ample scientific evidence to support its suitability for the treatment of microbial infections of various origins. Essential oils, which contain a range of active ingredients, also have antibacterial properties and can replace or complement antibiotic therapies. Research teams at our institute have demonstrated the antibacterial and biofilm inhibiting effects of several types of honey and essential oils. The aim of our studies was to test the combination of linden honey and lavender essential oil, which have been shown to have antibacterial activity, against bacteria (*Haemophilus influenzae*, *H. parainfluenzae* and *Moraxella catarrhalis*) that cause acute otitis media.

The origin of our honey sample was verified by organoleptic, physicochemical and melissopalynological studies, and the chemical composition of lavender oil was confirmed by gas chromatography-mass spectrometry (GC-MS) analysis. To investigate the antibacterial activity, the minimum inhibitory concentrations (MIC) of honey and essential oil were determined by microdilution and their biofilm inhibitory activity was determined by crystal violet staining. The microbiological methods were complemented by scanning electron microscopy (SEM) studies.

Based on sensory characteristics, pollen analysis and physicochemical parameters, our honey sample can be considered as a monofloral linden honey. GC-MS analyses showed that the main components of lavender oil were linalool and linalyl acetate, in agreement with literature data. The MIC value of honey was 111.11-142.86 mg/ml and that of essential oil 0.63-1.25 mg/ml. The biofilm inhibitory effect of the honey-essential oil combination at MIC/4 concentration was significant, with an inhibition rate of 80-84% against each bacterial strain. The results of the *in vitro* microbiological studies were confirmed by SEM images: the treated surface showed discrete bacterial cells (planktonic form), whereas the untreated control surface showed a three-dimensional bacterial network.

The significance of our results is that they may provide a starting point for the development of new antibacterial formulations of natural origin.

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