Title: Alleviation of adverse effects associated with high-fat diet through dietary patterns changes and/or supplementation of various forms of chromium

Obesity is one of the most prevalent diseases of civilization in the 21st century. It can be influenced by genetic, biological, and behavioural factors. However, a high-fat diet seems to be of particular importance in the pathophysiology of obesity. Obesity, especially visceral obesity, is the main component of metabolic syndrome, which is a combination of related factors increasing the risk of type 2 diabetes and cardiovascular disease, including hypertension, stroke, coronary artery disease, heart failure, and cardiomyopathy. Chromium (III) (Cr) is a key microelement involved in the metabolism of carbohydrates, proteins, and fats in humans and animals. Due to these properties of chromium, particularly its ability to regulate carbohydrate-lipid metabolism and reduce body weight, it is popularly used as a factor supporting the treatment of type 2 diabetes and as a component of supplements used in slimming (anti-obesity) treatments. Currently, the most popular form of chromium used in dietary supplements is, an organic compound, chromium picolinate. The use of chromium picolinate has many benefits, including weight reduction and increased muscle mass. However, due to the relatively low bioavailability of chromium picolinate, other forms of this element are sought that could be better utilized by the body. For this reason, researchers are increasingly interested in complexes of Cr with amino acids as well as inorganic chromium nanoparticles. Recently, nanoparticles have emerged as important players in modern science, including nutritional status of the host in health and disease. It has been shown that one should be careful when using chromium supplementation to counteract obesity, because it may be associated with the risk of deterioration of the functioning of some internal organs. In the recent own experiment on laboratory rats, it was established that the use of chromium to supplement a high-fat diet intensifies the negative epigenetic (DNA changes that do not affect the DNA sequence but impact gene activity) and oxidative changes in the heart and brain, especially in the case of chromium nanoparticles. In the present project the experimental schema is more adapted to common dietary and physiological environment that an obese consumer face. The laboratory growing rats will be first subjected to high-fat diet in order to induce undesired changes in the body functions (initial period of the experiment); then the obese animals will be divided into several groups and subjected to dietary treatments imitating different dietary behaviours and decisions of obese consumers (stick – or not, to an "old" dietary high-fat patterns with or without chromium supplementation support). Two forms of supplemental Cr will be used, namely most popular chromium picolinate (Cr-Pic) and novel chromium nanoparticles (Cr-NP). There is no doubt that the start of the story is in the intestine where the absorption processes would decide what amount of nutrients and non-nutrients enter the body systems. Moreover, the intestinal environments themselves, both as the upper and lower gut, modulate metabolic body response through e.g. activation of intestinal immunological cells and stimulation or thwarting of the "forgotten organ" – large intestinal microbiota. One of the paramount dietary factors is amount of ingested fat, and its level would play a crucial role in the assimilation and then physiological activity of Cr-NP and Cr-Pic. In the project we postulate that negative intestinal, vascular and hepatic effects associated with chronic consumption of high-fat diet could be subsequently alleviated through dietary supplementation of various forms of chromium and/or switching to low-fat diet. We hypothesized that the switch away from high-fat dietary habits combined with chromium supplementation (picolinate or nanoparticles) would beneficially affect physiological responses in the gastrointestinal tract and thus positively modulate the health status of the body. Moreover, the effects observed in the treatments with Cr-Pic will be more pronounced upon Cr-NP due to higher absorbability and reactivity of nanoparticles. The main intention of the project's authors is to bring as much as possible new insight with regard to the question whether negative intestinal, vascular and hepatic effects associated with chronic consumption of high-fat diet could be subsequently alleviated through dietary supplementation of various forms of chromium and/or switching to low-fat diet. Taking into account an urgent need to establish true action of dietary nanoparticles in the gastrointestinal tract and the whole body, a paramount attention will be paid to chromium nanoparticles and their action will be compared to commonly used dietary supplement chromium picolinate.