IJPSR (2013), Vol. 4, Issue 11 **(Review Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 30 June, 2013; received in revised form, 22 August, 2013; accepted, 25 October, 2013; published 01 November, 2013

TAHLAB (SPIRULINA) AND FEW OTHER MEDICINAL PLANTS HAVING ANTI-OXIDANT & IMMUNOMODULATORY PROPERTIES DESCRIBED IN UNANI MEDICINE - A REVIEW

Md. Anzar Alam*[1], Nafis Haider [2], Shamim Ahmed [3], Md. Tanwir Alam [4], Abdul Azeez [5] and Aisha Perveen [3]

Department of Moalajat (Medicine) National Institute of Unani Medicine (NIUM) [1], Under Ministry of Health and Family Welfare, Govt. of India, Bangalore, Karnataka, India

ITS Paramedical (Pharmacy) College [2], Murad Nagar, Ghaziabad, Uttar Pradesh, India

Department of Ilmul Advia, National Institute of Unani Medicine [3], Bangalore, Karnataka, India

Department of Tahffuzi wa Samaji Tib (PSM), AIUMC [4], Muzaffarnagar, Uttar Pradesh, India

Department of Moalajat (Medicine) National Institute of Unani Medicine [5], Bangalore, Karnataka, India

Keywords:

Antioxidant, Immunomodulator, Food Supplements, Unani medicine; Tahlab; Spirulina

Correspondence to Author:

Md. Anzar Alam

Department of Moalajat (Medicine) National Institute of Unani Medicine (NIUM) , Under Ministry of Health and Family Welfare, Govt. of India, Bangalore, Karnataka, India

E-mail: dranzarnium@gmail.com

ABSTRACT: Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals; free radicals damage may lead to cancer and other diseases. Some of the example of antioxidants are like β-carotene, lycopene, Vit. C, E & A and other substances which are found in variety of fruits, vegetables, algae (spirulina) & other medicinal plants. Spirulina (Blue green algae) is a microscopic single cell alga which grows in fresh water and has a simple structure but a complex composition. It is a concentrated source of food containing nutraceutical, antioxidants, probiotics and phytonutrients. It has been subjected to through screening for its biological role; some of the finding is promising. It has immunostimulant activities. It stimulates the production and activity of bone marrow stem cells, macrophages, T-cells, spleen & thymus gland shows enhanced function. *In-vitro* studies on spirulina indicate that it enhances the cell nuclease activity and DNA repair & hence, it has possible role in cancer treatment. Spirulina has the potential to be accepted by global certification authorities as a safe nutritional and dietary supplement. Some of the plants extensively studied for immunostimulant activity are *Halela, Balela, Amla, Asgandh, Satavar, Ustakhudoos, Gilo, Zanjabeel, Brahmi* etc. The activation of mononuclear cells to release cytokines and interleukins-I, has been documented for Gilo (*Tinospora cordifolia*), syringing and cordial, the active constituents of this plant, show anticomplimentry and immunomodulatory activity.

INTRODUCTION: Antioxidant properties of spirulina were demonstrated as inhibition of lipid per oxidation by its extract [1].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.4(11).4158-64

Article can be accessed online on: www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.4(11).4158-64

Spirulina seems to be one of the best solutions for the simple production of high quality food supplement. Human nutritional and dietary requirement is basic need so optimal provision of the same is of primary importance.

Alteration in lifestyles, dynamic restructuring of micro and macro niches and unavailability of nutrition sources contribute to an increasing incidence of malnutrition and other related health problem.

Nature has been blessed with many "miracle foods" that provide us with incredible amounts of concentrated nutrition and healing and at the same time affordable. Everyone should take miracle foods like spirulina easily found or cultivated throughout the globe for nutrition and healing. Over the past decade, numerous studies have been conducted to evaluate the effect of spirulina supplementation on promoting health & controlling various disorders in humans [2, 3, 4].

Blood lipid-lowering effect of spirulina has been reported in healthy subjects [5], patient with heart disease [6] and diabetic patients [7]. Mice fed spirulina containing diet showed immune-enhancing effect [8, 9], anticancer [10, 11, 12] and hypocholesterolemic effect [13, 14] with health improvement [15]. The agent is gaining attention as a neutraceutical and a source of potential pharmaceutical productS.

