

Obesity is the one of the most important problems of XXI century. In 2014 more than 600 million subjects worldwide were classified as obese and more than 1.9 billion adults were overweight. Obesity, wherein the BMI is above 35 and is accompanied with an additional diseases is classified as morbid obesity (MO). In Poland the frequency of morbid obesity is estimated to be about 1%, whereas 5% in United States. Excessive deposition of lipids in patients with morbid obesity contributes to the metabolic and cardiovascular disorders by inhibiting the action of insulin and leading to the lipid metabolism disorders in liver, kidney, pancreas, adipose tissue, skeletal and cardiac muscle. The MO comorbidities include: diabetes, metabolic syndrome, lipid disorders, gallstones, sleep apnea, nonalcoholic fatty liver disease, chronic kidney disease, cardiovascular diseases and some types of cancer- including prostate, breast, liver, kidney, colon, ovarian and endometrial cancer. According to epidemiological data the problem of obesity in last decade in the United States rose by 30%, and on the basis of estimating of the organization Trust for America's Health the participation of obese patients may exceed 50% by 2030 and by 2015 approximately 2.3 billion adults will be overweight and more than 700 million will be obese.

Bariatric surgery (BS) is one of the methods of MO treatment. In contrast to diet and pharmaceutical treatment, it is characterized by high efficiency. BS causes a reduction of food intake, decrease in the digestion and absorption, and induces changes in the secretion of gastrointestinal hormones. However, BS as each therapy can have a negative consequences including: apnea and cardiopulmonary arrest, atelectasis, pulmonary embolism, anastomotic bleeding, abnormal permeability and an hernia internal distension of the stomach, rhabdomyolysis, stenosis of anastomosis of the gastrointestinal tract, marginal ulcers, hernia, Wernicke's polyneuropathy, peripheral neuropathies, metabolic bone disease, micronutrient deficiency, gallstones and protein-calorie malnutrition.

The principal objective of this research project is to demonstrate how bariatric surgery (*omega loop gastric bypass*) affects the level of bioactive lipids, a lipophilic signal molecules, which have great medical/health significance and they occur in small amounts. This research will demonstrate the association between alterations in the blood bioactive lipids (branched-, odd chain fatty acids, and products of oxidation of polyunsaturated fatty acids such as oxylipins) and health status of MO patients after bariatric surgery. The results would also help to identify the deficiencies of important bioactive lipids in patients after BS.

Fatty acids with branched chain (BCFA) and odd chain (OCFA) circulate in human blood and have antibiotic, anticancer and immunosuppressive properties. As evidenced by our preliminary results, the amount of *iso*-BCFA is significantly reduced in obese patients. BCFA similarly as unsaturated fatty acids, elevate the lipid fluidity of membrane, while they are less susceptible to oxidation process than unsaturated fatty acids and many of these acids has anticancer properties. In turn, OCFAs could also display antioxidant properties by scavenging the hydroxyl radical, and high intake of OCFAs is associated with the lower level of cholesterol, the risk of cardiovascular disease and metabolic diseases. The consumption of diet rich in FA with 15 and 17 carbon atoms early in life is recommended in order to prevent or delay the development of cardiovascular diseases in later life. Despite the wide spectrum of the positive effects of BCFA and OCFA, there is a little knowledge about the composition and the role of long-chain BCFA and OCFA, and the available literature is mainly based on the characteristics of FA 15:0 and 17:0. Inflammation play an important role in progress of MO. Therefore, the level of polyunsaturated fatty acids (PUFA) varies in course of disease, and accordingly, their oxidized derivatives (oxylipins) also would be changed. Oxylipins have important anti-inflammatory (n-3 oxylipins) or pro-inflammatory (n-6 oxylipins) properties.

The wide fatty acids profile with the series of parameters determining the progression of the disease, and MO comorbidities will be determined. The study of association of fatty acids and oxylipins with markers of health status of MO patients before and after surgery will reveal the significance of alterations in these bioactive lipids in obesity. Additionally, the results of the analysis of whole profile of fatty acids and oxylipin would provide the answer to the question whether disorders in fatty acids profile are one of the reasons for MO progression, or if they are a result of this disease. Comparison of the lipid profiles in healthy subjects, MO with type 2 diabetes mellitus (T2DM), and MO without T2DM and research on *in vitro* model should help to answer this question. The analysis of expression of genes associated with lipid synthesis, fatty acids oxidation as well as branched chain amino acids (potential precursors of OCFA and BCFA) in adipose tissue collected during bariatric surgery and from liver and adipose tissue of experimentally obese mice will provide the evidence on the role of endogenous lipid metabolism in formation of blood lipid profiles. In summary, it is expected that the implementation of these studies will determine the relationship between the composition of fatty acids and oxylipin in patients' blood and the MO progression and MO comorbidities. The results would also indicate the necessity of supplementation of some important bioactive lipids in case of their deficiency in MO patients after bariatric surgery.