With increasing life expectancy of man, the frequency of diseases of the nervous system associated with senility, like Alzheimer's and Parkinson's syndroms or epilepsy, increases as well. Therefore, new drugs are being tested for more effective treatment, prevention of the diseases or alleviation of their symptoms. There are also attempts of alternative approach including different kinds of diet because of both a low effectiveness of pharmacotherapy and increasing needs of more "natural" treatments.

The best known example of a successful dietary treatment of neurological disorders is the use of ketogenic diet in patients suffering from drug-resistant epilepsy. Although the exact mechanism of action of ketogenic diet is not fully understood, it is well documented that it exerts an important influence on the energy metabolism. This is a high fat diet devoid of carbohydrates. Because of the lack of carbohydrates, all the energy is obtained from the oxidation of fatty acids. This produces large amounts of acetyl-CoA leading to the synthesis of acetoacetic acid in the liver. It can then be converted to ketone bodies, which are an alternative energy source necessary for cellular processes.

The physiological state of increased production ketone bodies is called ketosis. Ketones are transported from the liver into the bloodstream and then to other organs, including the brain. This diet has been successfully used for many years in the treatment of refractory epilepsy, especially in adolescents and children. It can also be effective in treatments of Alzheimer's and Parkinson's diseases, migraine, amyotrophic lateral sclerosis or brain damage.

In the pathogenesis of all these diseases glial cells play significant roles. They are a very large, heterogeneous population of cells of ectodermal origin maintaining the homeostasis of the nervous system. They constitute also the first line of defense in case of infection or damage. The cells dominate significantly over the number of neurons. In the last few years a growing interest in these cells can be observed due to discoveries of their new and important features.

In spite of the important but unsolved problems, no regular investigation was aimed at understanding how the glial cells would behave when the energy required to carry out vital processes derives from ketone bodies rather than from glucose. This is the subject of the present research proposal. We would also like to see effects of this dietary treatment using MRI (imaging changes of intracerebral connections (tractography) and in the molecular composition of nervous tissue). These data will serve as a starting point for further comparisons with results of histological and biochemical analyzes.

The results obtained in the planned experiment will expand our knowledge on the mechanisms of action of the ketogenic diet. Perhaps the research will prove that glial cells but not neurons are the main target of influences exerted by the ketogenic diet.

Observations of morphological changes of glial cells in the animals fed with ketogenic diet will provide data on the extent to which these cells are involved in metabolic processes. This may help in understanding the underlying mechanisms of action.