Insulin like property is reported in spirulina [16]. Spirulina (Blue green algae/Tahlab) is also used in Unani Medicine for the wound healing, diabetes mellitus, Arthritis, stiffness and in hernia [17, 18, 19, 20, 21, 22, 23, 24, 25, 26]. Current production of spirulina worldwide is estimated to be about 3,000 metric tons. Early interest in a spirulina focused mainly on its rich content of proteins, vitamins, all essential amino acids, minerals and essential fatty acids. Spirulina is 60-70% proteins by weight and contains a rich amount of vitamins, especially vitamin B_{12} and provitamin-A (β-carotene) and minerals especially iron. It has been stated by NASA that the nutritional value of 1000 kg of fruits and vegetables equals one kg of spirulina.

Therefore, in long term Space mission NASA (CELLS) and European Space Agency (MELLISA) proposed that spirulina can serve as a major source of food & nutrition [27, 28]. The United Nations has hailed spirulina as the possible "best food for the future" in its world conference held during 1974. Spirulina can be harvested by simple method & can be processed in to a variety of final forms such as powders, tablets, flakes, syrups etc [29].

In Russia, spirulina has been approved to treat symptoms of radiation sickness, because the carotenoids, it contain absorb radiation [30]. Spirulina has been exhaustively and extensively tested by Scientists around the world and is reported to be powerful and well balanced source of nutrition.

Spirulina has a unique quality to detoxify (neutralize) or to chelate toxic minerals, a characteristic that is not yet confirmed in any other microalgae [31, 32]. Hence, Spirulina can be used to detoxify arsenic from water and food. It may also be used to chelatize or detoxify the poisonous effect of heavy metals from water, food and environment. Beijing University has extracted bioactive molecules from spirulina which could neutralize or detoxify the toxic and poisonous effect of heavy metals and which showed anti-tumor activity. Several institutions in China are focusing on biomolecules which show antitumor, antiaging and antiradiation properties [33, 34]. The basic biochemical composition of spirulina can be summarized as follows:

1. **Protein:** Spirulina contains unusually high amounts of protein between 60-70% by dry weight, depending on the source,[35] from a qualitative point of view, spirulina protein are complete, since all the essential amino acids are present, among these essential amino acids, the most poorly represented are sulphur-containing amino acids methionine and cystine,[36, 37] even so, they are present more than 80 % of ideal level defined by the Food and Agricultural Organization, calculated on the basis of an egg albumin and casein.

   It also appears that one of the drying methods used in industry is drying on hot drums. This spectrum of amino acids shows that the biological value of protein in spirulina is very high and that optimum products could be achieved by supplementation with a good source of sulphur – containing amino acids and possibly lysine and histidine also. As compared to standard protein such as that from meat, eggs or milk, it is however superiors to all standard plant protein such as that from legumes.

2. **Essential Fatty acids**: Human requirements of essential fatty acids are considered to be 1-2% of energy intake for adults and 3% for children [38, 39]. It is now well established that essential lipid intake has an influence on the immune system, both humoral and cellular [40]. Spirulina has a high amount of polyunsaturated fatty acids 1.5-2% as 5-6% of total lipid. In particular spirulina is rich in gamma linolenic acid, linoleic acid, stearidonic acid,

eicosapentaenoic acid, docoschexaenoid acid (DHA) and arechidonic acid. The importance of these fatty acids lie in their biochemical evolution, they are the precursor of the prostaglandins, leukotriens and thromboxanes that serve as chemical mediators of inflammatory and immune reactions. Polysaccharides of spirulina show radio-protective effect [41].

3. **Carbohydrate:** In general carbohydrate constitutes 15-25% of the dry weight of spirulina [42]. Carbohydrate consists of polymer of glucosamine, rhamnosamine, glycogen, glucose, fructose & sucrose. It is worth nothing that spirulina polysaccharides are believed to have a stimulating effect on DNA repair mechanism [43], certain polysaccharides are also thought to have immune stimulating & immune regulating properties [44, 45].

4. **Nucleic acids:** The nucleic acids (DNA & RNA) content is an important nutritional point, because the biochemical degradation part of their components (the purines adenine and guanine) ends by producing uric acid. Total nucleic acid level of 4.2-6% of dry matter have been reported [46].

