Jundishapur J Microbiol. 2015 March; 8(3): e19640. DOI: 10.5812/jjm.19640

Published online 2015 March 21. **Letter**

In Vitro Activity of *Cordia myxa* Mucilage Extract Against *Leishmania major* and *L. infantum* Promastigotes

Jasem Saki [1]; Shahram Khademvatan [2]; Nader Pazyar [3]; Alborz Eskandari [4]; Ali Tamoradi [5]; Pedram Nazari [6,*]

[1]Health Research Institute, Infectious and Tropical Diseases Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran
[2]Cellular and Molecular Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran
[3]Department of Dermatology, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran
[4]Department of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran
[5]School of Laboratory Sciences, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran
[6]Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran

*Corresponding author: Pedram Nazari, Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran. Tel: +98-9382464798, Fax: +98-6133332036, E-mail: dr.pedramnazari@gmail.com

Received: April 25, 2014; **Revised:** September 14, 2014; **Accepted:** September 27, 2014

Keywords: Plant Mucilage; *Cordia*; *Leishmania*; Inhibitory Concentration

Dear Editor,

Leishmaniasis is an important protozoan disease, which still is a major health problem in endemic countries, such as Iran (1). Despite, recent advances, there is a long way until arriving to the ideal anti-leishmanial agents, with less toxicity, side effects and more potent efficacy. The World Health Organization (WHO) has suggested usage of herbal plants to reach this aim (2). In the Iranian folk medicine, *Cordia myxa* is an herbal plant, which belongs to the *Boraginaceae* family and grows in tropical regions, such as Iran (3). Its fruits contain phenolic compounds, which can be a potential therapeutic option for leishmaniasis, similarly to several herbal plants, such as green tea extract (4). The objective of this study was to evaluate the *in vitro* effects of *C. myxa* mucilage on *Leishmania Major* and *L. infantum* promastigotes. The fruits of *C. myxa* were collected from a traditional harvesting region for this plant, Ahvaz, Southwest Iran. A total of 50g of *C. myxa* fruits were boiled slowly, in one liter of hot water, for 30 minutes. The residue was filtrated through Whatman paper No. 33. The mucilage filtrate was freeze-dried. The mucilage extract of *C. myxa* was initially dissolved in dimethyl sulphoxide (DMSO) (Sigma-Aldrich Corp., St. Louis, MO, USA) and further diluted with the RPMI 1640 medium (GIBCO, Grand Island, NewYork, USA) after a sterilizing the filtrate.

To examine the anti-leishmanial activity of the extract, logarithmic phase promastigotes of *L. infantum* (MCAN/IR/96/LON49) and *L. major* (MRHO/IR/75/ER) (1×10^6 cells/ mL) were seeded in a 96-well microtiter plate, in the presence of the serial concentrations (0, 0.61, 1.22, 2.44, 4.88, 9.75, 19.5, 39, 78, and 156 mg/ mL w/v) and then incubated at 24°C, for 72 hours. Anti-leishmanial activity was assayed by light microscopy and (3-(4,5-dimethylthiazol-2-yl)-2,5 diphenyl tetrazolium bromide) MTT method. Each assay was performed in triplicate, with three independent experiments. The concentration inhibiting parasite growth by 50% (IC50 value) was calculated with a sigmoid dose-response curve. Mucilage extract of *C. myxa* was active against promastigotes form of *L. major* and *L. infantum,* with an IC50 of 26 ± 2.2 mg/mL and an IC50 of 35 ± 2.2 mg/mL, respectively. The survival percentage of *L. major* and *L. infantum* promastigotes after 72 hours treatment, with different concentrations of *C. myxa* mucilage extract, is shown in Table 1.

