

Lipolysis inhibition by proteose-peptone : an interfacial study.

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Lipases are enzymes that specifically act on aggregated lipids in an aqueous environment and more accurately at interfaces. In order to explain the pathway of lipolysis, several investigators have proposed a reversible adsorption or penetration of the enzyme into the interface. This first step is supposed to precede the formation of the enzyme-substrate complex (1). Studies using monolayers have shown that activity of lipolytic enzymes will be greatly influenced by "the interfacial quality" (1) (2). For reasons of simplification, most studies of model interfaces have involved only one or two type of lipid and/or protein. Generally all biological interfacial regions are however composed of a complex mixture of lipids and proteins. An example of action of lipases which causes real problems is lipolysis in milk (3). In milk and dairy cream, the interfacial region between milk fat and the aqueous phase where lipases may be present is the milk fat globule membrane (MFGM). This MFGM is a complex combination of proteins and phospholipids (4).

The main purpose of this work was to describe the interactions between a MFGM monolayer and three kind of lipases in order to investigate the mechanism of lipolysis in milk.

The monolayer technique used in this work has the advantage that the arrangement of the molecules can be controlled by changing the molecular area and the surface pressure of the monolayer. So this monolayer technique was used to provide a model system where the quality of the interface could be controlled (5) (1).

The effect of lipase injection beneath a MFGM monolayer compressed at 20mN/m in the presence of PPt is shown at fig 1. The first stage of this curve corresponds to 10 minutes of equilibration of the film (see other poster : Mechanism of lipolysis in milk : a modelistic approach using a Langmuir film balance. S.Danthine, C.Blecker, M.Paquot, C.Deroanne), the area 2 shows the effect of PPt injection beneath the monolayer and the area 3 represents the effect of the lipase on the PPt/MFGM film. We observed no increase of the monolayer area upon lipase injection, indicating that lipase could not interact with the complex PPt/MFGM membrane.

Those results show that lipolysis inhibition by proteose-peptone is an interfacial phenomena.

Proteose-peptone strengthen the MFGM monolayer. This strengthening effect can be seen on one hand by the surface pressure increase and on the other hand by the very high stability of this surface pressure during time.

Those effects are certainly responsible for the PPL inhibition by PPt.

So this complex fraction of milk proteins is able to reach a compressed MFGM monolayer and increase the surface pressure of this monolayer in a way that lipase could no more interact with this film. Furthermore presence of PPt obstructs lipase insertion in a MFGM monolayer even if the surface pressure of the latest is lower than the critical surface pressure of the considered lipase.

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