5. **Vitamins:** Spirulina contains vitamin B_1, B_2, B_3, B_6, B_9, B_{12}, C, D, E & provitamin-A (β-carotene). Beta-carotene accounts for 80% of the carotenoids present in spirulina, the remainder consisting mainly of physoxanthin and cryptoxanthin [47], clinical studies have also shown excellent utilization of spirulina carotenoids in humans [48].

6. **Minerals and trace elements:** the minerals of particular interest are iron, calcium, phosphorus and potassium. The very high iron content should be doubly stressed because iron deficiencies (anemia) are very widespread, particularly in pregnant women and children, and good sources in food are rare. In the case of spirulina, iron bioavailability has been demonstrated both in rats and in humans [49], calcium, phosphorus and magnesium occur in spirulina in quantities comparable to those found in milk.

7. **Experimental studies on few other plants which act as antioxidants & immune-modulator:** There is large number of plant species available in India, most of the plants uses for medicinal purposes in traditional medicine (Unani medicine, Ayurveda etc.). Growing scientific evidence have shown adverse and side effects of synthetic antioxidants, therefore recently there has been an upsurge of interest in natural products as antioxidants & immunomodular activities, that can inhibit the free radical reactions and protect the human body from various diseases like cancer, rheumatoid arthritis, inflammation, obesity etc.

Some of the plants which are used for its antioxidant & immunomodulator activity in Unani medicine and have been validated by pharmacological studies also, are describe as below:

1. **Halela** (*Terminalia chebula*): Family-Combretaceae. Oral administration of ethanol extract of Halela fruits in rats against isoproterenol induced oxidative stress, suggest that the cardio protective effect of *T. chebula* fruits may partly be attributed to its antioxidant properties [50]; alcohol extract of *T. chebula* shows immunomodulatory effect [51].

2. **Balela** (*Terminalia bellerica*): Family-Combretaceae. Acetone extract of fruits of balela contains β-sitosterol, gallic acid, belleric acid & chebulinic acid which shows antioxidant activity [52], inhibitory effect of HIV-I reverse transcriptase, water extract of fruits shows hepatoprotective activity against CCl_4 – induced hepatotoxicity. The ethanolic extract of *T. belerica* produces stimulatory effect on the humoral and cell mediated immune response in the experimental animals due to flavonoids and phytosterols compounds and suggests its therapeutic usefulness in disorder of immunological origin [53].

3. **Amla** (*Embellica officinalis*): Family-Euphorbiacae. The butanolic extract of the water fraction of fruits possess an anti-oxidant property, responsible for cytoprotective action in rats, gastric ulcer induced by indomethacin.

The alcoholic extract of fruits also indicated a significant reduction in the ulcer score and acidity [54, 55], immunomodulator, antioxidant & anticancer activity [56].

4. **Asgandh** (*Withania somnifera*): Family- Solanaceae. *Withania somnifera* possess many pharmacologically and medicinally important chemicals like glycowithanolides, withaferin, they protect the cells from oxidative damage and diseases, good antioxidant, immuno-modulatory, anti-inflammatory, anti-tumor, anticancer properties [57, 58, 59].

5. **Satavar** (*Asparagus racemosus*): Family- Asparagacae. Hydro-alcoholic extract of satavar exhibit antioxidant in rats against CCl_4 induced hepatoxicity [60], *A. racemosus* root extract which contains highest amount of, flavonoids, polyphenols and vitamin-C exhibits antioxidant potential, anti-hyperlipidemic effect & anti-hyperglycemic activity [61].

6. **Ustakhuddus** (*Lavandula stoechas*): Family- Lamiaceae. The flowers' extracts are reputed to possess antibacterial, antifungal and antioxidant properties [62, 63], linalyl acetate (15.26%), linalool (10.68%), 18 cineole (10.25%), γ-terpinene (11.2%) and camphor (11.25%) acts as antioxidant activity [64], flavonoids in *L. stoechas* acts as anti-inflammatory, antioxidant activity in rats [65, 66] and anti-tyrosinase activity [67].

