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Immunosuppressive activity of a molecule isolated from *Artemisia annua* on DTH responses compared with cyclosporin A

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Abstract

Artemisia belongs to the family of *Compositea*; there are different Artemisias in Iran, of which *Artemisia annua* L. is grown in the north of Iran. In this study, Artemisinin was extracted and purified from the whole plants. The purification of Artemisinin was performed using column chromatography in different polarities of solvents and the results were evaluated by Thin Layer Chromatography (TLC). ^{1}H-NMR (NMR-500) spectroscopy was used to characterize the purified Artemisinin. The immunosuppressive activity of Artemisinin was investigated on Balb/c mice by DTH response in comparison to cyclosporin A (CsA). The data indicated that Artemisinin could suppress the delayed type hypersensitivity (DTH) against sheep blood capsule in Balb/c mice. Also its inhibitory effect on calmodulin (CaM) structure was determined by fluorescence spectroscopy. The data indicated an inhibitory effect of that on the activity of calmodulin by increasing the fluorescence emission of calmodulin. Both in vivo (DTH response) and in vitro (spectrofluorometry) studies indicated the activity of Artemisinin as an immunosuppressive agent and that the fluorescence emission of calmodulin is more than cyclosporin A.

Keywords: *Artemisia annua*; Artemisinin; Calmodulin; Immunosuppressive; Cyclosporin A

1. Introduction

Artemisinin, the key ingredient obtained from *Artemisia annua*, has a long history as an antimalarial remedy [1–3]. Artemisinin is a powerful oxidant [1]. The peroxide bridge in artemisinin (Fig. 1) and its derivatives are essential for the antimalarial activity. Artemisinin has been observed to react with hemin, and in the presence of red cell membranes, this leads to the oxidation of protein thiols. As malarial parasites are rich in hemin, this may explain artemisinin's selective toxicity for the parasites. The mechanism of action of artemisinin appears to involve two steps. In the first step (activation): intra-parasitic iron catalyses the cleavage of the endoperoxide bridge and the

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