

Characterizing antioxidant and chemopreventive properties of Polish varietal honeys after applying gastrointestinal digestion and using absorption models

DESCRIPTION FOR THE GENERAL PUBLIC

Due to the increasing number of cases of lifestyle diseases in recent years, there has been a growing interest in food that has a health-beneficial effect on the human organism. Basis for many mechanisms that are described for leading to degenerative diseases is the redox imbalance with an excess of free radicals present in the organism. In certain physiological states (e.g., during breathing or autoxidation of various biological molecules), the human organism produces radicals. Radicals produced under normal conditions pose no threat to human health, because the organism has several endogenous defense systems with varying compounds being able to keep homeostasis. The threat is, though, connected with free radicals that are produced in pathological conditions (e.g., inflammation) or as a result of exposure to exogenous factors (UV radiation, smoking, air pollution, and also as a result of an imbalanced diet). These contribute to the pathogenesis of many diseases, such as cardiovascular diseases, respiratory diseases, cancer, nervous system disorders, atherosclerosis and eye diseases. The effective defense against free radicals' effects may be a consumption of foods rich in antioxidants – substances which are of particular importance in maintaining the balance of the oxidation-reduction potential.

Honey is a natural food product and traditionally believed to provide a significant nutritional as well as preventive and therapeutic value. Numerous literature sources point out that regular consumption of honey is one of the best forms of providing the organism with easily digestible carbohydrates, biologically active and bacteriostatic substances, organic acids, several amino acids as well as further micronutrients. The consumption of honey is especially recommended for the elderly and convalescent people. Recent studies on honeys indicated that their biological properties can be assigned to the content of phenolic compounds. Polyphenols are one of the most effective antioxidants and thus, consumption of food products rich in these compounds is recommended for prevention of many lifestyle diseases. As honey originates from various single and/or multiple plant species, the content of bioactive components including polyphenols can vary depending on the floral source. In addition, climatic and processing conditions influence the composition of honey, thus, the properties of the same varieties produced in diverse parts of the world can be different. Moreover, digestion processes that take place in human gastrointestinal tract influence the compounds' structures and thus, bioactivity and bioavailability. As bioavailability of phenolic compounds is highly depending on their chemical structure it is crucial to elucidate it to deepen the knowledge on the properties of honey.

Many studies have been conducted on the exact mechanism of antioxidant capacity of honey and component's structures responsible for this feature, but it has not been comprehensively clarified yet. Moreover, although there were some *in vivo* and *in vitro* studies that confirmed the therapeutic and/or preventive potential of selected varieties of honey of various origin, there is a scarce research considering structural changes during processing and after digestion and the following trans-epithelial transport. Consequently, bioactivity is not yet explained comprehensively and cannot be predicted yet. Polish dark varietal honeys provide one of the highest total phenolic contents worldwide and therefore they can serve as models for the bioactivity and results can be transferred to all kinds of honeys and related products.

The main objective of this research is to characterize honey's biological activity, including antioxidant responsibility and chemopreventive properties of selected Polish honey varieties with consideration of postharvest influence on structural changes of the polyphenols and their behavior during digestion and absorption. The research will include verification of the botanical origin using pollen analysis and physicochemical methods, simulation of the digestion and trans-epithelial transport, determination of the total phenolic content and composition, and characterization of the contribution of single compounds to the overall antioxidant activity by quantification of antioxidant compounds (polyphenols and their degradation and reaction products). Moreover, there will be an evaluation of bioactive properties (antioxidant and chemopreventive) using *in vitro* methods. The synergic effects between honey compounds will be evaluated. As a result, comprehensive knowledge on the chemopreventive potential of honey with consideration of changes after digestion and trans-epithelial transport within the structure of antioxidant compounds will be obtained. Both the cytoprotective effect of honeys under oxidative stress as well as their influence on the intracellular level of free radicals and the activity of the antioxidant enzyme will be assessed. Chemopreventive properties of honey and its fractions will be investigated and correlated with antioxidant compounds structure changes. Analyzes with the use of cell cultures will provide information on the impact of the tested honeys on the viability, proliferation and metabolic activity of various tumor cells. Additionally, the type of cell death of the cancer cells exposed to the tested honeys will be assessed.