A Comparative Study of the Physicochemical Characteristics and Health-Promoting Properties of Donegal Heather Honeys Vs Manuka Honey

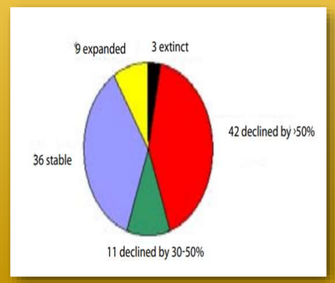
Project Summary

This project was to compare two natural recourses of raw honey; New Zealand's premium Manuka Honey 300 MGO and my own Raw Heather Honey from Donegal Ireland.

My aim essentially was (to find value for money between the two samples) to inquire into if it's better to spend your money on an expensive honey with a large amount of air miles attached like Manuka or to instead put that money into your local community by buying raw Donegal heather honey.

My goal will require the examination of each honey samples physico-chemical characteristics to compare the health promoting properties

There are three types of bee, solitary , The bumblebee is a part of the Apidade family but belong to the Bombus Genus of the bee clade, Last are the Honey bee they are a part of the Apidade family but belong to the Apis mellifera of the bee clade they are known for forming colonies and hives out of wax. Ireland has 101 different bee species with only one being native and have recently seen a consistent decline in their numbers. According to a study by Biodiversity Ireland the Irish bee population is declining with it said that 3 out of the 101 species to be extinct the pie chart to the right identifies the decline percentage out of the 101 species



Formula's used in my experiments

FORMULA 1:

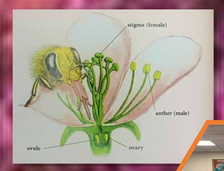
⇒ 1-(OD T0/OD T24)x 100 for percent inhibition.

FORMULA 2:

⇒ (Concentration1) (Volume1)= (Concentration 2)

FORMULA 3:

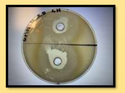
%DPPH remaining = Absorbance sample / Absorbance control x 100 The control

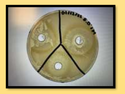


Images above: Left to right: The Manuka Plant New Zealand, The Heather Plant, Donegal, a diagram of the Worker bee extracting the nectar from the flower.

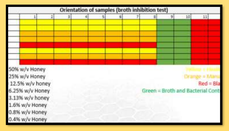
Method

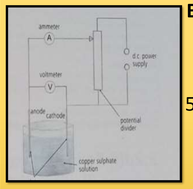
Well Diffusion: This well-known procedure, agar plates are inoculated with a standardized inoculum of S. Aureus. Then wells are board into the agar(4 mm in diameter), and 100µl of the honey dilution is pipetted into the wells. The Petri dishes are incubated under suitable conditions. Generally, antimicrobial agent diffuses into the agar and inhibits germination and growth of the test microorganism and then the diameters of inhibition growth zones are measured.





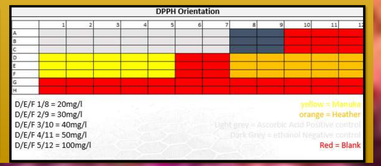
Broth inhibition test/Spectrophotometric assay for MIC determination : I began by filling the wells shown in the picture to the right, with the dilutions and different samples (180µl), I then covered them with 20µl of S. Aureus solution, the OD was determined prior to incubation, it was then incubated at 600nm and left overnight.





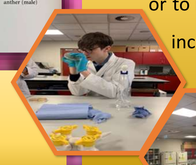
Electrical conductivity: The two images to the right show a diagram and the format to conduct the experiment. I made a honey solution (100ml water added to 50mg of honey samples), 5g of copper sulphate were added and mixed, I then put copper and carbon plates into the solution and recorded the voltage and current.

DPPH Assay: A stock solution of ascorbic acid was prepared in order to construct the calibration curve using Formula 2. the final concentration of the ascorbic acid solution was 10mg/L. Standards were prepared from this stock solution with concentrations of 0-10mg/L. 0.75ml of each standard was added to 1.5ml of DPPH solution and incubated in a test tube at 25°C for 15 minutes. The free radical scavenging activity was determined by the 1.1-diphenyl-2- pic-rylhydrazyl (DPPH assay). 0.75ml of the methanolic honey solutions at the different concentration was added to 1.5nl DPPH solution in test tubes As shown in the Figures to the right.



