

Algae *Cladophora vagabunda* decoction and cryoextract' on healthy individuals blood leucocytes functional activity influence in vitro

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Abstract: In recent years, researchers have been paying increasing attention to the properties of freshwater and marine algae. Marine biomass is considered an important resource for the pharmaceutical industry, cosmetology, as a raw material for the extraction of biologically active substances (vitamins, sterols and collagen), biofertilizers and preparations for wastewater treatment. [1,2,3,4]

The Caspian Sea is rich in algae. Among them, blue-green, diatom, red, brown, charophytes and others predominate. This group includes *Cladophora sericea*(CS), *Cladophora vagabunda* (CV) (L.) [5] *C. vagabunda* (KB) is widespread in open and surf-protected shores along the entire coast of the Eastern Caspian. It grows attached to rocky slabs [6].

The composition of *Cladophora vagabunda*, *Cladophora glomerata* and *Vaucheria sp.* contains phenolic compounds, chlorophyll and b-carotinoids, proteins and carbohydrates, the amount of which depends on the taxon of algae and the type of extracts [7].

The antimicrobial (against *Staphylococcus aureus*), cytotoxic (against choriocarcinoma cells (JAR) and normal fetal lung fibroblast cells - MCF-7) activity of acetone and ethanol extracts of *C. glomerata* and *Vaucheria* in vitro has been studied comparatively recently. The chemical composition, antibacterial and cytotoxic effects of extracts from *Cladophora* representatives allow us to assume their immunomodulatory activity. However, in the available literature we did not find information on the effect of extracts from algae and, in particular, CV on the functional activity of mammalian immunocompetent cells [8,9,10].

The aim of the present study was to investigate the Caspian seaweed *Cladophora vagabunda* decoction and cryoextract' influence on spontaneous (SM) and bronchoalveolar antigen (BAAG) induced blood leukocytes migration activity (LMA) in vitro.

Materials and Methods

The migration activity of peripheral blood leukocytes was studied in 87 practically healthy individuals (PHI) aged 18 to 25 years. The study design is presented in Fig. 1.

