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ORIGINAL ARTICLE

Immunotherapeutic effects of *Glycyrrhiza glabra* and Glycyrrhizic Acid on *Leishmania major*-infection BALB/C mice

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Abstract

Treatment of cutaneous leishmaniasis (CL) is a public health problem in endemic areas. The objective of the current study was to investigate the immunotherapeutic activities of the hydroalcoholic extract of *Glycyrrhiza glabra* (HEG) and glycyrrhizic acid (GA) in the treatment of Leishmania major (*L. major*)-infected BALB/c mice. In this study, the effect of HEG and GA was checked *in vitro* on growth of *L. major* promastigote and amastigote using MTT assay and microscopic counting, respectively. For *in vivo* experiment, the lesion induced by *L. major* on BALB/c mice were treated intraperitoneally with HEG, GA, meglumine antimoniate or phosphate buffer saline (negative control) for one month. Then, the lesion development and the parasite burden of the lymph node was assessed, the cytokine response (IFN-γ and IL-4) to *Leishmania* antigens was evaluated using ELISA method. The results showed that HEG and GA significantly inhibited the growth of *L. major* promastigotes and amastigotes, the lesion development, parasite burden in the lymph nodes, level of IFN-γ and the ratio of IFN-γ/IL-4 in HEG, GA and meglumine antimoniate-treated mice were significantly higher compared with the negative control group, there was no difference between the HEG, GA and meglumine antimoniate group. It is concluded that hydroalcoholic extract of *G. glabra* and glycyrrhizic acid showed therapeutic and immunomodulatory effects on *L. major*-infected BALB/c mice

KEYWORDS
Glycyrrhiza glabra, glycyrrhizic acid, immunomodulation, *Leishmania major*

1 | INTRODUCTION

Cutaneous Leishmaniasis (CL) is a protozoan skin disease caused by different species of *Leishmania* in the old world. CL is the most common form of leishmaniasis. Treatment of CL is difficult in different parts of the world; Iran is among 9 countries with the most reported.[1] Clinical form of CL depends upon the causative species *Leishmania*, and the host immune response.[2-4] Experimentally, it has been shown that induction of Th1 type of response plays a critical role in leishmaniasis control. IFN-γ which is secreted mainly by Th1 cells up-regulates macrophages nitric oxide (NO) generation, and NO inhibits parasite replication, while induction of Th2 response is associated with secretion of interleukin IL-4, IL-10 and IL-13 which is associated with suppression of IFN-γ-mediated macrophage activation.[5-8]

Pentavalent antimonial derivatives (meglumine antimoniate or meglumine antimoniate, and sodium stibogluconate or Pentostam) remain the first-line treatment for CL. It has been demonstrated that meglumine antimoniate is responsible for oxidative stress-derived DNA damage in Leishmania infection with reduced side effects and more availability.[9,10] However, many other modalities are used as the second-line treatment. In general, on the one hand, treatment of CL

