The *in vitro* antibacterial activity of engineered honey (Surgihoney™) against important biofilm-forming burn wound pathogens

Fenella Halstead 1,2,3, Beryl Oppenheim 1,2, Matthew Dryden 4,5

1Queen Elizabeth Hospital, University Hospitals Birmingham NHS Foundation Trust, Birmingham; 2 NHR Surgical Reconstruction and Microbiology Research Centre, Queen Elizabeth Hospital, Birmingham; 3 Institute of Microbiology and Infection, School of Immunity and Infection, University of Birmingham; 4 Department of Microbiology and Infection, Hampshire Hospitals NHS Foundation Trust; 5 Rare and Imported Pathogens Department, Public Health England, Porton Down, UK.

**INTRODUCTION**

- Antimicrobial resistance continues to be a global issue in healthcare, and consequently there is increasing interest in alternative agents that can support wound healing and prevent colonisation and infection.
- Honey contains innate antimicrobial components (methylglyoxal, bee defensin-1 and hydrogen peroxide) and has a long history of use [1].
- Surgihoney™ (SH) (Figure 1) is a not a natural honey but an engineered formulation of honey with enhanced antimicrobial properties (owing in part to enhanced production to hydrogen peroxide; H₂O₂) (Figure 2). It is scaleable as it does not rely on a single floral source.
- Patients with severe ulcers, pressure sores, caesarean wounds and infected traumatic wounds have been treated topically with SH and favourable clinical outcomes have been observed [2,3].

**RESULTS**

All the SH formulations were able to:
- Prevent biofilm formation (in a dose-dependent manner) for all *P. aeruginosa* and *A. baumannii* tested (Figure 4 & Table 1).
- Reduce the seeding of pre-formed biofilms of *A. baumannii* after 24 hour exposures (Figure 5)

SH also compares favourably to a range of commercial dressings and creams in prevention of biofilm formation (Figure 6)
- All SH formulations are as effective as Acticoat Ag and Mepilex Ag (and better than the other dressings) in preventing biofilm formation.

**PURPOSE**

To test the *in vitro* antibacterial activity of Surgihoney™ against biofilms

**METHODS**

- Four isolates of *Pseudomonas aeruginosa* and four of *Acinetobacter baumannii* were tested (Table 1) against four formulations of honey (diluted from 1:2 to 1:4096):
  - Surgihoney (SH) 1, 2 and 3
  - Manuka honey (MH) (Convitma, Manukacare™ 18+)
- Two laboratory experiments performed (96 well microtitre trays):
  - Biofilm Formation Inhibition Assay (BFIA)
  - Biofilm Seeding Inhibition Assay (BSIA)

**CONCLUSIONS**

Our experiments show that SH can prevent biofilm formation and reduce the seeding of pre-formed biofilms.
- SH is therefore a promising topical antimicrobial agent with potent anti-biofilm activity against key Gram-negative pathogens of burn wounds.

Further experiments and controlled clinical trials are warranted to assess activity against biofilms produced by Gram-positive organisms, a wider range of Gram-negative organisms, and to formally assess clinical efficacy.