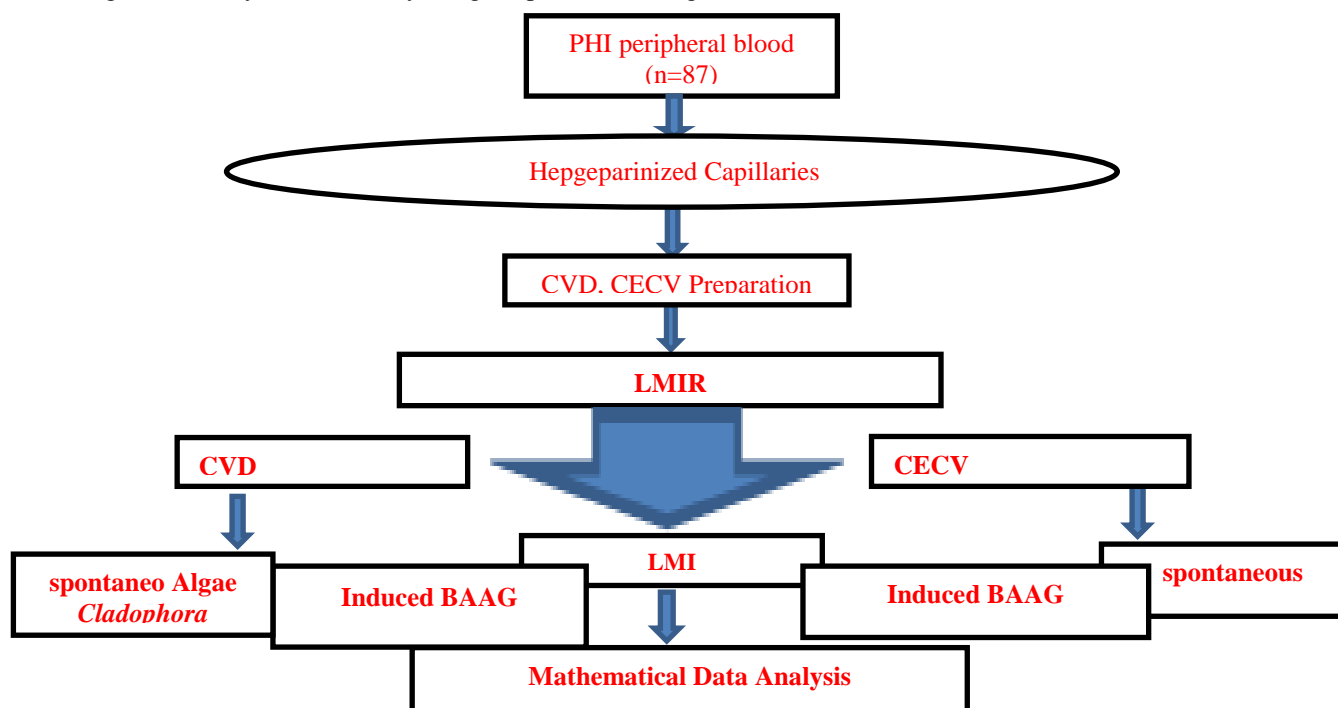


Fig.1.The study design

Blood for the study was collected from the ring finger of the left hand in compliance with aseptic rules. MAL was studied in the leukocyte migration inhibition reaction (LMIR) as modified by [11]. The results were expressed as the leukocyte migration index (LMI). BAAG was chosen due to the antistaphylococcal activity of the extract from *Cladophora glomerata* [6]. The antigen was prepared by water-salt extraction method [12]. *Cladophoravagabunda* decoction (CVD) was prepared according to Pharmacopoeia requirements at a ratio of 1:20 (). In addition, *Cladophora vagabunda* cryoextract (CECV) was prepared by freeze-thawing 50 mg of CV homogenate 5 times followed by centrifugation for 30 min at 4000 rpm. The supernatant was collected and used in the LMIR. The results were mathematically processed using the SPSS program (USA).

Results of the Study

It was found that CVD and CECV *in vitro* affect the migration of leukocytes from a glass capillary. The table shows the migration index (MI) values (table).

Table
 The LMI value of practically healthy individuals depending on the reaction inducer

LMI (%)				
CVD	CECV	CVD + BAAG	CECV + BAAG	BAAG
117,6± 8,2*	111,7±9,7*	105,7±7,7*	68,2±6,2*	87,3±5,7

Note: * - $p < 0.05$ in relation to BAAG

As can be seen from the table, CVD and CECV stimulate spontaneous migration of leukocytes from the glass capillary to almost the same extent (LMI >100). It was found that the practically healthy individuals' leukocytes sensitivity to CVD and CECV in *in vitro* is individual (Fig.2).

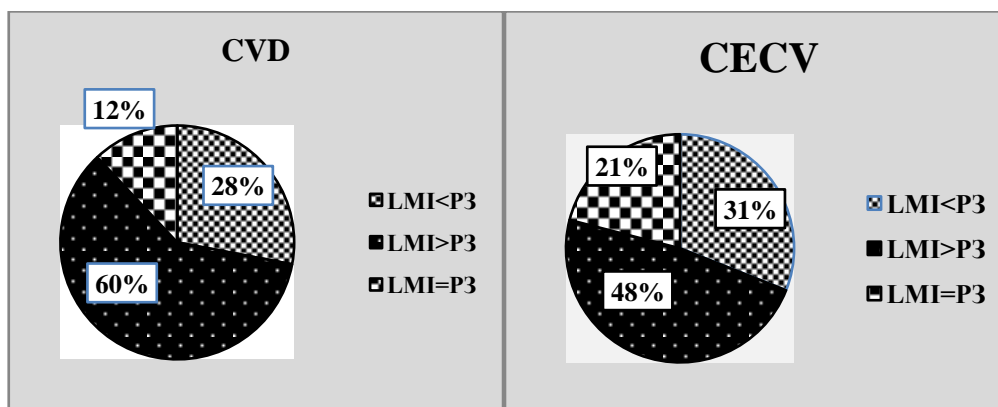


Fig.2 Frequency of occurrence of LMI value depending on the type of LMIR inducer and sensitivity of PHI blood leukocytes

The diagram shows that in the vast majority of cases CVD and CECV stimulate leukocyte migration *in vitro* (LMI value above the reference values), but CVD in a higher percentage of cases compared to CECV (60 and 48%, respectively). In almost equal percentage of cases (28 and 31 % respectively) CVD and CECV inhibit leukocyte migration - LMI below RH and even more rarely - do not change it. But CECV is almost 2 times more frequent in comparison with CVD (21 and 11 %, respectively).

When BAAG is introduced into the leukocyte culture medium of PHI, inhibition of leukocyte migration is observed – LMI = 87.3±5.7 (table). However, when BAAG, CVD and CECV are introduced into the culture medium together, significant modulations of leukocyte migration from the glass capillary are observed (Fig. 3).

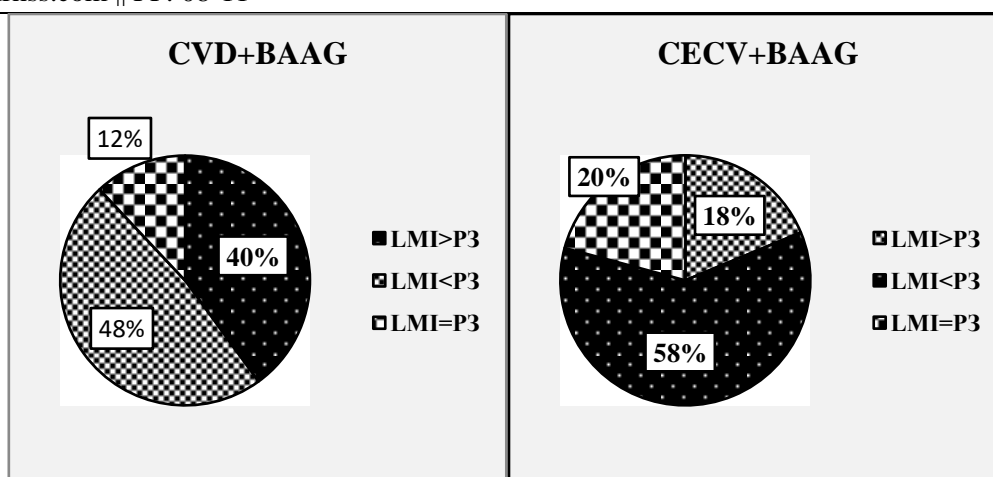


Fig.3.Frequency of LMI value in the presence of BAAG, CVD and CECV and sensitivity of PHI blood leukocytes

