

The popularity of coffee results not only from attractive organoleptic properties, but also pro-health ones, which, along with the stimulant properties caused by caffeine, also include antioxidant properties, determined by the polyphenol content. Many scientific reports indicate that the polyphenols contained in coffee limit the pathogenesis of a number of chronic civilization diseases. Coffee has been consumed for over 1000 years as a brew of roasted beans, and drunk in moderate amounts is considered to be part of a healthy diet. The roasting process increases the Maillard reaction products (MRP) content, which bind polyphenols, as well as the reduction of free polyphenols. Roasting results in the formation of aroma components and reduce the astringency of the brews. Current analytical capabilities have contributed to the demonstration that roasted coffee beans in addition to health-promoting components contain potentially harmful low-molecular-weight Maillard reaction products, such as acrylamide and 5-hydroxymethylfurfural (5-HMF). Their concentrations are relatively low and with moderate consumption of coffee brews may be below the level of risk for human health.

However, this has contributed to the popularization in recent years of an unroasted green coffee that does not contain MRP and shows a high concentration of free polyphenols. Green coffee however, bind to enzymes in the digestive tract, limiting digestion and absorption of food. Interestingly, at the beginning of 2018, California in the United States introduced the obligation to inform consumers of roasted coffee about the potential carcinogenic activity of the coffee brews. Although epidemiological studies among people who drink coffee clearly indicate its beneficial effects on health with moderate consumption, now the consumer is completely lost reaching for the favorite brew with the health warning. Meanwhile, coffee brew is an inseparable part of the diet of hundreds of millions of people, so studies on the impact of coffee on human health must be continued, so that the public discussion on this subject is based on evident scientific facts. The aim of the study is to indicate the most favorable anti-neurodegenerative, antidiabetic and anticancer properties of coffee brews depending on the degree of roasting, beans species and level of consumption.

The reason for undertaking the presented research problem is the ambiguity of recommendations regarding coffee consumption and confusion of the consumer about what coffee and in what amounts he can consume, in order to positively stimulate the body in the fight against oxidative stress and at the same time maintain health safety. Given the importance of coffee in the diet of adults, this problem is very important.

The project plan includes the preparation of coffee bean extracts of two species Arabica and Robusta green and roasted to light and dark levels and their fractionation to separate fractions containing various groups of polyphenols, free and bound with MRP, and selected low molecular weight MRP (LMRP), including acrylamide and 5-HMF. The full extracts and extract fractions will then be subjected to enzymatic digestion *in vitro* to investigate the level of release of bioactive compounds from complexes with high molecular components. The degree of absorption of polyphenols in a model system with a layer of enterocytes will also be examined. In this way, an image of bioavailable polyphenols and LMRP will be obtained. Then selected polyphenols and LMRP, as well as extracts and their fractions, will be subjected to molecular modeling by docking simulation and to calorimetric tests with systemic enzymes and receptors to indicate coffee components exhibiting the highest ability to activate metabolic pathways responsible for inhibiting selected civilization diseases. The results of these models will be compared with the evaluation of health-promoting properties of coffee components in a cellular model to confirm the activation of selected metabolic pathways in a more complex biological system and to select extracts and their fractions that after digestion and absorption most preferably work at the cell level and to determine their most beneficial concentrations corresponding to a given level of consumption.