Bioavailability testing of drug products in humans provides the most appropriate method available for determining bioequivalence. Two drug products are considered bioequivalent if they are pharmaceutically equivalent and their bioavailabilities after administration in the same molar dose are similar to such a degree that their effects, can be expected to be essentially the same. The design, performance, and evaluation of Bioavailability and bioequivalence studies have received major attention from academia, the pharmaceutical industry and health authorities over the last couple of decades. Hence the focus of the research is to evaluate bioavailability and bioequivalence study of selected drugs. The research work is composed to conduct bioequivalence of Febuxostat, Acamprosate and Mesalamine formulations in human plasma and pharmacokinetic study of Milnacipran formulation in rat plasma. This research has contributions in 3 important scientific fields. From an bioanalytical point of view, the extensive study of this novel instrumentation has resulted in innovative methodology for selected drugs in human plasma and rat plasma. From a clinical and bioequivalence point of view, application of the new LC-MS/MS procedures widened our knowledge about concentration-time profiles in human plasma. From a pharmacokinetic point of view application of the concentration-time profiles by non-compartmental statistics model using WinNon-Lin 5.0 software for selected drugs broadened our knowledge in in vivo studies calculations. Hence, it is evident and will unquestionably expand future research capabilities.