7. **Tulsi** (*Ocimum sanctum*): Family- Labiatae. Antioxidant effects of *O. sanctum* in experimental streptozocin-induced diabetic rats [68], aqueous extract of *O. sanctum* at the oral doses of 100, 200 mg/kg/day in rats enhances the production of RBC, WBC, haemoglobin and also enhanced the production of antibodies without affecting the biochemical parameters [69]. Hepatoprotective activity of *O. sanctum* alcoholic leave's extract against paracetamol-induced liver damage in Albino rats synergism with silymarin and concluded that *O. sanctum* alcoholic leave's extract showed significant hepatoprotective activity andsynergism with silymarin [70].

8. **Gilo** (*Tinospora cordifolia*): Family- Menispermaceae. Dry stem crude extract of *T. cordifolia* contained a polyclonal B cell mitogen, which enhanced immune response in mice[71]. The active component G1-4A enhanced humoral immune response in mice and also protected them against lipopolysaccharide induced endotoxic shock [72, 73]. The extracts from the leaves of *T. cordifolia* exhibited different levels of antioxidant activity in all the models studied [74, 75].

   Antiviral and immunomodulatory effect in HIV patients an antipyretic effect [77].

9. **Zanjabeel** (*Zingeber officinale*): Family- Zingiberaceae. The alcohol extracts of ginger showed an antioxidant and inhibiting effect with regard to the hydroxyl radicals [78, 79, 80]. The immunomodulatory effect of *Z. officinale* essential oils was reported in mice,[81] Antioxidant activity of the zinger is due to the presence of flavones, isoflavones, flavonoids, anthocyanin, coumarin lignans, catechins , Isocatechins; all these act against a variety of free radicals [82].

10. **Brahmi** (*Centella asiatica*): Family- Apiaceae. Brahmi is well known to have a high antioxidant activity [83, 84, 85], triterpenoid, saponins of Centella showed immuno-modulatory effect [86]. Aqueous extract of *C. asiatica* showed significant effect on learning and memory enhancing and significantly decreased the levels of norepineprine, dopamine and 5-HT and their metabolites in the brain [87]. Ethanolic and methanolic extracts of *C. asiatica* had shown significant protection and lowered the blood glucose levels to normal in glucose tolerance test carried out in the alloxan induced diabetic rats [88]. It also exhibit Radio-protective activity [89].

CONCLUSION: Unani System of Medicine always relies upon the use of natural products and has been the source of information for the discovery of many drugs we have today. Currently, increased cost of conventional healthcare has become a driving force in the shift towards interest in alternative medicine for wellness and self-care. In Unani system, a lot of medicines are getting greater recognition among diet and health care professionals.

Spirulina and other medicinal plants discussed above are already in use in Unani medicine since centuries for various health care approaches.

Conflict of interest: NONE

Funding: NIL

ACKNOWLEDGEMENT: Authors acknowledge immense help received from scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/ editors/publishers of all those articles, journals, books from where the literature for this article has been reviewed and discussed.

REFERENCES:

