ORIGINAL ARTICLE

Surveying Antioxidant Activity of Hydroalcoholic Extract of *Matricaria chamomilla L.* and Comparing it to Lovastatin in Rat

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Abstract

Background: One of the most known reasons of the majority of diseases is oxidative stress, created by free radicals, and the most important defensive factors against these free radicals are antioxidants that can be naturally found in most herbs; hence, we studied antioxidant activity of *Matricaria chamomilla L.* hydroalcoholic extract (MCHAE) and compared it to lovastatin in Wistar rats. **Materials and Methods:** In this research, 30 Wistar rats (165 ± 15 g) were used that were randomly put in the control group (common diet), sham group (high cholesterol diet [2%]), experimental Groups of 1 and 2 (high cholesterol diet 2%) and arrangement with 0.55 and 1.1 mg/ml doses of *M. chamomilla L.* extract), and experimental Group 3 (high cholesterol diet [2%] and 10 mg/kg lovastatin). At the beginning and end of the study, blood sampling was performed on the rats, and plasma serum malondialdehyde (MDA) and red blood cell (RBC) superoxide dismutase (SOD) concentrations were measured. The results were analyzed by SPSS 16 software and $P < 0.05$ was considered as the limit of statistical inference. **Results:** The amount of SOD in RBC and plasma MDA in control group did not show a significant difference. In addition, the levels of these two enzymes in experimental Groups of 1 and 3 that, respectively, received 0.55 mg/ml MCHAE and 10 mg/kg lovastatin drug did not show a significant difference at the beginning and end of the study and were in normal level, "in spite of receiving high cholesterol (2%) diet. But 1.1 mg/ml dose of hydroalcoholic extract of *Matricaria chamomilla* L. that experimental group 2 was treated by it, could not prevent increase of Superoxide Dismutase in Red Blood Cell and Malondialdehyde in plasma at the end of the study compared to its beginning. **Conclusion:** The results of this research indicate that *M. chamomilla L.* has good antioxidant activity and can contrive making natural antioxidant compounds to prevent diseases caused by oxidative stress.

Key words: Antioxidant, lovastatin, malondialdehyde, *Matricaria chamomilla*, rat, superoxide dismutase

INTRODUCTION

Today, in most countries of the world, cardiovascular disease is a major cause of mortality.[1-5] What is noticeable is increasing incidence of these patients considering the growth of aging.[6] One of the most common causes of many diseases is oxidative stress caused by free radicals. The most important damaging effects of free radicals are the onset of the lipid peroxidation process, which leads to the destruction of cell membranes.[7]

The most important defensive factors against free radicals are antioxidants.[8] Antioxidants are in two synthetic and natural forms. Scholars and experts in nutrition always try to find natural compounds with antioxidant effects to decrease the effects of free radicals on the body. Natural antioxidants do not have the side effects of synthetic antioxidants.[9]

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Plants have natural compounds that, in addition to increasing the quality and nutritional value of the food, are used in other forms such as drinking, color, cosmetics, medicinal, and healing. Some plants have considerable natural antioxidants. Following their consumption, it has been observed that the antioxidant capacity of the plasma increases significantly.[10]

Positive effects of vegetative nutrition are related to the presence of polyphenolic compounds and special flavonoids in them.[11,12] Flavonoids are compounds that due to antioxidant activity protect the cells against the destructive effects of reactive oxygen species such as superoxide radicals.[12] Among these nutrients, we can refer to the extract of *Matricaria chamomilla L.* and its elements such as flavonoids.[13]

M. chamomilla L. (Chamomile) is one of the oldest known herbals and is a member of Asteraceae family.[14] Main and active chemical elements in chamomile flowers mainly include apigenin, quercetin, and luteolin flavonoids, and α-bisabolol terpenoids and its oxides and chamazulene.[15,16] Apigenin in *M. chamomilla* extract is a ligand for benzodiazepine receptor and, as a result, has anti-anxiety and relaxing effects and significantly decrease the delay in sleeping and contrary to diazepam does not result in paramnesia.[17] Quercetin has an inhibitory effect on monoamine oxidase A and therefore has a relaxing effect.[14,18] Chamomile extract and essential oil are considered as natural antioxidants.[19]

Considering the important role of natural antioxidant compounds in preventing cardiovascular disease, in this study, we surveyed the antioxidant activity of chamomile hydroalcoholic extract and its comparison with lovastatin in Wistar rats.

