

BY's Apitherapy Niagara Honey proves to be a higher concentration of Hydrogen Peroxide and lower PH than Manuka Honey making it a more effective for option for Wound Healing, Swelling and Pain Control.

R.Gagne, EET, CFE, NADEP

Honey has antioxidant, anti-bacterial and anti-inflammatory properties. It can be used as a wound dressing to promote rapid and improved healing. These effects are due to honey's anti-bacterial action, secondary to its high acidity, osmotic effect, antioxidant content and hydrogen peroxide content. The use of honey leads to improved wound healing in acute cases, pain relief in burn patients and decreased inflammatory response in such patients.

In the past ten years, the Manuka Honey from New Zealand was thought to supersede the healing qualities of Canadian made honey due to its superior qualities including hydrogen peroxide and PH levels. For this reason, the recent study completed with the assistance of Loyalist College Applied Research and Innovation Office, Centre for Natural Products, was performed to clarify the content and therapeutic qualities of Canadian made honey from BY's Apitherapy Center versus Manuka Honey. Results clearly display the superior abilities of the Niagara based honey in comparison to the New Zealand brand.

Background

Honey is derived from nectar gathered and modified by the honeybee, *Apis mellifera*. It is a carbohydrate-rich syrup derived from floral and other plants nectars and secretions. Traditionally, honey has been used to treat burns, infected and non-healing wounds and ulcers, boils, pilonidal sinus, venous and diabetic foot ulcers (1-6). Recent studies confirm the efficacy of honey in treating venous ulcers (7). In patients suffering from malignant wounds, improvement with respect to wound size and cleanliness was seen after treatment with honey-coated bandages (8). Similarly, honey dressing quickened rates of healing in pressure wounds.

"Unrefined honey has anti-inflammatory, anti-bacterial and antioxidant properties (11). The antibacterial action is due to its acidity, hydrogen peroxide content, osmotic effects, nutritional and antioxidant content, stimulation of immunity, and unidentified compounds (12)." R.Gagne

Different kinds of honey like *Gelam, Medihoney, Tualang and Manuka, have been tested and found to have similar properties, but in third part testing of BY's Niagara based honey and their proprietary Immune Boost Honey, the findings display that BY's Niagara based honey has both a higher Hydrogen Peroxide and lower PH properties than Manuka honey making it a more effective choice for anti-bacterial, anti-inflammatory and anti-oxidant treatment etiology's. Honey has almost equal or slightly superior effects when compared with conventional treatments for acute wounds and superficial partial thickness burns.

Anti-bacterial Activity

Honey has been principally used for its antibacterial effects since ancient times (1). It was believed that honey could be used in the topical treatment of wounds and burns due to its anti-bacterial and wound healing promotion activity (2-4). Different mechanisms of action have been suggested for the anti-bacterial effects of honey. Its sugar content is high enough to hinder microbial growth. This is believed to be a result of its osmotic effect, which prevents the growth of bacteria and therefore promotes healing. The application of a topical sugar paste for the same purpose was also reported in many studies (4, 10, 11). The high sugar content of honey is not the sole reason for this effect. If honey is diluted with water to reduce its sugar content and osmotic effect, it is still able to inhibit the growth of many bacteria causing wound infection (10, 14-16).

The results show a considerably shorter healing period when dressing the wound with a honey bandage (19). It is also noticed that using honey for dressing infected wounds gives it a clean, clear base that allows early grafting and an increased chance of acceptance.

While over 100 substances are candidate for antibacterial activity (10), Antibiotics attack the cell wall of bacteria to destroy it. Honey works in a different way. Honey is hygroscopic, meaning that it draws moisture out of the environment and dehydrates the bacteria with the aid of its hyperosmolar properties (honey is high in sugar) (14). It provides rapid autolytic debridement and wound deodorization (12, 15, 20).

Hydrogen Peroxide Analysis

The antibacterial activity is due to hydrogen peroxide activity, which is continuously produced by enzymes even when honey is diluted and remains well below the level that causes inflammatory effects (17). To determine the concentration of the active ingredient, Hydrogen Peroxide, a scientific analysis was performed using a hydrogen peroxide assay kit from Megazyme, catalogue number K-MRH202. The kit utilizes a highly sensitive Megaplex Red probe which in the presence of horseradish peroxidase (HRP), allows for the measurement of H₂O₂ in a sample. The coloured product formed is measured colour metrically at 570 nm.

WOUND HEALING PROPERTIES OF BY'S HONEY



Concentration of hydrogen peroxide in provided samples.

