Antimicrobial activity of Finnish organic honeys against human pathogenic

bacteria

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**Implications**

Research on antimicrobial activity of organic honeys is a novel approach (Oinaala et al.

2015) and may lead to unknown antimicrobial mechanisms and factors (Cooke et al.

2015) and it also represents sustainable development. In the present study we show

that Finnish organic honeys have antimicrobial activity against the growth of human

pathogenic organisms *E. coli, S. typhi, P. aeruginosa, K. pneumoniae, B. cereus and S.*

*epidermidis* responsible for various human diseases. Moderate concentrations of the

studied organic honeys were active against most of the pathogenic organisms and thus

could have applications *in vivo* in order to control infections caused by the studied

pathogens. The determined minimum inhibitory concentrations (MIC) of the organic

honeys were significant, when considering applications to medical practice. The impact

of this study fits in to the theme “Organic food, human health and wellbeing”.

**Background and objectives**

Recent years have seen substantial improvements in life expectancy and access to

antimicrobials, especially in low-in-come and lower-middle-income countries, but

increasing pathogen resistance to antimicrobials threatens to roll back this progress.

Alternative methods and solutions for fighting against infectious diseases are urgently

needed. Honey has been used as a traditional medicine for centuries (Zumla & Lulat

1989) and its antimicrobial properties have been revealed in several *in vitro* studies

against wide variety of human pathogenic bacterial species, including antibiotic resistant

strains (Kwakman et al. 2010). Our previous studies have shown that Finnish monofloral

honeys possess significant antimicrobial activity against important human respiratory

pathogen *Streptococcus pneumoniae* and MRSA (Huttunen et al*.* 2013). We have also

shown that Finnish organic honeys have antimicrobial activity against food poisoning

pathogen *Clostridium perfringens* (Oinaala et al. 2015). In the present study, five

organic and one conventionally produced Finnish honeys were tested for their

antibacterial activity against six important human pathogenic bacteria causing variety of

human infections such as wound infections, diabetic foot ulcers, urinary tract infections,

diarrhea, septicaemia, food poisoning, gastroenteritis, enteric fever or upper

respiratory tract infections.

**Key results and discussion**

The results from the present study show that antibacterial activity was dose dependent

and the activity increased with the increased honey concentration, regardless of the

honey sample. When compared to antibiotic controls, which induced zones of inhibition

of 19-22 mm, the highest inhibition was achieved by organic honey sample F against *S.*

*epidermidis* (15-16 mm), followed then by *E. coli* and *P. aeruginosa* (14-15 mm).

Organic honey samples B, D and E showed moderate activity against all the bacteria

tested. Organic honey A had low activity against *E. coli, S. typhi* and *P. aeruginosa*, but

no activity was detected against *K. pneumoniae* and *S. epidermidis*. Nonorganic honey C

had the lowest activity, showing moderate activity only against *E. coli* and *S. epidermidis*

but no activity against *S. typhi, P. aeruginosa, K. pneumoniae* and *B. cereus*.

The lowest MICs (12.5% except 25% against *B.cereus*) were detected with the organic honey F and with the organic honeys E and D (12.5-50%).

The organic honey A and the nonorganic honey C were active only at the 80% honey concentration and induced low zones of inhibition.

**How work was carried out?**

Laboratory strains of the pathogenic bacteria used in the study were obtained from the

Department of Medical Laboratory Science, University of Eastern Africa, Baraton, Kenya.

The bacterial organisms were *Escherichia coli, Salmonella typhi, Pseudomonas*

*aeruginosa, Bacillus cereus, Staphylococcus epidermidis* and *Klebsiella pneumoniae*.

After cultivation the bacterial concentrations were standardized to 1.0 x108 cfu/ml and

used in the antimicrobial assay.

Honey samples were purchased from the major supermarkets in Helsinki, Finland. They

were labelled from A to F. Five of the honey samples (A, B, D, E and F) were organic

and honey C was non-organic. Honeys were diluted in sterile deionized water to

achieve concentrations of 80, 50, 25, 12.5 and 6.25% (w/v). In the study the control

antibiotic against *K. pneumoniae, B. cereus* and *S. epidermidis* was gentamycin (10ug)

and against *E. coli, S. typhi* and *P. aeruginosa* ciprofloxacin (10ug).

The antimicrobial activity of the honeys and the MIC values were determined by the agar

well diffusion method (Oinaala et al. 2015). Nine replicates of each honey sample were

pipetted into wells with diameters of 6 mm. For MIC analysis five honey concentrations,

80, 50, 25, 12.5 and 6.25 % (w/v) of each honey were used. The artificial honey,

positive and negative controls were studied in parallel with honeys against each of the organism tested.

**References**

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