MATERIALS AND METHODS

Extraction

After collecting chamomile plant from the plains around Ilam city and identification and scientific approval of it, we dried it in shadow and powdered it. Then mixed the powder with hydroalcoholic solvent and put it in incubator shaker machine for 3 days. Then, the extract was purified by Whatman paper and concentrated in the rotary device. By putting the concentrated extract in 30–40° dry heat machine, finally we obtained a dry extract.

Animals and treatment: In this experiment, we used 30 Wistar rats (165 ± 15 g) purchased from Tehran Pastor Institute. Animals were kept in laboratory conditions in 23°C, 55 humidity and lighting cycle of 12 h light and 12 h darkness.

Grouping

The control group received a common daily diet. Sham group received high cholesterol (2%) diet. Empirical Groups of 1 and 2, in addition to high cholesterol diet (2%), were treated, respectively, by 0.55 and 1.1 mg/ml of *M. chamomilla* hydroalcoholic extract (MCHAE) and experimental Group 3 had high cholesterol (2%) diet and received 10 mg/kg lovastatin drug.

Blood sampling was performed on rats at the beginning, and the end of the study and the serum concentration of malondialdehyde (MDA) and superoxide dismutase (SOD) was measured using biochemical diagnostic kits.

The results were analyzed by SPSS 16 software, *t*-test and one-way analysis of variance. For each group of rats, the mean of variant levels was calculated as Means ± SD. Limit of statistical inference was considered as $P < 0.05$.

RESULTS

The results of this research indicate that the level of red blood cell (RBC) SOD at the end of the study in the sham group which had 2% cholesterol diet, had a significant increase compared to the beginning ($P < 0.001$). It also had a significant increase in the second experimental group which received 1.1 mg/ml of MCHAE ($P < 0.05$). However, in experimental Groups of 1 and 3 that were, respectively, treated by 0.55 mg/ml of *M. chamomilla* extract and 10 mg/kg lovastatin, SOD level in RBC did not show a significant difference at the beginning and the end of the study [Figures 1 and 2].

Furthermore, at the end of the study, there was a significant difference in plasma MDA level in the sham and experimental groups ($P < 0.01$ and $P < 0.05$, respectively). This difference was not significant in experimental Groups of 1 and 3, despite a high cholesterol diet (2%).

DISCUSSION

The present study showed that high cholesterol diet created a significant difference in antioxidant system of the rat and

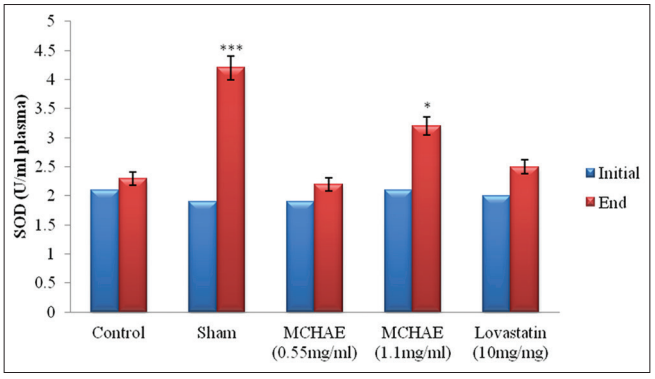

Figure 1: Comparison of superoxide dismutase in red blood cell at the beginning and the end of the study in different groups (Data are explained as Means ± SD [*n*=6])

