DESCRIPTION FOR THE GENERAL PUBLIC

A newborn child is exposed to many factors that can negatively influence its health and even life. In this earliest period of infant's life, protection can be provided by mother's milk, which is rich not only in substances ensuring correct growth and development of the child but also in bioactive compounds. The latter group include proinflammatory cytokines which in a complex network of influences can have immunomodulatory effect by binding to an appropriate receptor. It is these substances that support and participate in all kinds of defense mechanisms, strengthen the immunological system and are indispensable for the newborn's health, particularly as their endogenous production starts later in life. However, their levels in milk can be influenced by many external factors, especially heavy metals that are able to cross the brain-blood barrier, which is also conducive to penetrating into mother's milk; as a consequence, heavy metals can constitute a threat to newborns. Similarly, due to its high fat content, human milk can contain lyophilic organic pollutants such as polychlorinated biphenyls (PCBs). Due to the exposure to these harmful environmental pollutants and the influence of negative stimuli such as stress, the production of such polypeptides as cytokines in milk can be disrupted. Therefore the paramount objective of this research is elucidation of mechanisms blocking the production of selected cytokines in breastfeeding mothers, and in particular the disorders leading to actual insufficient milk supply which be an effect of environmental pollutants and food contaminants. It will be necessary to determine the proteomic profile of human milk with particular focus on proteins with immunomodulatory functions – proinflammatory cytokines. To isolate these compounds from biological matrix, a new approach will be proposed, involving synthesizing dedicated sorbents based on magnetic molecularly imprinted polymer (MMIP) and analysis with the MALDI-ToF technique. To determine the contents of endogenous and exogenous substances in milk, new methods will be developed which will utilize liquid chromatography with a variety of detection techniques (UV-VIS, FLD, ECD, MS, ELSD). To describe the mechanism of cytokine production blocking, the results of the analytical studies will be correlated with medical data by statistical analysis.

The results of this research will make it possible to determine the proteomic profile of human milk with special attention paid to proinflammatory and immunomodulatory cytokines and correlating their content in milk with the influence of environmental pollutants. A clear progress will be made in basic research due to developing a new approach to sample preparation which would allow researchers to isolate selected cytokines with the synthesized sorbents based on magnetic molecularly imprinted polymers (MMIPs). The proposed solution may offer an alternative to selective but sometimes overly sensitive ELISA tests particularly in the case of such complex matrix as human milk. The possibilities opened by application of new sorption materials combined with sensitive analytical techniques may prove valuable in the studies on toxicodynamics in human organism, which in turn will ensure better understanding of the influence of environmental pollutants on people's health. Besides, through a number of developed analytical procedures which will make it possible to determine substances with different physico-chemical properties isolated from a complex biological matrix that is human milk, data necessary to establish the connections between the studied analytes and cytokines will be collected.