Both honey samples supplied by BYs contained higher hydrogen peroxide content than that of the manuka honey. The highest hydrogen peroxide content was found in the immune boost formulation, which is due to the additional ingredients and raw nature of the honey.

	Sample identifier	Abs _{sample}	Sample volume (mL)	Dilution (-fold)	ΔAbs (H ₂ O ₂)	Concentration (microM)	Concentration (mg/L)
1	Manuka1	1.1920	0.967	1.00	1.1920	29.906	1.017
2	Manuka2	1.2670	0.946	1.00	1.2670	32.494	1.105
3	Manuka3	1.2240	0.931	1.00	1.2240	31.896	1.085
4	Premium Wildflower1	1.8230	0.931	1.00	1.8230	47.506	1.616
5	Premium Wildflower2	1.3950	0.941	1.00	1.3950	35.966	1.223
6	Premium Wildflower3	1.9150	0.987	1.00	1.9150	47.072	1.601
7	Immune Boost 1	1.9540	0.943	1.00	1.9540	50.272	1.710
8	Immune Boost 2	1.9530	0.943	1.00	1.9530	50.246	1.709
9	Immune Boost 3	1.9520	0.938	1.00	1.9520	50.488	1.717

Loyalist College Applied Research and Innovation
Centre for Natural Products LC-NPMC-REP-0035

Anti-inflammatory Properties – Reduction of Swelling and Pain

Aside from the fact that honey can remove bacteria that causes inflammation, a decrease in wound inflammation after applying honey gauze can be a result of honey's direct anti-inflammatory properties (19).

The amount of wound exudates is due to the local inflammatory process around the wound. Therefore, the anti-inflammatory action of honey reduces edema and exudates, which can subsequently improve wound healing. This effect also reduces pain caused by pressure on nerve endings and reduces the amount of prostaglandin produced in inflammatory process (10).

Honey also stimulates the angiogenesis, granulation and epithelialisation, which helps speed up the healing process (14, 27, 28).

pH Levels

The abbreviation pH stands for potential hydrogen, and it tells us how much hydrogen is in liquids—and how active the hydrogen ion is.

Lower pH number means stronger acid, higher pH number means stronger base. It can be a little confusing, but the lower the pH of a substance is, the stronger of an acid it is. The pH scale may seem small, but each whole number represents a ten-fold leap in concentration of either H ions or OH ions. pH scale is a commonly used scale to measure the acidity or the basicity of a substance. The possible values on the pH scale range from 0 to 14. Acidic substances have pH values ranging from 1 to 7 (1 being the most acidic point on the pH scale) and alkaline or basic substances have pH values ranging from 7 to 14.

Most honey has a mean pH of 4.4 (21, 22), while the BYs Apitherapy Honey has a pH of 4.00 to 4.01. This lower pH means a higher acidity which results in more effective healing properties. The acidification of wounds speeds up healing and honey can also reduce wound colonization or infection as such conditions are often accompanied by a pH of > 7.3 in wound exudates (21-24).

Honey is known to increase nitric oxide end products and decrease the prostaglandin levels (30). The acidification of wounds can enhance healing due to honey's low pH. Honey's low pH can enhance off loading oxygen from hemoglobin in capillaries. It can also suppress protease activity in wounds because of non-neutral pH which is not favorable for their activities (10). The anti-inflammatory activity of honey can eliminate this obstacle to healing. The antibacterial activity of honey works by removing infectious bacteria stimulating the inflammatory response. Honey has debriding action which helps to reduce the sources of bacteria and hence prevent further inflammatory reactions (10).

The pH of each honey was tested by an independent lab by adding approximately 10 g of honey to distilled water with a starting point of 5.72. The most acidic honey was the premium wildflower, followed by the immune boost, and the one with the least amount of acidity was Manuka.

Honey	Mass	pH
Premium Wildflower	10.058	4.00
Immune Boost	10.161	4.01
Manuka	9.688	4.19

Loyalist College Applied
Research and Innovation
Centre for Natural Products
LC-NPMC-REP-0035

Antioxidant Properties

Honey contains both aqueous and lipophilic antioxidants which enable it to act at different cellular levels as an ideal natural antioxidant (36). This activity decreases the cellular damage caused by free radicals by protecting the antioxidant enzymes and decreasing the oxidative stress, thus decreasing the inflammatory process (37).

Why Niagara and BY's Apitherapy Honey?

Honey is made from the nectar of flowers collected by honeybees and is composed mostly of glucose and fructose. However, it also contains vitamins, minerals, amino acids, enzymes, organic acids, and other compounds. Its composition is affected by seasonal variations as well as the geographic location where the nectar was gathered by the bees. The moisture content of the deposited nectar mixture reduces and dries out, becoming more concentrated and producing viscous honey.

