Journal of Chemistry of Goods and Traditional Medicine

J Chem Good Trad Med, Volume 4, Issue 1, 2025 Traditional Medicine

DETERMINATION OF ANTIRADICAL ACTIVITY OF CHESTNUT AND GARLIC ONION

Gofurjon U. Tuychiev
Andijan State Medical Institute Senior teacher of the Department of Pharmaceutical Sciences
https://orcid.org/0000-0002-6631-8471
E-mail: tu.gafur@gmail.com

Ibragim R. Askarov
Andijan State University Professor of the Department of Chemistry, Doctor of Chemistry, Honored Inventor of Uzbekistan, Chairman of the TABOBAT Academy of Uzbekistan
https://orcid.org/0000-0003-1625-0330

Obidjon Sh. Abdulloev
Andijan State University, Acting Professor of the Department of Chemistry, Doctor of Chemical Sciences (DSc), member of the Tabobat Academy of Uzbekistan
https://orcid.org/0000-0003-2289-1273

DOI: https://doi.org/10.55475/jcgtm/vol4.iss1.2025.480

Keywords:
Horse chestnut (Aesculus hippocastanum), garlic (Allium sativum), synthetic preservatives, free radical, 2,2-diphenyl-1-picrylhydrazyl

Annotation
In this scientific work, the antiradical (antioxidant) activity of extracts of horse chestnut (Aesculus hippocastanum) and garlic (Allium sativum) plants was studied. The main goal of the study was to determine the ability of bioactive compounds in these plants, in particular flavonoids, phenolic compounds and organic sulfur substances, to neutralize free radicals. During the work, antiradical activity was assessed using the DPPH (2,2-diphenyl-1-picrylhydrazyl) test. According to the results, high antioxidant activity was observed in garlic extract, which indicates its potential use as a natural antioxidant in medicine and pharmacy. The results of this study expand the possibilities of identifying and using natural antioxidant sources in the production of phytopreparations.

How to Cite
Tuychiev, G. U., Askarov, I. R., & Abdulloev, O. S. DETERMINATION OF ANTIRADICAL ACTIVITY OF CHESTNUT AND GARLIC ONION. Journal of Chemistry of Goods and Traditional Medicine, 4(1). https://doi.org/10.55475/jcgtm/vol4.iss1.2025.480

Introduction. The high reactivity of radicals and their presence in the cells of the body are inextricably linked with vital processes and play an important role in the prooxidant-antioxidant balance in the body. Oxidative damage is caused by endogenous and exogenous factors that generate active oxygen species. Internal sources of oxidants include the mitochondrial electron transport chain and the nitric oxide synthase reaction, as well as non-mitochondrial reactions [1]. In recent years, the topic of free radicals and reactive oxygen species has attracted more attention. Food consumed by humans and environmental conditions significantly affect the generation of free radicals [2-3]. As a result of the influence of endogenous and exogenous factors, as well as normal metabolic processes in the human body, a number of highly active forms of oxygen and nitrogen are constantly formed in the form of free radicals [4]. They are the central link of the concept of the free radical mechanism of

the development of pathological processes in the body [6] and liver damage [5]. As a result of the large amount of formation of free radicals, the oxidative process of destruction of lipids, proteins and DNA is activated. The cellular and antioxidant defense systems fail, and a number of other metabolic changes occur [7]. It contributes greatly to the pathophysiology of human diseases.

LITERATURE ANALYSIS AND METHODOLOGY

The human body has an antioxidant defense system that works with the help of primary antioxidant enzymes and secondary antioxidant vitamin systems [8]. When the human body is exposed to extreme factors such as radiation, poisons, many harmful molecules are produced, and in this case, the body needs more antioxidants [9]. Since free radical molecules are missing one or more electrons, they aggressively attack healthy molecules and cause a chain reaction. Free radicals usually accumulate in cell membranes and begin to eat them, as a result of which the cells of our body gradually disintegrate [10].

Exogenous sources are environmental influences. Excessive formation of free radicals damages the cell's natural antioxidant defenses and leads to deterioration of the body's functionality [11]. An increased burden of free radicals is considered to be the cause of general aging and degenerative diseases of aging. One of the most important strategies to reduce oxidative stress is to consume exogenous antioxidants rich in beneficial components, usually from plant sources [11,12]. Antioxidants stop the rapidly increasing oxidation processes, create inactive particles and remove them from the body [13]. Aromatic plant extracts are known to be promising substitutes for synthetic antioxidants [14,15]. Free radicals are the cause of many diseases in humans and animals. The body's antioxidant system helps neutralize these free radicals. Antioxidants are also widely used in modern practice. Antioxidants are able to neutralize the activity of free radicals, thus protecting cells from oxidation [16]. A number of methods are used to evaluate antioxidant and antiradical activity [17]. The most common are volumetric, photometric, chemiluminescence, fluorescence, electrochemical methods, and biological marker methods [17].

