Insulin resistance (IR) is considered to be an important factor influencing the progression of atherosclerosis and is associated with higher morbidity and mortality. IR is a common feature of diabetes mellitus Type 2 and obesity. Many authors consider IR being the crucial abnormality of the metabolic syndrome which is characterized by the essential hypertension, hyperliproteinemia, visceral obesity, endothel dysfunction and many other abnormalities. Impaired insulin action (IR) is also described in diabetes mellitus Type 1, however this phenomenon has not been fully explained. The subjects of dissertation thesis was directed on the IR importance in diabetic Type 1 patients as well as on the renin angiotensin system inhibition in patients with IR and metabolic syndrome with impaired glucose homeostasis. Hyperinsulinemic euglycemic clamp is used in combination with indirect calorimetry to estimate the IR in vivo in humans. In our project we focused on a) the existence of the metabolic inflexibility phenomenon in type 1 diabetic patients b) the methodological evaluation of the hyperinsulinemic euglycemic clamp procedure in the same group c) the influence of renin angiotensin system inhibition with angiotensin II type 1 receptor inhibitor telmisartan in patients with metabolic syndrome and impaired glucose homeostasis. The dissertation thesis results indicate an altered substrate utilization in type 1 diabetic patients – metabolic inflexibility (study 1). To the best of our knowledge, this is the first report showing this phenomenon in diabetic Type 1 subjects. Until now the importance of the metabolic inflexibility is still unknown as well as its therapeutical consequences. The methodological aspects of the substrate utilization measurement using hyperinsulinemic euglycemic clamp with indirect calorimetry was evaluated in the study 2. This study has proved that urine collection performed during the clamp with urea excretion adjusted for changes in urea pool size is the most suitable technique for measuring substrate utilization both in diabetic Type 1 patients and healthy subjects. Urine collection during the clamp cannot be replaced either by the 24-hours sampling or by the single 24-hours urine collection. Attenuated insulin-stimulated decrease in urea excretion corrected for the changes in urea pool size implicates the impaired insulin effect on proteolysis. The last part of the dissertation thesis in the study 3 dealing with the „ metabolic treatment“ using renin angiotensin system inhibition. We found as the first the positive effect of telmisartan on selected adipokines in patients with metabolic syndrome and impaired fasting glucose. Telmisartan administration within 3-weeks did not influence insulin resistance and substrate utilization, however statistically significant plasma glucose decrease was found as well as the changes in selected adipokine levels. We can conclude that in patients with metabolic syndrome with impaired fasting glucose the short-term treatment with telmisartan surprisingly increases plasma adiponectin, leptin and resistin concentrations and decreases plasma TNFα levels. These results also implicate that the effect of telmisartan could be important during hyperinsulinaemia and this is the first study presenting the positive effect of telmisartan on plasma adipokines during hyperinsulinaemia in patients with impaired fasting glucose. The changes in plasma concentrations of adipokines cannot be explained by their expressions in subcutaneous adipose tissue. The results support the hypothesis that the changes in selected plasma adipokines might be involved in the beneficial metabolic effects of telmisartan in patients with metabolic syndrome.