Langmuir monolayers as cell membrane model to study parathormone/phospholipds interaction

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INTRODUCTION: The literature reports the parathormone (PTH) as an anabolic medication able to improve bone quality by increasing the bone density and strength due to the stimulation of its receptors on cellular membrane. The development of biomaterials which stimulates locally the bone regeneration by fixation of PTH on titanium (Ti) implants is a challenge.

OBJECTIVE: Cell membrane models like Langmuir monolayer are ideal environments to incorporate this hormone for investigations regarding its delivery on osteoblasts cultures as well assists mineralization ability.

METHODS: The preparation of lipid/PTH Langmuir films composed by dipalmitoyl-phosphatidylcholine (DPPC), and dihexadecyl-phosphate (DHP) were investigated using a Langmuir trough. The characterization of the interaction between the PTH and the lipids were evaluated by zeta-potential measures, the Langmuir isotherms of lipids before and after PTH incorporation, and the amount of PTH transferred to Langmuir-Blodgett films by quartz crystal microbalance (QCM).

RESULTS AND CONCLUSION: A negative zeta-potential at the pH 7.4 was found (-4.9 mV) to PTH. The Langmuir isotherm of DPPC showed a decrease of the minimum area occupied per lipid molecule after the PTH injection into the water subphase (50 μL of 0.5 mg/mL solution) by 10.97 $Å^2$ (68.1 $\pm$ 1.2 to 57.1 $\pm$ 0.9 $Å^2$), which could be due to the insertion of PTH in this film. The DHP minimum area changed by 2.3 $Å^2$ (52.8 $\pm$ 1.1 to 50.5 $\pm$ 1.3 $Å^2$), which is not statistical significant. The QCM analysis showed deposit of 50.47 ng of PTH on DPPC film, and 23.41 ng of PTH on DHP film for each 25 μg of PTH injected into the Langmuir trough. These results evidence the strong interaction between PTH and the phosphatidylcholine group of DPPC allowing the study of these hormone in biomimetic cell membrane models.

KEY WORDS: Langmuir monolayers, Parathormone, DHP, DPPC

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