Simulation of enzymatic activity in the digestive tract using olive oil microemulsions

Aristotelis Xenakis, Vassiliki Papadimitriou, Aggeliki Kyriazi, Stavros Koliofoutis, Theodore G. Sotiroudis

Institute of Biological Research & Biotechnology, National Hellenic Research Foundation, 48, Vassileos Constantinou Ave., 11635, Athens, Greece
*e-mail: arisx@eie.gr

Biocompatible w/o microemulsions composed of olive oil/lecithin/1-propanol/water were used as a biomimetic model to simulate aspects of the digestion process in the gastrointestinal tract. Trypsin is a serine protease excreted by the pancreas taking part in the digestion of food proteins to their component peptides and amino acids. In fact, trypsin among other digestive proteinases, continues in the slightly alkaline environment of the small intestine the process of digestion begun in the stomach.

In the present study trypsin was incorporated in the aqueous core of olive oil based microemulsions and its activity towards hydrolysis of a synthetic substrate, namely lysine p-nitroanilide, was examined [1]. The hydrolytic reaction was followed at pH and temperature conditions corresponding to human gastric pipe conditions (pH 8.5 and 36.6°C). Kinetic constants were calculated and found \( K_m = 0.077 \text{ mM} \) and \( V_{max} = 0.0117 \text{ absorbance units/min} \). Then, several antioxidants that naturally occur in virgin olive oil were added in the reaction system and their effect on the proteolytic reaction was investigated. Except from gallic acid that caused a concentration depended decrease of enzymatic activity, all other olive oil polyphenols tested seem to have the opposite effect. More specifically, when cafeic acid, protocatechuic acid, p-coumaric and o-coumaric acids were added, enzymatic activity was enhanced. The effect of squalene and oleuropein on trypsin activity was also examined.

The development of an \textit{in vitro} protein digestion model suggested in the present study may improve our understanding of food nutritional benefits and could potentially lead to the production of food with better functionalities.