1. Benedetti S, Benvenuti F, Pagliarani S, Francogli S, Scoglio S, Canestrari F. Antioxidant Properties of a novel phycocyanin extract from the Blue-Green Alg. Aphanizomenon flos- aquae. Life Sci.2004; 75:2353–2362.
2. Kim MH, Kim WY. The change of lipid metabolism andimmune function caused by antioxidant material in the hypercholesterolemin elderly women in Korea. KoreanJ Nutr. 2005; 38:67-75.
3. Parikh P, Mani U, Iyer U. Role of *Spirulina* in the control of glycemia and lipidemia in type- 2 diabetes mellitus. Dig Dis Sci. 2001; 4:193–199.
4. Rodriguez-Hernandez A, Ble-Castillo JL, Juares-Oropeza MA, Diazagoya JC. *Spirulina maxima* prevent fatty liver formation in CD-1 male and female mice with experimental diabetes. Life Sci. 2001; 69: 1029–1037.
5. Park JY, Kim WY. The effect of *Spirulina* on lipid metabolism, antioxidant capacity and immune function in Korean elderly. Korean J Nutr. 2003; 36: 287–297.
6. Ramamoorthy A *et al*. Effect of supplementation of *spirulina* on hypercholesterolemic patients. J Food Sci Technol. 1996; 33:124-128.
7. Mani UV, Desai S, Iyer UM. Studies on the long-term effect of *Spirulina* supplementation on serum lipid profile and glycated proteins in NIDDM patients. J Nutra Funct Med Foods. 2000; 2: 25–32.
8. Hayashi T, Hayashi K. Calcium spirulan, an inhibitor of enveloped virus replication, from a blue-green alga *Spirulina platensis*. J Nat Prod .1996; 59: 83-87.
9. Gustafson KR, Cardellina JH II, Fuller RW, Weislow OS, Kiser RK, Snader KM, Gregory ML, Patterson, Boyd MR. AIDS antiviral sulfolipids from cyanobacteria (blue-green algae). J Natl Cancer Inst. 1989; 8:1254–1258.
10. Babu ML. Evaluation of chemoprevention of oral cancer with *Spirulina fusiformis*. Nutr Cancer. 1995; 24:197-202.
11. Anzar MA, Nafis H, Sadique H, Shamim A, Tanwir MA. Dafe'-E-Sart'an (Anticancer) Activity of T'ah'lab (Spirulina)- A Review. Int J Pharm Bio Sci. 2013; 4(4): (B) 1148-1155.
12. Qishen P. Enhancement of endonuclease activity and repair DNA synthesis by polysaccharide of *Spirulina platensis*. Acta Genet Sinica.1988;15:374–381.
13. Nakaya N, Homma Y, Goto Y. Cholesterol lowering effect of *Spirulina*. Nutr Rep Int .1988; 37: 1329-1337.
14. Kato T, Takemoto K, Katayama K, Kuwahara Y. Effect of *Spirulina platensis* to alimentary hypercholesterolemia in rat. Jpn Nat Food Assoc J. 1984; 37: 323.
15. Abdulqader G, Barsanti L, Tredici M. Harvest of *Arthrospira platensis* from Lake Kossorom (Chad) and its household usage among the Kanembu. *J Appl Phycol*. 2000; 12: 493-498.
16. Anwer R, Anzar A. Detection of immunoactive insulin in *spirulina*. J Appl Phycology. 2012; 24: 583-591.
17. Ibn-Sina. Al-Qanoon Fit tib, Urdu translated by Hkm. Ghulam Hussain Kantoori. Published by Idara Kitab-Us-Shifa New Delhi.2012; 2:354.
18. Ibn-Baitar, Al-Jameli Mufradat Al-Advia wa Al-Aghzia. (Urdu). Central Council for Research in Unani Medicine. Ministry of Health & Family Welfare. Govt. of India NewDelhi1999; 3:215-216.
19. Baghdadi IH. *Al-Mukhtarat Fit tib*. (Urdu). Central Council for Research in Unani Medicine. Ministry of Health & Family Welfare. Govt. of India New Delhi2005; 2:161.
20. Rhazi Z. Kitab Al-Mansoori. (Urdu). Central Council for Research in Unani Medicine. Ministry of Health & Family Welfare. Govt. of India. New Delhi. 1991:139.
21. Rhazi Z. Kitab Al-Havi. (Urdu). Central Council for Research in Unani Medicine. Ministry of Health & Family Welfare. Govt. of India New Delhi.2007; 21:95.
22. Khan HA. Al-Ikseer. (Urdu). Aijaz Bublishing House New Delhi.2003;2:1197
23. Ibn-Rushd. Ktab Al-Kulliyat. (Urdu). Central Council for Research in Unani Medicine. Ministry of Health & Family Welfare. Govt. of India New Delhi.1987: 307.
24. Momin HM. Tohfatul Momineen. (Persian). Dar Matba HasniYNM: 170.
25. Maghribi ASI. Kitab Alfath Fi Al-Tadawi. Urdu Translation by Hkm. Abdul Bari.Published by NCPC Printers Delhi.2007; 122-123.
26. Ghani HN. Khazainul Advia. (Urdu). Published by Idara Kitab-Us-Shifa New Delhi.2010; 1014-1015.
27. Cornet JF, Dubertret G. The cyanobacterium *Spirulina* in the photosynthetic compartment of the MELISSA artificial ecosystem. Workshop on artificial ecological systems.Marseille, France: DARA-CNES.1990: 24–26.
28. Characterization of *Spirulina* biomass for CELSS diet potential. Normal, Al.: Alabama A&M University, 1988.
29. Vonshak A. *Spirulina platensis* (Arthrospira). *Physiol Cell-Biol Biotechnol*. London: Taylor & Francis; 1997.
30. Cifferi O. Spirulina as a microorganism. *Microbiol Rev*. 1983; 47(4): 551–578.
31. Maeda, S. & Sakaguchi, T. Accumulation and detoxification of toxic metal elements by algae. *Introduction to Appl. Phycol*. 1990: 109–136.
32. Okamura, H. & Aoyama, I. Interactive toxic effect and distribution of heavy metals in phytoplankton. *Toxicol. & Water Quality*.1994; 9: 7–15.
33. Liu, L.C., Guo, B.J. & Ruan, J.S**.** Antitumour activity of polysaccharides extracted from Spirulina *Oceanogr*. 1991; 5: 33–37 (In Chinese).
34. Li DM, Qi YZ**.** Spirulina industry in China: Present status and future prospects. *J. Appl.Phycol*. 1997; 9: 25–28.
35. Phang SM, Miah MS, Chu WL. Hashim M**.** Spirulina culture in digested sago starch factory waste water. *J. Appl. Phycol*. 2000; 12: 395–400.
36. Bujard –E, U.Braco-U, *et al*. Composition and nutritive value of BGA (Spirulina) and their possible use in food formulations.3rd International Congress of food Science and Technology, Washington, 1970.

