

Activity of honey against wound-infecting bacteria (including 'superbugs')

Summarised below are results from published work carried out by the Honey Research Unit and collaborators, using standardised honeys of average-level antibacterial potency (as are available commercially). The honeys used were a manuka honey (with its antibacterial component unique to honeys from *Leptospermum* species) and another honey that had the usual type of antibacterial activity due to enzymically produced hydrogen peroxide.

Minimum concentration of honey (% v/v) in the growth medium needed to completely inhibit the growth of various species of wound-infecting bacteria

(From: Willix, D. J.; Molan, P. C.; Harfoot, C. J. (1992) A comparison of the sensitivity of wound-infecting species of bacteria to the antibacterial activity of manuka honey and other honey. *Journal of Applied Bacteriology* **73** : 388-394)

Species	Manuka honey + catalase	Other honey
<i>Escherichia coli</i>	3.7	7.1
<i>Proteus mirabilis</i>	7.3	3.3
<i>Pseudomonas aeruginosa</i>	10.8	6.8
<i>Salmonella typhimurium</i>	6.0	4.1
<i>Serratia marcescens</i>	6.3	4.7
<i>Staphylococcus aureus</i>	1.8	4.9
<i>Streptococcus pyogenes</i>	3.6	2.6

(Note: the manuka honey had catalase added to remove hydrogen peroxide, so that only the unique *Leptospermum* antibacterial component was being tested. Minimum concentration values would be approximately halved if the catalase were not added and the hydrogen peroxide were also involved in the antibacterial activity.)

Minimum inhibitory concentration of honey for 20 strains of *Pseudomonas* isolated from infected wounds

(From: Cooper, R. A.; Molan, P. C. (1999) The use of honey as an antiseptic in managing *Pseudomonas* infection. *Journal of Wound Care* **8** (4): 161-164)

5.5%-8.7% (v/v) for manuka honey

5.8%-9.0% (v/v) for pasture honey

Minimum inhibitory concentration of honey for 58 strains of coagulase-positive *Staphylococcus aureus* isolated from infected wounds

(From: Cooper, R. A.; Molan, P. C.; Harding, K. G. (1999) Antibacterial activity of honey against strains of *Staphylococcus aureus* from infected wounds. *Journal of the Royal Society of Medicine* **92**: 283-285)

2%-3% (v/v) for manuka honey

3%-4% (v/v) for pasture honey

(Thus growth of *S. aureus* would still be prevented if honeys were diluted by body fluids 7- to 14-fold beyond the point where the sugar content was ineffective.)

Minimum inhibitory concentration of honey for some MRSA strains

(From: Molan, P.; Brett, M. (1998). "Honey has potential as a dressing for wounds infected with MRSA." The Second Australian Wound Management Association Conference, Brisbane, Australia.)

<u>MRSA strain</u>	<u>Manuka Honey</u>		<u>Pasture Honey</u>	
	MIC (% v/v)	MBC (% v/v)	MIC (% v/v)	MBC (% v/v)
[Acc 2243, sensitive control]	2	4	2	2
MR97 284, WSPP1 strain	2	4	2	2
MR97 285, WSPP2 strain	2	4	2	2
ST86 203, PNPB strain	2	4	4	4
ST85 653, WNWH strain	2	4	2	4
Acc 1056	1	4	2	2
Acc 2891, SK18 strain	2	4	2	2
MR96 808	1	4	2	2

(MIC = minimum inhibitory concentration; MBC = minimum bactericidal concentration)

Note: MR96 808 is resistant to Methicillin, Mupirocin, Erythromycin, Clindamycin, Gentamicin, Trimethoprim/Sulphamethoxazole, and Ciprofloxacin

Summary of some unpublished work (just completed), in collaboration with the Central Public Health Laboratory, Colindale, London, on MRSA (methicillin-resistant *Staphylococcus aureus*) and VRE (vancomycin-resistant Enterococci):

	MIC	No. of cultures with that MIC
MRSA (82 cultures tested)		
Manuka honey	4%	81
	7%	1
Pasture honey	3%	55
	4%	20
	5%	3
	6%	1
	>6%	3

(MIC = minimum inhibitory concentration)

Mupirocin-resistant MRSA

Culture No.	MIC	MIC
	Manuka honey	Pasture honey
9187*	4%	6-8%
9188*	4-6%	6-8%
9192*	4%	6%
9288	4%	3%
9293	4%	4%

*tested in steps of 2%

(MIC = minimum inhibitory concentration)

VRE

	MIC	No. of cultures with that MIC
Manuka honey (56 cultures tested)	<5%	1
	6%	2
	<7%	3
	7%	2
	8%	30
	9%	16
	10%	2
Pasture honey (34 cultures tested)	8%	2
	12%	6
	14%	2
	16%	15
	18%	3
	>18%	1
	20%	4
>20%	1	

Acinetobacter (5 cultures tested)

	MIC	No. of cultures with that MIC
Manuka honey	6%	2
	7%	1
	8%	1
	>8%	1
MIC for pasture honey	>7%	5

Stenotrophomonas maltophilia (4 cultures tested)

	MIC	No. of cultures with that MIC
Manuka honey	3%	3
	4%	1
Pasture honey	<4%	1
	5%	1
	6%	2

Recent work carried out collaboratively by Dr. Rose Cooper of the Wound Healing Research Unit at the University of Wales, Cardiff:

b-HAEMOLYTIC STREPTOCOCCI

No. of strains	Type	MIC Manuka honey	MIC Pasture honey
10	Lancefield G (<i>Strep. equisimilis</i> G)	4.5-9.3%	5.3-9.8%
1	Lancefield C (<i>Strep. equisimilis</i>)	5.7%	6.5%
1	Lancefield A (<i>Strep. pyogenes</i>)	8.3%	9.3%

4	Lancefield D (<i>Enterococcus faecalis</i>)	7.7-9.7%	7.7-9.8%
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