Wheat bread is still a basic component of the diet despite the fact that it contains gluten. Consumers choosing the adequate wheat bread are paying more and more attention to its quality and composition. This is due to the growing public awareness of the impact of food consumed on human health. Supplementation of bread with compounds that can have a beneficial effect on health is a good way to diversify your diet and enrich it. Compounds that have many health-promoting properties and can also serve as bread supplements include dietary fibre preparations and polyphenol extracts (supplements). These supplements contain dietary fibre and polyphenols, which have strong antioxidant properties, as well as have anti-coagulant, anti-inflammatory and anti-cancer effects.

As a result of washing out of starch and other water-soluble ingredients from wheat dough, we get gluten. It is a viscous-elastic mass, which consists of two types of proteins: gliadins and glutenins. As a result of the dough kneading, these proteins combine with each other through hydrogen bonds and disulphide bridges to form a gluten network. The proper structure of this network is necessary to obtain bread of adequate quality and structure. However, the use of various supplements of bread dough may disturb the formation of gluten network characterized by appropriate mechanical properties, and thus, may affect the sensory quality of bread.

The aim of the project is to determine the mechanism of interactions between gluten proteins and selected polyphenols (phenolic acids) during the process of kneading bread dough. The main research object of the project will be a model bread dough supplemented with eight phenolic acids (4-hydroxybenzoic, protocatechuic, vanillic, syringic, p-coumaric, caffeic, ferulic and synapic acids). These acids are found most in cereals, fruits and vegetables. Gluten, gliadin and glutenin will be obtained from the supplemented dough. The research planned in the project will concern the study of changes in the secondary and tertiary structure of proteins obtained from the model dough, determination of the type of bonds formed between amino acids in polypeptide chains and phenolic acids and determination of binding sites of individual phenolic acids to gluten proteins. Protein-polyphenol interactions do not only affect the structure and functionality of proteins, but also the antioxidant activity of polyphenols, which will also be studied in this project. Scientific research indicates that the antioxidant activity of bread supplemented with polyphenols increases compared to the antioxidant activity of free polyphenols. However, most scientific research into protein-polyphenol interactions indicates a reduction in polyphenol antioxidant activity as a result of the formation of protein-polyphenol linkages. Changes in the structure of gluten proteins will be studied using infrared and Raman spectroscopies, whereas LC-MS (liquid chromatography coupled with mass spectrometry) method will be used to determine phenolic acid binding sites.

Understanding the mechanisms of interactions between gluten proteins and phenolic compounds with gluten may enable the creation of an appropriate bread production technology, and the bread will have health-promoting properties and at the same time will have the appearance, taste and smell desired by consumers. In addition, the incorporation of phenolic acid into the gluten network may cause blockage of the epitope, i.e. the amino acid sequence responsible for triggering the body's immune response. As a result of blocking the epitope, we can get gluten and bread with reduced allergenicity.