37. Clement G, Giddey C and Menzi R. Amino acid composition and nutritive value of the alga spirulina maxima. J.Sc.Fd.Agric. 1967; 18:497-501.
38. Manuel Merk. 2nd edition, francaise, editons d'apres Paris. 1994.
39. Pascaud, Brauard C. Acides gras polyinsatures essentiels w6 w3. Besoins nutritionnels, equilibres, alimentaires. Cah. Nutr. Diet. 1991; 25(13):185-190.
40. Hwang D. Essential fatty acids and immune response. FASEB J. 1989; 3:2052-2061.
41. Qishen P, Baojiang G, Kolman A. Radioprotective effect of extract from *Spirulina platensis* in mouse bone marrow cells studied by using the micronucleus test. Toxicol Letters. 1989; 48:165-169.
42. Quillet M. Recherches sur les substances glucidiques elaborees par les spirulines. Ann. Nutr.Aliment. 1975; 29: 553-561.
43. Pangs-QS *et al*. Enhancement of endonuclease activity and repair DNA synthesis by polysaccharides of *Spirulina platensis*. 1988; 15(5):374-81.
44. Baojiang G *et al.* Study on effect and mechanism of polysaccharides of spirulina on body immune function improvement, Second Asia Pacific Conference on Algal Biotech University of Malaysia. 1994: 33-38.
45. Zhang Cheng-Wu *et al.* "Effects of polysaccharide and phycocyanin from spirulina on peripheral blood and haemopoietic system of bone marrow in mice" Proc. of Second Asia Pacific on Algal Biotech. Univer. of Malaysia.1994.
46. Santillan-C. Cultivation of spirulina for human consumption and for animal feed. International congress of Food Science and Technology. Madrin. September1974.
47. Palla JC, Busson F. Etude des carotenoides de *Spirulina platensis* Geitler.CR.Aca. Sc, Paris. T.1969; 269:1704-107.
48. Annapurna V. Bioavailability of Spirulina carotene in preschool children. J Clin Biochem Nut. 1991; 10:145–151.
49. Jonson P, Shubert E. Availability of iron to rats from spirulina, a blue green algae. Nutrition Research, 1986; 6: 85-94.
50. Sulatha S *et al.* Antioxidant activity of ethanolic extract of *Terminalia chebula* fruits against isoproterenol-induced oxidative stree in rats. Indian Journal of Biochemistry and Biophysics, 2005; 42:246-249.
51. Aher V *et al. Pharmacological Review on Terminalia* Chebula - International Tropical Journal of Pharmaceutical Research. 2011; 10 (5): 567-576.
52. Guleria S *et al.* Antioxidant activity of acetone extract/fractions of *Terminalia bellerica* Roxb. fruit. Indian Journal of Biochemistry and Biophysics. 2010; 47: 110-116.
53. Choudhary GP. Scholars Research library Der Pharmacia Lettre. 2012;4 (2):414- 417.
54. SandipB *et al*.The role of antioxidant activity of *P.embellica* fruits on prevention from indomethacin induced gastric ulcer, J. Ethnopharmacol. 2000; 70 (2):171-176.
55. Bhattacharya A, Chatterjee A, Ghosal S, Bhattacharya SK. Antioxidant activity of active tannoid principle of *Emblica officinalis* (amla). Indian Journal of Experimental Biology. 1999; 37:676-80.
56. Madhuri S, Pandey G, Verma KS. Antioxidant, Immunomodulator and anticancer activity of *Emblica officinalis*- An over view. IRJP. 2011: 2(8): 38-42.
57. Singh N, Verma P, Pandey BR, Gilca M. Role of *Withania somnifera* in Prevention and Treatment of Cancer:An Overview. International Journal of Pharmaceutical Sciences and Drug Research 2011; 3(4): 274-279.