The studies have shown that CVD and CECV affect the response of PHI leukocytes to BAAG *in vitro* to different degrees. CVD stimulates the response to BAAG in 48% of PHI, inhibits it in 40% and practically does not change it in 12% of PHI.

When inducing leukocyte migration to BAAG, CECV inhibits the response in 58% ($p < 0.01$), stimulates it in 18% ($p < 0.05$) and does not change it in 20% of PHI. This means that, CECV has a greater ability to cancel the leukocyte response to BAAG in PHI.

Thus, the decoction and cryoextract of the Caspian alga *Cladophora vagabunda in vitro* exhibit both anti-inflammatory (inhibition of leukocyte migration) and pro-inflammatory (stimulation of leukocyte migration) effects. In addition, they are capable in some cases of canceling the “response” of blood leukocytes to BAAG, which indicates the prospect of their use in the treatment of inflammatory diseases of the human bronchopulmonary system.

References:

- [1]. Maria Tofana Chis Maria Simona Wastewater Treatment Using Marine Algae Biomass as Pollutants Removal Article // in Revista de Chimie • May 2018 DOI: 10.37358/RC.18.5.6267
- [2]. Auer M.T, Tomlinson L.M, Higgins S.N, et al (2010). Great Lakes Cladophora in the 21st century: Same algae-different ecosystem. J Great Lakes Res, 36, 248–55
- [3]. Biris-Dorhoi S.E., Tofana M., Chis M. S., Carmen E. L. Wastewater Treatment Using Marine Algae Biomass as Pollutants Removal May 2018 Revista de Chimie 69(5):1089-1098 DOI:10.37358/RC.18.5.6267
- [4]. Воровка В. П., Солоненко А. М. Звідкицяпошеть? Водорості на пляжах Азовського моря Архивная копия от 19 июля 2020 на WaybackMachine // Мелитопольский краеведческий журнал, 2013, № 1, с. 68-72.
- [5]. Zulkifly S. B., Graham J. M., Young E. B., Mayer R. J., Piotrowski M. J., Smith I., Graham L. E. The genus *Cladophora* Kützing (Ulvophyceae) as a globally distributed ecological engineer // Journal of Phycology. — 2013. — Vol. 49, № 1. — P. 1—17. — doi:10.1111/jpy.12025.
- [6]. Stefanović OD, RakonjacAB, Nikodijević DD, Milojević SD, Dinić A, Simić SB. Freshwater algae *Cladophora glomerata* and *Vaucheria* sp. from Serbia as sources of bioactive compounds: chemical analysis and biological activities. Arch Biol Sci. 2024;https://doi.org/10.2298/ABS240215012S
- [7]. *Cladophora vagabunda* file:///C:/Users/%D0%90%D0%B4%D0%BC%D0%B8%D0%BD%D0%B8%D1%81%D1%82%D1%80%D0%B0%D1%82%D0%BE%D1%80/Desktop/(Cladophora%20vagabunda)%20-%20Botanical%20Realm.html
- [8]. Atef M. Abo-Shady Prof., Saly F. Gheda, Gehan I., Cotas J. Antioxidant and Antidiabetic Activity of Algae //February 2023 Life 13(2):460 DOI:10.3390/life13020460 LicenseCC BY 4.0
- [9]. Raghad J. Fayyad*, Alaa Naseer Mohammed Ali, Noor Al-Huda Ali A. H. Saeed, Israa Hussein Hamzah, Ahmed S. Dwais Phycosynthesis of Silver Nanoparticles Using *Cladophora Glomerata* and Evaluation of Their Ability to Inhibit the Proliferation of MCF-7 and L20B Cell Lines(2019). October 2022 Asian Pacific Journal of Cancer Prevention 23(10):3563-3569

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- [10]. Khalafi T., Buazar F.& Ghanemi K. Phycosynthesis and Enhanced Photocatalytic Activity of Zinc Oxide Nanoparticles Toward Organosulfur Pollutants Scientific Reports volume 9, Article number: 6866 (2019)
Cite this article
- [11]. Плескановская С.А. Клеточный и гуморальный иммунный ответ при кожном лейшманиозе (экспериментальные исследования и наблюдения) Автореф. Дисс. Канд. Мед. наук. Москва-1992. 22 с.
- [12]. Фримель Г. Иммунологические методы. 1987. М:Медицина. 321 с.