Data/Statistical Analysis

These experiment were to give insight onto which honey was better within the tests, with the prior knowledge of the Manuka sample being informally the best in the world. For my analysis a total of six tests were conducted with some having longer preparations than others and many having to conducted more than once for an accurate result. A few instruments used were an Eppendorf pipette (a multi-dispense pipette) ,a stereological pipette , a pre-programmed pipette, a voltage and a ohm meter. Most of the data collected from the experiments went into a table to be easily accessible and to further be processed into a chart or graph, which was all done on Excel. For the broth inhibition test The OD for the replicate at T0(the plate determined prior to incubation at 600nm) was subtracted from the OD for each replicate at T24 (after incubation) The adjusted OD of each control well was then assigned a value of 100% growth. I then used Formula 1 to get the percent inhibition. The DPPH scavenging activity was found through Formula 3 where the stronger antioxidant produces a smaller DPPH Scavenging Activity. These where done through a spectrometer then sent to an excel docu-

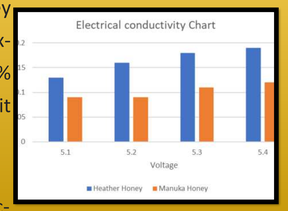


Results

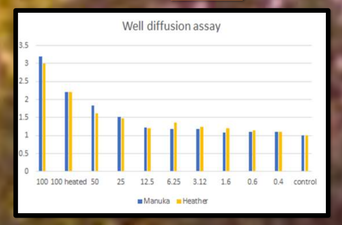
The laboratory tests conducted began with a well diffusion assay, this was conducted four times over the course of three weeks, the results showed Manuka take the lead with a difference of 83 µm (micrometres) (a very small margin 1000 times smaller than a millimetre) This test also highlighted that when honey is heated honey above >50°C it reduces the quality.

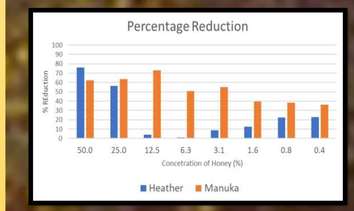
The next test conducted were the broth inhibition assay conducted twice these tests showed the percentage reduction in S. Aureus, For the raw optical density it showed heather higher with a difference of 0.18 OD, the percentage reduction it showed Heather reduce more in the higher dilutions and then Manuka take the lead from 6.25% concentration onward to 0.4%

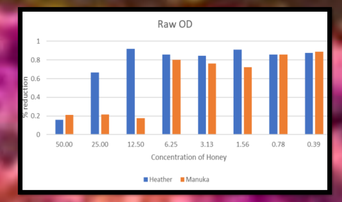
After that the DPPH assay was conducted which showed Manuka honey produced more antioxidants with a 5.45% difference between it and the Heather

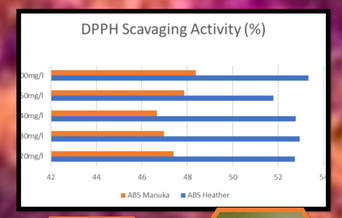


The Final test was electrical conductivity of each honey which showed









Conclusions

In conclusion my comparison of Manuka Honey Sample with a quality of 300+ MGO to my own locally sourced Heather honey sample using the physico-chemical characteristics and health promoting properties, The Manuka Honey had a minimal difference between Heather in a majority of the tests with heather even being the most acidic, so it is only fair to say manuka is better due to its 5.45% difference in antioxidants and its 83µm in the well diffusion assay.

I also found that if honey is heated above 50°C it can reduce the quality of the Honey. Although the Aim of this project was really to show people that you didn't need to spend so much money on an expensive jar of honey to get the health benefits from them and in fact it's much more sustainable to support your local beekeepers and purchase a local jar instead and far cheaper. Future expression and research into Irelands Honey would be useful not just to us, not just to the bees and beekeepers but to all of Irelands Biodiversity and would help guide consumers to a more locally sourced produce. Past papers also recommend locally sourced honey to be the most beneficial to our health. And commercial opportunities could also be exploited.