58. Anzar A, Shamim M, Tanwir A, Aziz A. Cancer (Sartan) and Its Management in Unani (Greco-Arab) System of Medicine. International Journal of Pharmamedix India, 2013, 1(4), 612-630.
59. KumarA, Kalonia H. Protective effect of *Withania somnifera* Dunal on the behavioral and biochemical alterations in sleep-disturbed mice (Grid over water suspended method). Indian Journal of Experimental Biology. 2007; 45: 524-52.
60. Acharya SR *et al.* Antioxidant and hepatoprotective action of *Aspragus racemosus* Wild. root extract. Indian Journal of Experimental Biology. 2012; 50:795-801.
61. Vadivelan R. Hypoglycemic, antioxidant and hypolipidemic activity of *Asparagus racemosus* on streptozotocin-induced diabetic in rats Advances in Applied Science Research. 2011; 2 (3): 179-185.
62. Laib I. Etude des activités antioxydante et antifongique de l'huile essentielle extraite des fleurs sèches de *Lavandula officinalis*. Mémoire de Magister, INATAA, Université de Constantine. 2011:21-69.
63. Lis-Balchin M. Lavender: the genus Lavandula. Taylor and Francis, London. 2002; 37-50, 155-200.
64. Malika B, Laib I. Antioxidant activity of the essential oil from the flowers of *Lavandula stoechas*. Journal of Pharmacognosy and Phytotherapy. 2012; 4(7):96-101.
65. Amira S, Dade M, Schinella G, José-Luis R. Anti-inflammatory, anti-oxidant, and apoptotic activities of four plant species used in folk medicine in the Mediterranean basin. Pak. J. Pharm. Sci. 2012; 25(1):65-72.
66. Upson TM, J Grayer R, Greenham JR, A Williams C, AlGhamdi F and Chen F. Leaf flavonoids as systematic characters in the genera Lavandula and Sabaudia. Biochem. Syst. Ecol., 2000; 28: 991-1007.
67. Sariri R., Seifzadeh S, Sajedi RH. Anti-tyrosinase and antioxidant activity of lavandula sp. Extracts. Pharmacologyonline.2009; 3: 319-326.
68. Muralikrishnan G, Pillai SK, Shakeel F. (). Protective effects of *Ocimum sanctum* on lipid peroxidation and antioxidant status in streptozocin-induced diabetic rats. Nat Prod Res. 2012; 26:474-478.
69. Jeba CR, Vaidyanathan R, Kumar RG. Immunomodulatory activity of aqueous extract of *Ocimum sanctum* in rat. Int J on Pharmaceutical and Biomed Re. 2011; 2: 33-38.
70. Lahon K, Das S. Hepatoprotective activity of *Ocimum sanctum* alcoholic leaf extract against paracetamol-induced liver damage in Albino rats. Pharmacognosy Res. 2011; 3:13-18.
71. Desai VR, Kamat JP, Sainis KB. An immunomodulator from *Tinospora cordifolia* with antioxidant. Indian Acad. Sci. (Chem. Sci.), 2002; 114(6):713–719.71.
72. Ramakrishnan R. Studies on the interactions of natural products from *Tinospora cordifolia* with immune system Ph D thesis, University of Mumbai. Mumbai. 2001.
73. Sainis KB, Ramakrishnan R, Sumariwalla PF, Sipahimalani AT, Chintalwar GJ, Banerji A. Immunopharmacology (ed.) S N Upadhyay (New Delhi: Narosa) 1999: 96.
74. Praveen N, Thiruvengadam M, Kim HJ, Kumar PJK, Chung IM. Antioxidant activity of *Tinospora cordifolia* leaf extracts through non-enzymatic method. Journal of Medicinal Plants Research. 2012;6(33):4790-4795.
75. Aher V, Wahi AK. Biotechnological Approach to Evaluate the Immunomodulatory Activity of Ethanolic Extract of

