

In recent decades human lifestyle has changed significantly. Reduced physical activity, imbalanced nutrition, and inappropriate eating habits occurred to be highly detrimental for human health. Overweight and obesity rates have recently reached epidemic proportions and became a world-wide health problem. World Health Organization (WHO) reported in 2022 that overweight and obesity have been found to affect almost 60% of adults and nearly one in three children (29% of boys and 27% of girls) in European Region. Recent estimates suggest that overweight and obesity is the fourth most common risk factor for noncommunicable diseases in Europe, after high blood pressure, dietary risks and tobacco.

Overweight and obesity are the factors contributing to the development of infertility, which has recently increased significantly and has become the third most serious disease after cancer and cardiovascular diseases. Moreover, increasing evidences indicate diet as one of the most important modulator influencing how DNA is transcribed without altering its sequence. This, in turn, leads to altered gene activity which may be either beneficial or detrimental for the physiological condition of both maternal and offspring organisms. Therefore, developing appropriate nutritional strategies, research, education, and awareness creation about the significance of healthy eating habits is critical for increasing human health.

Introducing specific diet programs aims to reduce body weight. Many clinical nutritional trials evaluating different types of diet on physiological effects of obesity treatment have been performed however, due to multi-factorial etiology of obesity it is highly challenging to create effective and universal diet program for weight loss and the maintenance of correct body weight. One of the promising approach is a ketogenic diet (KD) which is a dietetic regime which mimics fasting through a marked restriction of daily carbohydrate intake (5-10% of total energy) and a proportional intake of fat (about 80-90%) and protein (up to 10%). This specific combination of macronutrients aims to force the organism to break down fat instead of glucose to produce the energy, inducing ketosis. Nowadays, ketogenic diets are regarded as valid therapeutic options in various clinical situations including obesity but also impaired fertility. However, ketogenic diet is also applied by healthy (often nulliparous) women as a life-style choice helping them to keep feet and healthy. Although, KD is widely used to prevent and treat various clinical conditions, both the molecular mechanisms and further consequences of KD for the organism and the offspring remains largely unknown. Therefore a key question arises: does ketogenic diet affect DNA of the oocyte and, if so, does it affect the health status of the offspring of females under this nutritional regime? Therefore, the main objective of the project is to evaluate whether ketogenic diet may affect female fertility and induce epigenetic changes in oocyte DNA and whether these changes may be transmitted to the offspring and influence their health?

In order to answer this questions we set the experiments in which we will test how ketogenic diet affects the health status of female rats and whether this dietary intervention may affect its reproductive performance. Moreover, if we will notice any changes induced by ketogenic diet by maternal genome we will check, whether these changes may be transmitted to the offspring and affect their health. Results from the proposed project will help us to resolve whether ketogenic diet is safe for female metabolism and reproductive outcomes and whether it is safe for their offspring.