Manuka Honey Explained

David Cramp

Confusion around manuka honey has existed ever since this remarkable product was proven to have medicinal qualities in the 1980s and, despite the attempts of the manuka honey industry in New Zealand, it still exists in large measure today.

The confusion around manuka honey prompted me to ask myself the question: how many consumers know the difference between the acronyms and numbers written for their benefit on manuka honey jars, or even what they mean?

I was a producer of active manuka honey. I knew exactly what it all meant. But others? The customer? What did they know of the terms and acronyms: Bio-Active; UMF®; TA; NPA; MGO™; MGS; AMF and Active. Just some examples that at least mean something. There are many that do not, yet all purport to say that this jar contains something special. Many jars do, some don't.

Once you have got past the acronyms, you have the numbers; UMF® 20+; MGO™ 20; NPA 10+; TA 25+ and so on. There is no other explanation on the jars that would indicate to consumers what they have just purchased, how it will help them or how it is different from a product with the same acronym and different number or a different acronym and the same number.

Manuka honey Bio Active UMF® 5+? Will that help my sore throat? Probably no better than any other honey; but how would you know that? You would need a pretty big label to explain it all anyway. The point is, how many would buy over the counter medicine without reading this sort of information in an explanatory leaflet? In this two part article I will attempt to clear away all of this confusion by firstly explaining just what manuka honey is and looking at what is so special about it. Part Two will look at the honey ratings and compare them so that when you buy a pot of manuka honey, you know exactly what you are buying.

Firstly, let's take a look at the antiseptic and anti-microbial properties that most honeys possess and then look at what makes manuka more special than others.

Peroxide activity (PA)

Most honeys have antibacterial activity, referred to as Peroxide Activity (PA), which is derived from Hydrogen Peroxide (H_2O_2). Peroxide Activity is created due to the activity of the enzyme Glucose Oxidase that is added to nectar by bees. It converts glucose into hydrogen peroxide and gluconic acid under aerobic conditions. The presumed function of H_2O_2 is to prevent spoilage of unripe honey when the concentration has not yet reached levels able to prevent microbial growth. During ripening, the glucose oxidase is inactivated but it is again activated on dilution, being at its highest level at a dilution of 30-50% honey.

Light and heat have an effect on this activity and it decreases over time with storage. Most honeys have this unstable peroxide activity, and the question is, does honey have any antimicrobial activity if you take away the hydrogen peroxide? The answer is yes – for many honeys, and this 'extra' antibacterial activity is especially strong in manuka honey. So what is this 'extra quality' of manuka honey and how can any difference be investigated?

Non Peroxide Activity (NPA)

Manuka honey has a strong, stable activity shown to be effective even after the elimination of peroxide activity in the honey and this Non Peroxide Activity (NPA) can be measured. All honeys have this NPA to varying degrees because there are other compounds and peptides in honey that provide a measure of NPA but it is only New Zealand's Manuka that has been given such an unmatched amount of attention in terms of empirical studies, research, accreditation and certification.

For many years it was not clear just what was providing this 'extra' activity but the effect could be quantified fairly early on by comparing its bacteria killing effect with that of the antiseptic phenol. Because the causative agent was unknown, the effect was nicknamed the 'Unique Manuka Factor' or 'UMF' by Dr. Peter Molan of Waikato University in New Zealand who lead early research into this phenomenon. Now, under the auspices of the UMF® Honey Association, the term has now become a trademark and companies wishing to use this trademark for their honey must adhere to the strict quality controls and testing regime of the association.

When Professor Molan tested the manuka honeys he used the internationally recognised method of measuring the surface area kill-zone of a sample of honey dropped onto a plate of bacteria. This type of assay is known in bacteriology as the 'agar well diffusion assay', and uses S*taphylococcus aureus* as indicator bacteria and the antiseptic phenol as standard. (Allen *et al*., 1991). In layman's terms, the ability of the honey to kill bacteria is compared to a known-strength chemical (phenol). For example, a UMF®10+ active Manuka will have a bacteria-killing activity equivalent to a

Fig. 1. Agar well diffusion assay.

10% solution of phenol. UMF®12+ active Manuka is equivalent to 12% solution of phenol and so on. This UMF® measure tells you what the effect of the honey is and is a recognised measure of the honey's NPA.

The size of the kill-zone (Fig. 1.) is compared to that which phenolic acid would achieve. The test shows that the honey has the germ killing effect of the phenol, not necessarily the actual effect on a person. For example, an industrial strength solution of phenolic acid is 4% (UMF® 4+) and that will kill bacteria but also harm skin tissue. The UMF honey equivalent would not. Manuka honey with a 20% (UMF®20+) potency has been used to treat eye infection but if 20% phenolic acid solution had been used it would have caused blindness.