Tinospora cordifolia Stem (Mango Plant Climber). Volume 2012;11(3):863-872.
76. Thawani VR, Kalikar MV, Varadpande VK, Sontakkee SD, Singh RP, Khiyani RK. Immunomodulatory effect on *T. cordifolia* in human Immunodeficiency virus positive patients. *Indian J. Pharmacol.* 2008; 40: 107-110.
77. Ikram M, Khattak SG, Gilani SN. Antipyretic studies on some indigenous Pakistani medicinal plants: II. *J. Ethnopharmacol.* 1987; 19: 185-192.
78. Stoilova A ,Krastanov A, Stoyanova A, Denev P, Gargova S. Antioxidant activity of a ginger extract (*Zingiber officinale*) Food Chemistry 2007;102:764-770.
79. Helle L, Grete B. Spices as antioxidants trends. Food Science Technology, 1995; 6:271-277.
80. Yen G, Chang Y, Su S. Antioxidant activity and active compounds of rice koji fermented with *Aspergillus candidus*. Food Chemistry, 2003; 83: 49–54.
81. Carrasco FR, Schmidt G, Romero AL, Sartoretto JL, Caparroz-Assef SM, Bersani-Amado CA, Cuman RK. Immunomodulatory activity of Zingiber officinale Roscoe, Salvia officinalis L. and Syzygium aromaticum L. essential oils: evidence for humor- and cell-mediated responses. J Pharm Pharmacol. 2009; 61(7):961-7.
82. Kumar, Gaurav, Karthik L, Bhaskara RKV. A Review on Pharmacological and Phytochemical Properties of *Zingiber officinale* Roscoe (Zingiberaceae) Journal of Pharmacy Research. 2011; 4(9):2963.
83. Wong SP, Lai PL, Jen HWK. Antioxidant activities of aqueous extracts of selected plants. Food Chemistry. 2006; 99: 775-783.
84. Kormin SB. The effect of heat processing on triterpene glycosides and antioxidant activity of herbal pegaga (*Centella asiatica* L. urban) drink. Master of Engineering (Bioprocess) Thesis, University of Technology Malaysia. 2005; 31-35.
85. Jaswir I, Hassan TH, Said MZ. Antioxidative behavior of Malaysian plant extracts in model food and oil systems. Asia Pac. J. Clin. Nutr. 2004; 13 (suppl.) S72.
86. Jamil SS, Nizami Q, Salam M. *Centella asiatica* (L) Urban – A review, Natural products radiance. 2007; 6(2): 158-170.
87. Seevaratnam V, Banumathi P, Premalatha MR, Sundaram SP, Arumugam T. Functional properties of *Centella asiatica* (L.): A review. International Journal of Pharmacy and Pharmaceutical Sciences. 2012; 4(5):8-14.
88. Chauhan PK, Pandey IP, Dhatwalia VK. Evaluation of the Anti-diabetic Effect of Ethanolic and Methanolic Extracts of *Centella asiatica* Leaves Extract on Alloxan Induced Diabetic Rats, Advances in Biological Research. 2010; 4 (1): 27-30
89. Sharma R, Sharma J. Modification of gamma ray induced changes in the mouse hepatocytes by *Centella asiatica* extract: *in vivo* studies. Phytother. Res. 2005; 19 (7): 605-611.

How to cite this article:
Alam MA, Haider N, Ahmed S, Alam MT, Azeez A and Perveen A: Tahlab (Spirulina) and few others medicinal plants having anti-oxidant & immunomodulatory properties described in Unani medicine - A Review. *Int J Pharm Sci Res* 2013; 4(11): 4158-64. doi: 10.13040/IJPSR. 0975-8232.4(11).4158-64