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**Antimicrobial effect of Manuka honey and  
Kanuka honey alone and in combination with the  
bioactives against the growth of  
*Propionibacterium acnes* ATCC 6919**

A Thesis

submitted in partial fulfilment of the requirements for the degree of  
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## Abstract

**Background:** Acne vulgaris is a chronic inflammatory disease of the pilosebaceous follicle. The *Propionibacterium acnes* (*P. acnes*) play a key role in inflammation and the formation of comedones. *P. acnes* has been reported to develop antibiotic resistance, which has generated some interest in developing natural antimicrobial compounds which forms the subject matter of this study. Recently, Manuka honey (*leptospermum scoparium*) has demonstrated strong antibacterial activities against a wide range of pathogens with distinct non-peroxide activity. Kanuka honey has also shown to be effective against many bacterial species. Many natural bioactives were reported to possess strong antibacterial activities, a few of which were studied against *P. acnes*. Therefore, the aims of this study were to investigate the antibacterial activity of Manuka honeys and Kanuka honey with and without catalase against the growth of *P. acnes* alone and to screen the antibacterial activities of five selected nature bioactives alone and in combination with honey against *P. acnes* *in vitro*.

**Methods:** The growth of *P. acnes* was evaluated under aerobic and anaerobic conditions. *P. acnes* was cultivated in nutrient broth and fastidious anaerobic agar containing horse blood. Manuka honeys 20+, 15+ and 10+ UMF and Kanuka honeys were tested against the growth of *P. acnes*, ranging from 0.5 % to 12.5 % (w/v) with and without catalase under both aerobic and anaerobic conditions. The artificial honey was used as the control. Manuka tree essential oil (MTO), lavender essential oil (LO), green tea extract (GTE), olive leaves extract (OLE), propolis were screened using disc diffusion method, spectrophotometric assay, viable cell counts to determine the survival of *P. acnes* in the bioactives testing solutions. The combination creams of Manuka honey 10+ UMF (10 %, w/v) with bioactives were studied using viable cell count method to determine the viable cells of *P. acnes*.

**Results:** *P. acnes* is capable of growing under both aerobic and anaerobic conditions. Manuka and Kanuka honeys exhibited antibacterial activity against the growth of *P. acnes*. Kanuka honey had similar antibacterial activity as Manuka honey 15+ UMF and Manuka honey 20+ UMF without catalase. MIC<sub>100</sub> of Manuka honey 20+ UMF was 148.90 mg/mL; MIC<sub>100</sub> of Manuka honey 15+ UMF was 125.81 mg/mL; MIC<sub>100</sub> of Manuka honey 10+ UMF was 144.43 mg/mL; MIC<sub>100</sub> of Kanuka honey was 123.28 mg/mL. Manuka honeys possessed non-peroxide activity, but the antibacterial activity of Kanuka honey decreased significantly after the removal of hydrogen peroxide with MIC<sub>100</sub> of 549.21 mg/mL. Artificial honey did not markedly inhibit the growth of *P. acnes*. Among the five bioactives, only GTE and MTO had bactericidal ability. Honey creams with bioactives showed that cream containing 10 % honey and 1 % GTE caused about five log reductions in the bacterial cell numbers; in contrast, cream of honey (10 %) and MTO (0.125 %) resulted in about two log reductions. No bacterial cells (< 100 CFU/mL) were found in the creams containing honey (10 %), MTO (0.125 %) and GTE (1 %).

**Conclusion:** Manuka honey exhibited antibacterial activity against the growth of the *P. acnes*. The antibacterial potency of the honey was significantly enhanced by the presence of bioactives in the emulsion cream.

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## ABBREVIATIONS

Abs <sub>595nm</sub>	=	Absorbance at wavelength of 595 nm
ANOVA	=	Analysis of variance
BHI	=	Brain heart infusion
CFU	=	Colony forming unit
CO <sub>2</sub>	=	Carbon dioxide
DHA	=	Dihydroxyacetone
DMSO	=	Dimethyl Sulfoxide
EGCG	=	Epigallocatechingallate
FA agar	=	Fastidious anaerobe agar
GTE	=	Green tea extract
HMF	=	Hydroxymethylfurfural
LO	=	Lavender essential oil
MBC	=	Minimum bactericidal concentration
MGO	=	Methylglyoxal
MIC	=	Minimum inhibition concentration
MRSA	=	Methicillin-resistant <i>Staphylococcus aureus</i>
MTO	=	Manuka tree oil
OLE	=	Olive leaf extracts
<i>P. acnes</i>	=	<i>Propionibacterium acnes</i>
UMF	=	Unique Manuka Factor
SD	=	Standard deviation
SEM	=	Standard error of mean
Ø	=	Diameter