Natural honey is composed of around 82% of water, carbohydrates, proteins, phytochemicals, antioxidants, and minerals. It has been proven that few of the ingredients that determine the biological and medical potential of this substance are likely to vary among the various types of honey. The sugars in honey include, in descending order, the following: "fructose (38.2%), glucose (31.2%), disaccharides and some other tri-saccharides and higher saccharides (9%) and sucrose (0.7–1%)" [14]. Honey containing a wide range of active compounds, including flavonoids, organic acids, phenolic acid, vitamins, and enzymes, has been proven to be clinically effective for a number of therapeutic treatments. The deposition of fibroblasts and collagen formation may also be promoted by the large amount of amino acids found in honey.

What and where the bees harvest is integral to the quality of product they provide.

At BY's Apitherapy Centre the bee management policy is to maintain healthy and productive honeybee colonies without the use of synthetic treatments or antibiotics. There are parasite and disease control options available for the management system. The treatments for pest and disease control are often based on natural chemicals or compounds. Cultural and physical controls are also management practices applied by our beekeepers that use specialized equipment or physical means to control pests and reduce the level of diseases in the hive. We also use genetic control of pests and diseases by selection and use of honeybees which have a genetic tendency to be resistant to infection or infestation.

The floral environment planted includes enough buckwheat, wildflowers, clover, etc. to ensure the food requirements are met for our bee population such that they do not have to travel far. Bees are known to fly as far as 12 km (8 miles), but usually foraging is limited to food sources within 3 km. Approximately 75% of foraging bees fly within one kilometer while young field bees only fly within the first few hundred meters. This is of particular importance as the farm on which BY's resides, has had no spraying of any harmful chemicals for at least the past 15 years.

Conclusion

Studies revealed that the healing effect of honey could be classified by its antibacterial, antiviral, anti-inflammatory and antioxidant properties of its components. Looking at the active ingredients in honey that produce these positive outcomes, we reviewed the percentage of hydrogen peroxide and pH in both the standard BY's wildflower honey and the advanced formulation of BY's Immune Boost Honey. Interesting notations gathered through the scientific third party testing labs indicated that BY's Apitherapy Honey provided contained a detectable amount of methylglyoxal, had higher hydrogen peroxide content than Manuka and that the pH of both Ontario honey samples were lower than that of the Manuka honey. The most effective honey mixture was noted as the BY's Immune Boost followed by the BY's Wildflower Honey and lastly the Manuka Honey. **The Niagara based BY's Apitherapy Honey production has been proven to contain higher concentrations of the active ingredients resulting in better outcomes than Manuka branded New Zealand honey for anti-bacterial, anti-inflammation, anti-oxidant, pain control and promoting microbial control and healing processes.**

**Gelam, Medihoney, Tualang and Manuka are registered trademarks of their respective companies and are not affiliated with BY's Apitherapy Center. BY's Immune Boost is a registered trademark of BY's Apitherapy Wellness Center Niagara 2023.*

References

1. Zumla A, Lulat A. Honey—a remedy rediscovered. J R Soc Med. 1989;82(7):384–5. [PMC free article] [PubMed] [Google Scholar]
2. Moore OA, Smith LA, Campbell F, Seers K, McQuay HJ, Moore RA. Systematic review of the use of honey as a wound dressing. BMC Complement Altern Med. 2001;1:2. [PMC free article] [PubMed] [Google Scholar]
3. Wijesinghe M, Weatherall M, Perrin K, Beasley R. Honey in the treatment of burns: a systematic review and meta-analysis of its efficacy. N Z Med J. 2009;122(1295):47–60. [PubMed] [Google Scholar]
4. Khan FR, Ul Abadin Z, Rauf N. Honey: nutritional and medicinal value. Int J Clin Pract. 2007;61(10):1705–7. doi: 10.1111/j.1742-1241.2007.01417.x. [PubMed] [CrossRef] [Google Scholar]
5. Jull AB, Walker N, Deshpande S. Honey as a topical treatment for wounds. Cochrane Database Syst Rev. 2013;2:CD005083. doi: 10.1002/14651858.CD005083.pub3. [PubMed] [CrossRef] [Google Scholar]
6. Mohd Zohdi R, Abu Bakar Zakaria Z, Yusof N, Mohamed Mustapha N, Abdullah MN. Gelam (Melaleuca spp.) Honey-Based Hydrogel as Burn Wound Dressing. Evid Based Complement Alternat Med. 2012;2012:843025. doi: 10.1155/2012/843025. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
7. Gethin G, Cowman S. Manuka honey vs. hydrogel—a prospective, open label, multicentre, randomised controlled trial to compare desloughing efficacy and healing outcomes in venous ulcers. J Clin Nurs. 2009;18(3):466–74. doi: 10.1111/j.1365-2702.2008.02558.x. [PubMed] [CrossRef] [Google Scholar]
8. Lund-Nielsen B, Adamsen L, Kolmos HJ, Rorth M, Tolver A, Gottrup F. The effect of honey-coated bandages compared with silver-coated bandages on treatment of malignant wounds—a randomized study. Wound Repair Regen. 2011;19(6):664–70. doi: 10.1111/j.1524-475X.2011.00735.x. [PubMed] [CrossRef] [Google Scholar]