The bioassay method used by Professor Molan was a simple laboratory test used against just one bacterium and was not initially intended for a complex task such as measuring differences between honeys. The method has been adapted and refined over the years and still remains the benchmark, but it can produce an unpredictable reading which critics claim offers misleading and variable advice to the purchaser of honey. Also, the assay only measures the level of antibacterial activity and is not informative regarding the identity of the components involved.

Another criticism, which also applies to the MGO™ measure (see below), is that it doesn't tell you what a given measurement will do for you. I know many who swear by UMF® 5+ manuka honey for sore throats. It has an insignificant to zero level of activity; but it is 'manuka' with a plus number and a plus sign, so it must be good – the placebo effect or would any other much cheaper honey have done as well with its normal peroxide activity?

In 2008, Professor Thomas Henle, Head of the Institute of Food Chemistry at the Technical University of Dresden, demonstrated that methylglyoxal (MGO) is the dominant ingredient that endows manuka honey with its unique antibacterial properties. (Henle, 2008).

Manuka Health, a New Zealand based company teamed up with Professor Henle to help further investigate this active ingredient in manuka honey and to set up a process in which manuka honey could be tested for levels of methylglyoxal. The company claims, with some authority, that this measurement offers the consumer complete transparency. MGO™ 400+ indicates that there are 400 milligrams per kilogramme of methylglyoxal in the honey. What could be clearer? At the moment, Manuka Health Ltd is the only New Zealand Company that offers certified MGO™ manuka honey and MGO™ has become a trademark.

The MGO™ measures the amount of one of the causative agents of NPA, and UMF® measures the effect of that agent on a specific bacterium and there is a correlation between the level of methylglyoxal and the honey's NPA or UMF®.

Critics of the MGO™ measurement claim that the measurement of the amount of methylglyoxal in honey gives no indication of the amount of anti-bacterial activity which is also influenced by other 'synergistic' compounds within honey without which methylglyoxal is not effective. For instance, activity against vancomycin-resistant *Enterococcus faecium* required different combinations of compounds, as neutralization of either H_2O_2 (hydrogen peroxide) or a combination of methylglyoxal and bee defensin-1 abolished activity. So, H_2O_2 is required but is not sufficient for activity against *E. faecium*, since the presence of methylglyoxal or bee defensin-1* is additionally required for full activity. (*Kwakman and Zaat, 2012)*.

Backing this up, another study has shown that the antimicrobial activity of methylglyoxal is enhanced when in honey solution, even if a honey has no antimicrobial action on its own. The reasons for this enhanced activity are unclear. In the clinical setting, therefore, a combined methylglyoxal and honey solution (whether from manuka or fortified non-methylglyoxal honey) yields a stronger antimicrobial activity compared to an equivalent. Methyl-glyoxal is therefore only partially responsible for the antibiotic activity of manuka honey. (Jervis-Bardy *et al*., 2011). Further proof exists in other studies and so it appears that methylglyoxal is not fully responsible for manuka non-peroxide antimicrobial activity.

It is evident that as honey is a purely natural product its mechanisms of bactericidal activity are highly complex and vary for individual bacterial species. Such complex interactions preclude prediction of the relative contribution of individual components to the overall antibacterial activity of honey and so merely giving an indication of the amount, in milligrams, of methylglyoxal, or any other antimicrobial agent, in a honey isn't really giving you the full story – but then, neither does the UMF® measure. Both of the rating systems have their advantages and disadvantages and neither is perfect.

As well as research into measuring the "strength" of the manuka honey, there is also an increasing body of research into the detection of adulteration of manuka honey. For example, the NPA rating of a batch of honey can be raised by adding extra methylglyoxal. With a higher methylglyoxal reading, a higher price can be achieved even though the honey may not actually have any extra NPA. The UMF® Honey Association has spent hundreds of thousands of dollars in research on the detection of adulteration, for example, the detection of synthetic DHA (Dihydroxyacetone) (understood to be a precursor for methylglyoxal with the potential to more accurately predict the future methylglyoxal content level in fresh

Footnote. *Bee defensin-1 is a small antimicrobial peptide and is part of the honey bee immune system. It also contributes to the antibacterial activity of honey. It is synthesized in the bee's salivary glands.

honey), and the detection of added methylglyoxal itself and will be rolling out this test method into its international network of labs in the near future.

So UMF® and MGO™ are both measures of NPA (Non-Peroxide Activity) and we have now seen exactly what they are measuring and why. In Part Two of the article, we look at how the two ratings correlate and we investigate all of the other ratings and numbers that you can find on jars of manuka honey. I also provide a buyers checklist so as to banish any confusion that may still may exist.

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