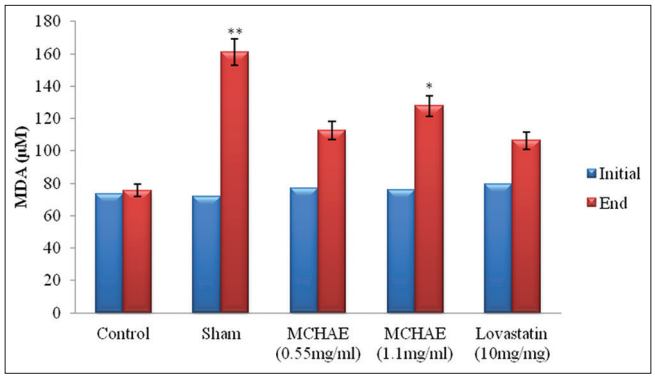

Figure 2: Comparison of plasma malondialdehyde at the beginning and the end of the study in different groups (Data are explained as Means ± SD [*n*=6])

increased serum MDA and SOD in RBC while prescribing MCHAE modified these changes and kept it in the normal range.

M. chamomilla is one of the plants in the Chrysopsis family, and many studies show its antioxidant properties and the presence of flavonoids in this plant.[14,20] Flavonoids can purify free radicals.[21] Phenolic compounds can give hydrogen atom from the aromatic to radical OH group to free radical and neutralize it.[22] Purification of free radicals by phenolic compounds is very important for their antioxidant property and can prevent the start of free radical chains, by breaking the reaction in these chains. Phenolic compounds apply their effect in the body of living creatures, probably by stimulating endogenesis antioxidant defensive system.[21-23]

A study performed by Papaioannou *et al*., titled "surveying phenolic compounds by antioxidant activity of *M. chamomilla L*.," indicated that two combinations of patulithic and rutin in this plant have strong scavenger effect on free radicals. Furthermore, these two compounds are strong inhibitors of lipoxygenase that is among the routes of production of free radicals.[24] In a study conducted by Asghari *et al*., in 2011, it was observed that antioxidant markers' activity in rats' liver cells increased significantly after consumption of chamomile extract.[7]

The lack of balance between the production of free radicals and antioxidants will result in an attack of free radicals to biologic molecules. The physiological role of antioxidants is a collection of free radicals. These compounds, collect free radicals especially superoxide and hydroxyl anions.[8]

Considering that 0.55 mg/ml dose of MCHAE has stronger antioxidant activity than 1.1 mg/ml dose, it seems that this activity is not dose-dependent.

CONCLUSION

In general, it can be said that oxidative damage induced by a high cholesterol diet is modulated by consumption of herbal extracts like chamomile and it can be said that to minimize the damages caused by free radicals, anti-oxidant power of persons shall be enhanced by consumption of natural antioxidants. Of course, recognition of detailed mechanism of these elements requires exact molecular and mechanism studies in the future.