References continued...

9. Yapucu Gunes U, Eser I. Effectiveness of a honey dressing for healing pressure ulcers. *J Wound Ostomy Continence Nurs.* 2007;34(2):184–90. doi: 10.1097/01.WON.0000264833.11108.35. [PubMed] [CrossRef] [Google Scholar]
10. Simon A, Traynor K, Santos K, Blaser G, Bode U, Molan P. Medical honey for wound care--still the 'latest resort'? *Evid Based Complement Alternat Med.* 2009;6(2):165–73. doi: 10.1093/ecam/nem175. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
11. Molan PC. The role of honey in the management of wounds. *J Wound Care.* 1999;8(8):415–8. [PubMed] [Google Scholar]
12. Al-Waili NS, Salom K, Butler G, Al Ghamdi AA. Honey and microbial infections: a review supporting the use of honey for microbial control. *J Med Food.* 2011;14(10):1079–96. doi: 10.1089/jmf.2010.0161. [PubMed] [CrossRef] [Google Scholar]
13. Lusby PE, Coombes A, Wilkinson JM. Honey: a potent agent for wound healing? *J Wound Ostomy Continence Nurs.* 2002;29(6):295–300. [PubMed] [Google Scholar]
14. Molan PC. The evidence supporting the use of honey as a wound dressing. *Int J Low Extrem Wounds.* 2006;5(1):40–54. doi: 10.1177/1534734605286014. [PubMed] [CrossRef] [Google Scholar]
15. Molan PC. Re-introducing honey in the management of wounds and ulcers - theory and practice. *Ostomy Wound Manage.* 2002;48(11):28–40. [PubMed] [Google Scholar]
16. Molan PC, Betts JA. Clinical usage of honey as a wound dressing: an update. *J Wound Care.* 2004;13(9):353–6. [PubMed] [Google Scholar]
17. Allen KL, Hutchinison G, Molan PC. The potential for using honey to treat wounds infected with MRSA and VRE. *First World Wound Healing Congress; Melbourne, Australia.* 2000. [Google Scholar]
18. Molan PC, Allen KL. The effect of gamma-irradiation on the antibacterial activity of honey. *J Pharm Pharmacol.* 1996;48(11):1206–9. [PubMed] [Google Scholar]
19. Molan PC. A brief review of the use of honey as a clinical dressing. *Aust J Wound Manage.* 1998;6(4):148–58. [Google Scholar]
20. Oryan A, Zaker SR. Effects of topical application of honey on cutaneous wound healing in rabbits. *Zentralbl Veterinarmed A.* 1998;45(3):181–8. [PubMed] [Google Scholar]
21. Aureli P, Franciosa G, Fenicia L. Infant botulism and honey in Europe: a commentary. *Pediatr Infect Dis J.* 2002;21(9):866–8. doi: 10.1097/01.inf.0000027418.41135.3f. [PubMed] [CrossRef] [Google Scholar]
22. Molan PC. The antibacterial activity of honey: 1. The nature of the antibacterial activity. *Bee World.* 1992;73(1):5–28. [Google Scholar]
23. Rushton I. Understanding the role of proteases and pH in wound healing. *Nurs Stand.* 2007;21(32):68–70, 72 passim. [PubMed] [Google Scholar]
24. Schneider LA, Korber A, Grabbe S, Dissemmond J. Influence of pH on wound-healing: a new perspective for wound-therapy? *Arch Dermatol Res.* 2007;298(9):413–20. doi: 10.1007/s00403-006-0713-x. [PubMed] [CrossRef] [Google Scholar]
25. Tonks AJ, Cooper RA, Jones KP, Blair S, Parton J, Tonks A. Honey stimulates inflammatory cytokine production from monocytes. *Cytokine.* 2003;21(5):242–7. [PubMed] [Google Scholar]
26. Tonks A, Cooper RA, Price AJ, Molan PC, Jones KP. Stimulation of TNF-alpha release in monocytes by honey. *Cytokine.* 2001;14(4):240–2. doi: 10.1006/cyto.2001.0868. [PubMed] [CrossRef] [Google Scholar]
27. Gupta SK, Singh H, Varshney AC, Prakash Prem. Therapeutic efficacy of honey in infected wounds in buffaloes. *Indian J Anim Sci.* 1992;62(6):521–3. [Google Scholar]
