

Acorns and the products made from them have been known to people for many generations. In their original function, they were to be food for animals. In times of scarcity and hunger, they were introduced into the diet of people as a "filler", which was to ensure the right volume of consumed food and be a source of carbohydrates. Currently, it is indicated that acorns and the flour obtained from them are characterized by high nutritional value, so it is worth treating them as an alternative ingredient in food products.

Acorns are characterized by a relative high content of fat rich in unsaturated fatty acids, fiber, minerals (especially calcium, potassium, copper, iron and manganese), antioxidant compounds and folates. Studies also shows that the content of these nutrients in acorn flour exceeds their content in traditionally used flours (wheat, rye, corn, rice or potato), but depends on the species and quality of the raw material and the technological process. On the other hand, the protein content remains lower than the mentioned raw materials.

Despite the high nutritional value of acorns, there are also contraindications to their large-scale consumption and processing. The main problem is the high content of tannins, which give acorns a bitter taste and, in too high concentrations, have anti-nutritional properties. The tannin content in acorns is not a definite obstacle to their consumption. There are methods that reduce the tannin content in acorn products, e.g. by washing with water. The use of appropriate processing methods also allows the decomposition of tannins to compounds that have health-promoting effects (which is observed, for example, by hydrolysis of ellagitannins to ellagic acid). In addition to the nutritional value of the acorn flour, its influence on the nutritional value, physical characteristics and sensory quality of the final product remains important. The effect of the addition of acorn flour on the nutritional value of gluten-free bakery products and products based on white flours seems to be particularly beneficial. But it is pointed out that acorn flour, lacking gluten proteins, may have a negative effect on the physical properties of the dough and the finished product. The product obtained on the basis of or with the addition of acorn flour shows colour changes, higher hardness and chewiness, and a lower volume. It is assumed that the use of an appropriate method of preparing acorn flour before its introduction into the product (e.g. by fermentation or microwave heating) and/or an appropriate method of dough preparing (e.g. selection of ingredients or fermentation conditions) may contribute to reducing its negative impact on physical characteristics.

The main goals of the research concern the development of such methods of producing, pre-treatment and introducing acorn flour into bakery and pastry products, which will allow to maximize the nutritional value of the obtained products while minimizing the negative impact on their physicochemical properties. The first goal is to gain new knowledge on the effectiveness of the tannin leaching process as a stage in the processing of acorns into flour and to assess the possibility of modifying this process in terms of its effectiveness. The second goal of the research is to gain new knowledge on the possibilities of using technological processes: fermentation, enzymatic treatment and microwave heating in the preparation of acorn flour for use in bakery and pastry products and their impact on the content of polyphenols in the raw material. The third objective of the proposed research is to gain new knowledge on the possibility of eliminating negative changes in the physical properties of dough and finished products with acorn flour by establishing appropriate process conditions and proportions of base ingredients and the use of natural technological additives.

In the I stage of the research, it is planned to determine the basic chemical composition, the content of biologically active compounds and the quality parameters of commercial acorn flour, bought in various countries. Stage II will be based on the use of various methods of pre-treating acorns and assessing their impact on the content and profile of polyphenols, the basic chemical composition and quality parameters of flour obtained from fresh acorns. Stage III provides for the use of: fermentation, enzymatic treatment and microwave heating of acorn flour in order to modify its composition (especially polyphenol profile) and improve technological properties, assessed on the basis of model bakery and pastry products. Stage IV will include the use of acorn flour and assessment of its impact on the polyphenol content and quality characteristics of wheat bakery and pastry products. In the V stage, the impact of the method of making wheat dough with acorn flour on the content of polyphenols and quality characteristics of wheat bakery and pastry products will be carried out. In the VI stage, the recipe for various bakery and pastry products with acorn flour will be validated.

In order to confirm or exclude the validity of the applied treatments, the research material and manufactured products will be subjected to laboratory analysis including methods of chemical analysis (with use of chromatographic and spectrophotometric techniques), rheological methods (farinographic, amylographic, TPA test), and sensory analysis. Detailed analysis of the composition of the tested material will include the determination of the profile of polyphenols, including phenolic acids, flavonoids and tannins, before and after the applied technological treatments.