Int J Appl Biol Pharm 2020; 11 (4): 276-278

Short Commentary

Photoprotective Properties of Honey Extracts and their Correlation with the Metabolomic Content

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Received: 16 October 2020; **Accepted:** 28 October 2020; **Published:** 18 November 2020

Citation: Konstantinos Gardikis. Photoprotective Properties of Honey Extracts and their Correlation with the Metabolomic Content. International Journal of Applied Biology and Pharmaceutical Technology 11 (2020): 276-278.

Abstract

UV Radiation (UVR) is one of the main causes of various skin disorders. Depending on the wavelength, the duration of the exposure and factors that concern skin physiology and structure, UVR may have detrimental effects on skin, varying from triggering of aging mechanisms and immunosuppression to DNA damage and carcinogenesis. In parallel, the link between air pollution, UVR and skin carcinogenesis has been demonstrated by a significant number of epidemiological studies. Especially, the accumulation of damages caused by UV radiation and air pollution are proven to have several effects on skin, including chronic inflammation, immunosuppression, atrophy and aging. Nowadays it is more evident than ever that products for skin application, such as traditional cosmetics or cosmeceuticals, may play a very important role in the preservation of the overall health of population – apart from the obvious well-being target. Especially in large cities where the above factors – air pollution and UVR – coincide, there is an emerging need for development of products that are effective in terms of protection from environmental aggressors. These products should optimally be based in safe, sustainable, and natural ingredients that demonstrate proven efficacy in terms of protection.

Honey has been widely recognized as such an ingredient. Its use since ancient times, its sweet taste and its abundancy – despite the recent challenges

imposed to bee populations because of environmental issues – make it ideal as a raw material for many human applications, beyond the per os use. Honey is a rather complicate and non-consistent mixture of molecules. It is mainly constituted, apart from water, from sugars, glucose and fructose. It also contains amino acids, organic acids, vitamins and minerals [1]. In small concentrations it contains flavonoids and phenolic acids that seem to play in important role in the bioactivity of honey. It has been reported that bioactive compounds are similar in different types of honey, though the metabolic fingerprint seems quite different due to varying concentrations of the ingredients. It is no surprise that some honey extracts may have very different bioactivity than others, though they contain very similar bioactive substances.

Due to numerous studies, several types of honey have been according to exhibit antimicrobial, antifungal, antioxidant, anti-inflammatory and anti-tumor activities [2,3]. As for the antioxidant activity of honey, it is attributed to the flavonoids and organic acids it contains. The photoprotective activity of honey, that may to a point be linked with antioxidant mechanisms, has been poorly investigated. The recent research paper by Karapetsas et al. [4] demonstrated the capacity of several honey extracts to protect HaCaT cells from UVB radiation while they exhibited antioxidant and antimutagenic capacity. Also they were found to downregulate metalloproteinases in reconstituted human skin tissue models, demonstrating a potential for prevention of photoaging. There was a correlation between the total phenolic content and ABTS antioxidant capacity, though no correlation with DPPH antioxidant capacity. Furthermore, no significant correlation between total flavonoid count and antioxidant capacity was found, but this may be attributed to the low concentrations. What is of most interest is that two honey extracts, that did not demonstrate the highest flavonoid content and that were not statistically different from other extracts in terms of total phenolic content and in vitro antioxidant capacity, demonstrated significantly higher antioxidant activity in HaCaT cell under UVB exposure conditions, effectively protecting cells from UVB induced DNA damage. This finding could be probably attributed to differences in the concentration of specific metabolites, mainly phenolic compounds, and not in the overall concentration of such compounds. It is undoubtful that the metabolic profile of honey – and especially the phenolic categories – should play an important role in the bioactivity mentioned above. The two honey samples come from very different areas, southern and central Crete, with very different vegetation, as depicted by the melissopalynological analysis.

A challenge implied by that publication is clearly the correlation between the concentration of metabolites of honey with bioactivity, primarily in cellular level. Already, Manuka honey has been assessed and recognized for bioactivity related to the concentration of a molecule, methylglyoxal. The situation with other types of honey, such as thyme, fir, heather etc is quite different as the bioactivity is not expected from a single molecule, but from a combination of them. In this perspective, current advanced metabolomic analysis could be very useful. Once the bioactivity of each honey metabolite has been identified, then the bioactivity of small fractions of honey extracts could be assessed too. What be of much interest is the correlation of such what is groups of molecules, and of their concentration, with the flora composition of different areas, as it is known that these are molecules collected from plants. This could prove to be the indication of specific “terroirs” for the

placement of beehives by beekeepers in order to be able to produce honey with specific medicinal properties. By thorough research honey -for skin applications – could be transformed from a mild soothing and hydrating agent, to a powerful ingredient that protects skin from photoaging – including DNA damages that may lead to cancer and other medical conditions. Since there are reports on the activity of honey against other environmental stressors too, honey produced in a specific, controlled way, could prove a valuable ingredient for the preservation of the total health of a population – and in parallel a means to significantly enhance local economies. The scientific tools are present and the preliminary data convincing.

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