Over the last few decades, poultry farming has been the most rapidly developing sector of animal production, holding a key position in the global animal protein balance and in national economies. Poland is the largest producer and exporter of poultry meat and turkey meat in Europe and the third largest producer of turkey meat in the world. To maintain that status, Polish poultry breeders and producers have to rely on the results of innovative research which define the optimal nutritional standards for fast-growing birds that are more susceptible to adverse environmental factors, including pathogens.

Intensive turkey breeding is a reflection on the spectacular genetic progress that has been made in recent decades. The body weights of commercial hybrid turkeys are twice higher than those noted 40 years ago at the same slaughter age (15 – 16 weeks in females, 19 – 22 weeks in males). However, the selection for growth performance has compromised the disease resistance of birds and increased their susceptibility to stress. On typical poultry farms with high stocking density, turkeys are exposed to various pathogens that are transmitted by air, feed, water and litter. Production losses can be minimized by enhancing the systemic and local (intestinal mucosal) immunity of birds. The above strategy will also contribute to reducing the use of antibiotics on poultry farms, which is an important consideration for poultry meat consumers.

The results of experiments performed on chickens and, to a limited extent, on turkeys, indicate that knowledge about amino acids which play regulatory (functional) roles, among them amino acids limiting the biological value of dietary protein, including lysine, methionine and arginine, can be essential for improving the welfare and health status of birds. There is evidence to demonstrate that the concept of ideal protein, which is used to determine the nutrient requirements of birds and which reflects the amino acid composition of protein accumulated in the body, does not account for amino acids that are essential for healthy metabolism, including the synthesis of transient metabolites such as methionine-derived homocysteine, carnitine and glutathione and arginine-derived nitric oxide, polyamine and creatinine.

The objective of the proposed study is to verify the hypothesis postulating that the optimal dietary inclusion levels and ratios of lysine, arginine and methionine can increase the growth potential of hybrid turkeys raised for meat, and limit metabolic disorders that intensify oxidative processes and weaken immune functions. The results of the study will indicate whether the dietary ratios of lysine, arginine and methionine significantly influence metabolism (including the redox and immune status) and whether they can be modified in diets with lower and higher nutrient concentrations consistent with NRC recommendations (1994) and BUT recommendations (BUT, 2013), respectively. A comprehensive evaluation of the physiological responses of turkeys to experimental factors will be based on an analysis of the antioxidant status of birds and meat as well as immune function, including its enhancement by the synthesis of transient metabolites of amino acids and by increased expression of genes that regulate metabolic processes.

The results of the study are important in view of the economics of poultry production and consumer expectations regarding bird welfare, reduced use of antibiotics on poultry farms, and high quality of poultry products. Intensively farmed turkeys are fed diets with high protein content, up to 27 – 28% in the first stage of rearing. The research project will also contribute to increasing the utilization of protein with optimal concentrations of lysine, arginine and methionine in order to maintain the economic efficiency of turkey meat production and reduce ammonia emissions from farms. The results will be used to optimize the dietary inclusion levels of amino acids in the Polish edition of the Nutrient Requirements of Turkeys (authored by the project manager) and to formulate practical turkey diets.