28. Bergman A, Yanai J, Weiss J, Bell D, David MP. Acceleration of wound healing by topical application of honey. An animal model. *Am J Surg.* 1983;145(3):374–6. [PubMed] [Google Scholar]
29. Tonks AJ, Dudley E, Porter NG, Parton J, Brazier J, Smith EL, et al. A 5.8-kDa component of manuka honey stimulates immune cells via TLR4. *J Leukoc Biol.* 2007;82(5):1147–55. doi: 10.1189/jlb.1106683. [PubMed] [CrossRef] [Google Scholar]
30. Al-Waili N, Salom K, Al-Ghamdi AA. Honey for wound healing, ulcers, and burns; data supporting its use in clinical practice. *Sci World J.* 2011;11:766–87. doi: 10.1100/tsw.2011.78. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
31. Sherlock O, Dolan A, Athman R, Power A, Gethin G, Cowman S, et al. Comparison of the antimicrobial activity of Ulmo honey from Chile and Manuka honey against methicillin-resistant *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*. *BMC Complement Altern Med.* 2010;10:47. doi: 10.1186/1472-6882-10-47. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
32. Schramm DD, Karim M, Schrader HR, Holt RR, Cardetti M, Keen CL. Honey with high levels of antioxidants can provide protection to healthy human subjects. *J Agric Food Chem.* 2003;51(6):1732–5. doi: 10.1021/jf025928k. [PubMed] [CrossRef] [Google Scholar]
33. van den Berg AJ, van den Worm E, van Ufford HC, Halkes SB, Hoekstra MJ, Beukelman CJ. An in vitro examination of the antioxidant and anti-inflammatory properties of buckwheat honey. *J Wound Care.* 2008;17(4):172–4. [PubMed] [Google Scholar]
34. Bashkaran K, Zunaina E, Bakiah S, Sulaiman SA, Sirajudeen K, Naik V. Anti-inflammatory and antioxidant effects of Tualang honey in alkali injury on the eyes of rabbits: experimental animal study. *BMC Complement Altern Med.* 2011;11:90. doi: 10.1186/1472-6882-11-90. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
35. Park DV. Antioxidants in human health and tissue: Nutritional antioxidants and disease prevention: Mechanism of action. *CABI Publishing;* 1999. [Google Scholar]
36. Aljadi AM, Kamaruddin MY. Evaluation of the phenolic contents and antioxidant capacities of two Malaysian floral honeys. *Food Chem.* 2004;85(4):513–8. doi: 10.1016/S0308-8146(02)00596-4. [CrossRef] [Google Scholar]
37. Erejuwa OO, Sulaiman SA, Wahab MS, Sirajudeen KN, Salleh MS, Gurtu S. Antioxidant protection of Malaysian tualang honey in pancreas of normal and streptozotocin-induced diabetic rats. *Ann Endocrinol (Paris).* 2010;71(4):291–6. doi: 10.1016/j.ando.2010.03.003. [PubMed] [CrossRef] [Google Scholar]
38. Al-Waili NS. Topical honey application vs. acyclovir for the treatment of recurrent herpes simplex lesions. *Med Sci Monit.* 2004;10(8):MT94–8. [PubMed] [Google Scholar]
39. Moore RA, Gavaghan D, Tramer MR, Collins SL, McQuay HJ. Size is everything--large amounts of information are needed to overcome random effects in estimating direction and magnitude of treatment effects. *Pain.* 1998;78(3):209–16. [PubMed] [Google Scholar]
40. Shmueli A, Shuval J. Are users of complementary and alternative medicine sicker than non-users? *Evid Based Complement Alternat Med.* 2007;4(2):251–5. doi: 10.1093/ecam/nel076. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
41. Bell SG. The therapeutic use of honey. *Neonatal Netw.* 2007;26(4):247–51. doi: 10.1891/0730-0832.26.4.247. [PubMed] [CrossRef] [Google Scholar]
42. Al-Waili NS, Saloom KY. Effects of topical honey on post-operative wound infections due to gram positive and gram negative bacteria following caesarean sections and hysterectomies. *Eur J Med Res.* 1999;4(3):126–30. [PubMed] [Google Scholar]