Magnetic hyperthermia effect in simple and complex biological systems: preliminary results

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Introduction
The ferromagnetic particles for thermal therapy are an alternative in laboratory studies where growing cell experimental research is made and they can be implemented relatively easy in studies of in vivo transformed cells as therapy in cancer diseases [1].

Objective
Preliminary experiments performed on two biological systems, where magnetite (Fe\textsubscript{3}O\textsubscript{4}) as ferromagnetic particles was diluted in various solvents are presented. These experiments were carried out with a magnetic device performed in our laboratory which produces magnetic stimulation at high frequencies (200 kHz) at intensities of micro Teslas.

Procedure
Two experiments were performed; first a group of six samples of proteins, three with magnetite and three as control were diluted. They were heated at 45 °C for 2, 4, and 6 minutes. The heating was produced with magnetic hyperthermia and water bath. The other groups similarly prepared, remained at 45 °C for 18 and 23 minutes in both heating modalities, respectively.

Results
In these experiments was shown that proteins with magnetite exposed during 2, 4 and 6 min were heated up to 45 °C, which was generated by magnetic hyperthermia. There was obtained a similar pattern of peptides with 58.30 and 26 kDa for samples of proteins without magnetite, which were heated in a water bath at 45 ºC in similar conditions. Nevertheless, gradual changes are shown in hyperthermia heated vs. water bath.

Discussion
The first results suggest a larger exposure time for a gradual degradation of proteins, so that when applying the heat pulse to cells, they lead to an induction of drastic apoptosis and necrosis. On the other hand, in experiment two, evidence of an alteration in the peptides exposed to magnetic hyperthermia was obtained by the degradation products due to the treatment. The degradation is gradual in contrast to controls. These preliminary results give us positive information about the effects that the magnetic hyperthermia produces in these biological solvents, by raising the temperature from 24 °C to 45 °C for a small period of time.

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Reference