

Phenylketonuria (PKU) is the most prevalent inborn error of amino acid metabolism, with the incidence in Europe reaching approximately 1:10,000 live births. A lack of normal activity of an enzyme called phenylalanine hydroxylase results in accumulation of a particular amino acid, namely phenylalanine. Since an increased concentration of phenylalanine is neurotoxic, the main symptom of untreated PKU is a severe intellectual disability. The predominant therapy is a diet with a low phenylalanine content, which means that patients are allowed to eat only very small amounts of natural proteins and, instead, are given special amino acid supplements without phenylalanine. Introducing such treatment as early as in the first days of a patient's life and following it throughout their whole life allows the normal development. However, this diet is very demanding for PKU patients as they cannot eat most of the products which are routinely consumed by a healthy person.

Significance of the project

Scientific research shows that dietary protein intake might influence kidney function. There were many studies conducted on patients with kidney diseases and on healthy individuals, but there is very little information about kidney function in PKU patients. There is only one publication in the world's academic bibliography on the effect of a life-long low-phenylalanine diet supplemented with synthetic amino acids on the renal function in patients with PKU, however, there was no control group in this study. Regarding the fact, that the predominant treatment in PKU is the diet with supplementation of synthetic amino acid formulas without phenylalanine, which involves higher total protein intake, further studies with a control group in order to assess renal function in PKU patients are really necessary

The project is going to be of an innovative nature because it will be the first comprehensive study aiming to compare the renal function in PKU patients to a healthy control group and analyse the impact of oxidative stress on the kidney function. The project will also try to establish whether assessment of kidney function should become part of routine care of PKU patients.

Scientific goal of the project

The main aim of the project is to evaluate renal function in patients with PKU treated with a diet in which the main source of dietary protein are synthetic amino acid supplements without phenylalanine. Moreover, the study aims to find different factors which could affect renal function, such as increased oxidative stress (elevated oxygen free radicals which can lead to cell and tissue damage).

Research methodology

The study group will consist of 50 PKU patients (aged between 5 and 45) diagnosed through newborn screening who started to be treated with a low-phenylalanine diet before the age of three months. The control group will consist of 50 healthy individuals. Participants will be enrolled to the project according to strict criteria concerning their health. Each participant will be provided with full information about the project's purpose and organisation. Only people who give informed written consent to their participation will be enrolled for the study.

The project will include evaluation of signs and symptoms of an impaired renal function, assessment of height, weight, body mass index (BMI), blood pressure, glomerular filtration, glomerular and tubules injury, adverse effects of possible impairment of renal function, total protein, albumin, phenylalanine and other amino acids concentration, oxidative stress and renal ultrasound. Moreover, each participant will be asked to complete a three-day food record. Statistical analysis of all collected data will allow us to draw conclusions from the research.

Expected benefits

The proposed study will be beneficial to the whole PKU population around the world, because the project results will make it possible to assess the risk of kidney injury, establish at what age it might appear and identify the factors which could modulate the renal function. An additional benefit will be the opportunity to establish recommendations on renal evaluation in PKU patients.