

Pesticides are widely used in both agriculture and household settings. While their levels in food products, including milk, are strictly regulated, growing concerns remain about the potential health effects of chronic, low-dose exposure in farm animals. According to data from the European Food Safety Authority (EFSA), the most frequently detected pesticide residues in cow's milk are dichlorodiphenyltrichloroethane (DDT) and hexachlorobenzene (HCB). In recent years, glyphosate (GLP) has also raised increasing concerns and has been closely monitored due to its potential health implications. While these levels typically remain within the permitted maximum residue levels (MRLs), little is known about their impact on the mammary gland and the cells responsible for milk production.

The aim of this project is to investigate how these pesticides (DDT, HCB, GLP) affect the function of mammary epithelial cells, which are essential for the synthesis of milk proteins and fats, as well as their role in the local immune response in the bovine mammary gland. The research will be conducted using the BME-UV1 cell line under *in vitro* conditions, which allows for the safe and precise examination of cellular responses to selected chemical compounds. The project includes three main objectives: (I) to assess the impact of pesticides on the modulation of gene expression involved in milk protein synthesis and fatty acid synthesis; (II) to determine the effects of pesticides on milk protein levels and lipogenesis-related markers; (III) to evaluate the impact of pesticides on induced inflammatory responses in mammary epithelial cell cultures, in order to determine whether pesticides can enhance or modulate this response.

The results of this research may help to better understand how environmental contaminants affect the quality of milk components at a very early stage of production - specifically, within the milk-producing cells of the mammary gland. They will also help answer the question of whether pesticides contribute to the development of inflammation in the bovine mammary gland. Mastitis is a common disease in dairy farming that leads to significant economic losses due to reduced milk yield and high veterinary treatment costs. This approach may reveal previously underestimated risks associated with chronic, low-dose pesticide exposure in livestock. The findings of this project could serve as a scientific basis for re-evaluating current maximum residue levels for pesticides, supporting potential legislative changes. The reliable data generated through this research will fill an important knowledge gap in the fields of food safety and animal health.