REFERENCES

1. Otaghi M, Qavam S, Norozi S, Borji M, Moradi M. Investigating the effect of lavender essential oil on sleep quality in patients candidates for angiography. Biomed Pharmacol J 2017;10:473-8.
2. Borji M, Otaghi M, Salimi E, Sanei P. Investigating the effect of performing the quiet time protocol on the sleep quality of cardiac patients. Biomed Res 2017;28:7076-80.
3. Borji M, Tarjoman A, Seymohammadi R, Salimi E, Otaghi M. Effects of continuous care model on blood pressure in patients with Type II diabetes. J Clin Diag Res 2018;12:JC07-10.
4. Borji M, Tavan H, Azami M, Otaghi M. The effect of continuous care model on blood pressure and quality of life in patients on hemodialysis. Biomed Pharmacol J 2016;9:689-95.
5. Borji M, Molavi S, Rahimi Z. The effect of sexual satisfaction on the quality of life on patients with cardiovascular disease. Int J Med Res Health Sci 2016;5:70-5.
6. Arani MM, Aazami S, Azami M, Borji M. Assessing attitudes toward elderly among nurses working in the city of Ilam. Int J Nurs Sci 2017;4:311-3.
7. Asghari S, Naderi GH, Bashardoost N, Etminan Z. The study of antioxidant potential of *Chamaemelum nobile* extract on liver cell of rats. J Herb Drug 2011;1:69-76.
8. Koksal E, Gulcin I. Antioxidant activity of cauliflower. Turk J Agric 2008;32:65-78.
9. Anilkumar M. 10 ethnomedicinal plants as anti-inflammatory and analgesic agents. Ethnomedicine 2010;2:267-93.
10. Kahkonen M, Hopia AI, Vuorela HJ, Rauha JP, Pihlaja K, Kujla TS, *et al.* Antioxidant activity of plant extracts containing phenolic compounds. J Agric Food Chem 1999;47:3954-62.
11. Parfitt VJ, Rubba P, Bolton C, Marotta G, Hartog M, Mancini M, *et al.* A comparison of antioxidant status and free radical peroxidation of plasma lipoproteins in healthy young persons from Naples and Bristol. Eur Heart J 1994;15:871-6.
12. Morel I, Lescoat G, Cogrel P, Sergent O, Pasdeloup N, Brissot P, *et al.* Antioxidant and iron-chelating activities of the flavonoids catechin, quercetin and diosmetin on iron-loaded rat hepatocyte cultures. Biochem Pharmacol 1993;45:13-9.
13. Heidari M, Sarani S. Growth, biochemical components and ion content of chamomile (*Matricaria chamomilla* L.) under salinity stress and iron deficiency. J Saudi Soc

Agric Sci 2012;11:37-42.
14. Srivastava JK, Shankar E, Gupta S. Chamomile: A herbal medicine of the past with bright future. Mol Med Rep 2010;3:895-901.
15. Zick SM, Wright BD, Sen A, Arnedt JT. Preliminary examination of the efficacy and safety of a standardized chamomile extract for chronic primary insomnia: A randomized placebo-controlled pilot study. BMC Complement Altern Med 2011;11:78.
16. Gardiner P. Chamomile (*Matricaria recutita*, *Anthemis nobilis*). Paris, France: Longwood Herbal Task Force; 1999.
17. Head KA, Kelly GS. Nutrients and botanicals for treatment of stress: Adrenal fatigue, neurotransmitter imbalance, anxiety, and restless sleep. Altern Med Rev 2009;14:114-40.
18. Jäger AK, Saaby L. Flavonoids and the CNS. Molecules 2011;16:1471-85.
19. Motavalizadehkakhky A. Antimicrobial activity and chemical composition of essential oils of chamomile from Neyshabur, Iran. J Med Plants Res 2012;6:820-4.
20. Guimarães R, Barros L, Dueñas M, Carvalho AM, Santos-Buelga C, Queiroz MJ, *et al*. Comparative study of the phenolic profile and antioxidant properties of *Chamaemelum nobile*: Infusion, decoction, and hydroalcoholic extract. Polyphenols Commun 2012;2:483-5.
21. Rice-Evans CA, Miller NJ, Paganga G. Structure-antioxidant activity relationships of flavonoids and phenolic acids. Free Radic Biol Med 1996;20:933-56.
22. Duthie G, Crozier A. Plant-derived phenolic antioxidants. Curr Opin Clin Nutr Metab Care 2000;3:447-51.
23. Croft KD. The chemistry and biological effects of flavonoids and phenolic acids. Ann N Y Acad Sci 1998;854:435-42.
24. Papaioannou P, Lazari D, Karioti A, Souleles C, Heilmann J, Hadjipavlou-Litina D, *et al.* Phenolic compounds with antioxidant activity from *Anthemis tinctoria* L. (*Asteraceae*). Z Naturforsch C 2007;62:326-30.

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