Table 1. Percentage of Survival *Leishmania major* and *L. infantum* promastigotes After 72 Hours Treatment With Different Concentrations of *Cordia myxa* Mucilage Extract

Concentration, mg/mL	**0.6**	**1.2**	**2.4**	**4.8**	**9.6**	**19.5**	**39**	**78**	**156**
***Leishmania major*, survival**	92.1	88.9	85.1	76.8	61.34	49.86	36.82	21.09	17.68
***L. infantum*, survival**	88.98	85.44	83.77	76.31	69.44	60.45	32.14	29.76	16.68

This study demonstrated that *C. myxa* extract had anti-leishmanial effects against *L. infantum* and *L. major* promastigotes, under *in vitro* conditions. Phytochemical studies have demonstrated *C. myxa,* as a good source of trace elements (such as selenium, copper, zinc, iron and manganese), phenolic, and flavonoid compounds (robinin, datiscoside, rutin, hesperidin, dihydrorobinetin, caffeic acid and chlorogenic acid) (5). Probably, *C. myxa* has potential anti-leishmanial activity because of phenolic and flavonoid compounds (rutin and caffeic acid) and several trace element content (selenium). Flavonoides bind to the nucleotide binding domains (NBD) of the ATP binding cassette (ABC) transporters, and their role is well established in most medications resistance phenomena, such as anticancer and anti-leishmaniasis drugs. Finally, these cellular events induced an increase of hydrophobic interactions, which leads to inhibition of multiple drug resistance (6). Several studies have focused on the anti-leishmanial activity of selenium compounds. These findings mention the selenium compounds, as novel anti-leishmanial agents for amastigotes and promastigotes, with more potent activity and lower cytotoxicty than miltefosine and edelfosine (IC50 promastigotes = 0.9 - 17 μM and 0.3 - 9 μM for amastigotes) (7, 8). Other benefits of *C. myxa* can be attributed to less cytotoxicity and cost, compared to current anti-leishmanial drugs, whose main limitation for their administration, particularly in developing countries (9).

Acknowledgements

The authors thank Iqbaleh Zaker Hosseini and Dr. Amir Siahpoosh (pharmacognosist) for their help in plant identification, study design and reviewing this manuscript.

Authors' Contributions

Jasem Saki and Pedram Nazari conceived and designed the study and they will act as guarantor of the study. Shahram Khademvatan, Jasem Saki, Alborz Eskandari and Ali Tamoradi performed laboratory works. Pedram Nazari and Jasem Saki drafted the paper, and revised the manuscript for important intellectual content. Nader Pazyar, Pedram Nazari and Jasem Saki helped in manuscript writing.

Funding/Support

This work was financially supported by grant number 90S13 from Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

References

1. World Health Organization . *Control of the Leishmaniases. Report of a Meeting of the WHO Expert Committee on the Control of the Leishmaniases.* Geneva: WHO; 2010. Available from: http://whqlibdoc.who.int/trs/WHO_TRS_949_eng.pdf.
2. Akendengue B, Ngou-Milama E, Laurens A, Hocquemiller R. Recent advances in the fight against leishmaniasis with natural products. *Parasite.* 1999;**6**(1):3–8.
3. Hussain N, Kakoti B. Review on ethnobotany and phytopharmacology of cordia dichotoma. *J Drug Deliv Ther.* 2013;**3**(1).
4. Feily A, Yaghoobi R, Namazi MR. The potential utility of green tea extract as a novel treatment for cutaneous leishmaniasis. *J Altern Complement Med.* 2009;**15**(8):815–6.
5. Aberoumand A. Natural compounds with Antioxidant properties in selected plant foods. *Int J Agric Food Sci.* 2011;**1**(2):27–9.
6. Perez-Victoria JM, Chiquero MJ, Conseil G, Dayan G, Di Pietro A, Barron D, et al. Correlation between the affinity of flavonoids binding to the cytosolic site of Leishmania tropica multidrug transporter and their efficiency to revert parasite resistance to daunomycin. *Biochemistry.* 1999;**38**(6):1736–43.
7. Moreno D, Plano D, Baquedano Y, Jimenez-Ruiz A, Palop JA, Sanmartin C. Antileishmanial activity of imidothiocarbamates and imidoselenocarbamates. *Parasitol Res.* 2011;**108**(1):233–9.
8. Plano D, Baquedano Y, Moreno-Mateos D, Font M, Jimenez-Ruiz A, Palop JA, et al. Selenocyanates and diselenides: a new class of potent antileishmanial agents. *Eur J Med Chem.* 2011;**46**(8):3315–23.
9. Al-Awadi FM, Srikumar TS, Anim JT, Khan I. Antiinflammatory effects of Cordia myxa fruit on experimentally induced colitis in rats. *Nutrition.* 2001;**17**(5):391–6.