

The dissertation is concerned to in vivo phosphorus MR spectroscopy (^{31}P MRS) and ^1H MR imaging (MRI) of muscle in combination with physical workload. The theoretical part of the thesis describes methodology of ^{31}P MRS measurement and its clinical use in research of metabolic changes in diabetes, heart failure and peripheral artery disease (PAD). The results of the thesis are divided into methodical and clinical parts. Methodical results deal with the construction of experimental equipment, software modification and development, and show of the reproducibility of the dynamic ^{31}P MRS. The MRI after exercise was used to describe involvement of the individual calf muscles to muscle contraction during pedal movement in MR compatible ergometer. The first part of the clinical results of the thesis describes changes in muscle metabolism during diabetes and critical ischemia. In patients with critical ischemia the effect of treatment by angioplasty or transplantation of mesenchymal stem cells was evaluated. In the second part of the clinical results the metabolism of patients with heart failure complicated by sideropenia was studied. In these patients the effect of experimental treatment by iron carboxymaltose was described.