Antioxidants, oxidation inhibitors - substances that prevent or slow down the oxidation of substances by molecular oxygen. Antioxidants include polyatomic phenols, aromatic amines, dialkyl sulfides, dialkyl phosphates and diaryldithiophosphates (zinc salts), dialkyldithiocarbamates (cadmium, zinc salts), etc. The process of oxidation of organic compounds proceeds in the form of a chain reaction; The first stage of oxidation takes place in the presence of free active peroxide radical, alkyl and alkyl radicals. Antioxidants react with these radicals, causing oxidation to stop or slow down – break the chain reaction. Even when added to substances in very small amounts (0,01 – 0,001%), effective antioxidants sharply reduce their oxidation rate, and they do not form oxidation products for a certain period of time (standstill period, induction). The effectiveness of antioxidants depends on the time of their reaction. They give very good results if they are added to the substances before the oxidation process begins.

Spices, various oils, teas, seeds, grains, cocoa pods, fruits and vegetables are used as natural antioxidants. There are compounds with high antioxidant activity of natural compounds, including proven ascorbic acid, tocopherols, carotenoids, as well as flavonoids (quercetin, kaempferol, myricitin), catechins (carnosol, rosmanol, rosamiridiphenol) or various individual antioxidants such as polyphenols and phenolic acids. Based on this, within the scope of this work X1 (1:3), X2 (3:1), X3 (1+1), extract antiradical activity (ARA); (garlic - (Latin Allium satiivum) and common chestnut Aesculus Hippo-castanum L) relative to a stable free radical stable free radical DFPG (2,2- diphenyl-1- picrylhydrazyl).

Materials. Based on 3 different samples:

1. №1 X1 Extract; (1:3),(chestnuts and garlic)
2. №1 X2 Extract; (3:1),
3. №1 X3 Extract; (1:1),

Method DFPG. In this study, we used spectrophotometric measurement of the kinetics of reduction of stable radical 2,2-diphenyl-1-picrylhydrazyl (DFPG) molecules by antioxidants to evaluate ARA. The method is based on the interaction of antioxidants with stable chromogenic radical 2,2-diphenyl-1-picrylhydrazyl (DFPG). A standard solution of DFPG (5x10-4 M) in ethanol acidified with acetic acid was diluted 1:10 with ethanol to obtain a working solution. The resulting solution should have an optical density not higher than 0,9 at 517 nm. 50 mkl of plant extracts were added to 5 ml of DFPG working solution, mixed, and the kinetics of the decrease in optical density of the solution was recorded at a wavelength of 50 nm for 30 minutes. DFPG working solution was used as a control sample.

Antiradical activity is determined by the following formula:

$$\%\, Inhibition = \frac{Akontr - AxAkontr}{Akontr} \cdot 100$$

Here, A x is the optical density of the test solution, and the numerator is the optical density of the test sample

Discussion of results.

Antioxidants can have different mechanisms of action, it is recommended to study their activity using different methods. In this study, ARF extracts were evaluated in relation to the free radical DFPG. When test plant compounds are added to an aqueous solution of DFPG, the free radical molecules are converted to non-radical forms, and the intensely purple solution of DFPG is decolorized. Shows the kinetics of the change in the optical density of the DFPG solution upon addition of the studied samples.

To compare the ARF of the test samples, a concentration of 50 µl of each extract was selected from the solution provided. As samples 1-3 showed very high ARF, we diluted 1:100 with the appropriate solvent (DMSO).

Analyzing the obtained results, we can conclude that when added to the solution of DFPG obtained from the examined preparations No. 1-3, a sharp decrease in the optical density of the DFPG solution is observed, which indicates their high ARF. ARF for 1 samples was evaluated after 100-fold dilution, indicating a clear antiradical ability of the plant extracts.

Table 1. Optical densities of DFPG solutions added to samples at different concentrations.

Plant name	optical density, D	Time, minute	Concentration
№1	0.1	30	0.02
№1	0.2		0.10
№1	0.3	25	0.18
№1	0.4		0.29
№1	0.5	20	0.34
№1	0.6		0.41
№1	0.7	15	0.48
№1	0.8		0.52
№1	0.9	10	0.59
№1	1.0		0.65
№1	1.1	5	0.72
№1	1.2		0.80
№1	1.3	0	0.87
№2	0.1	30	0.14

№2	0.2		0.22
№2	0.3	25	0.39
№2	0.4		0.36
№2	0.5	20	0.41
№2	0.6		0.47
№2	0.7	15	0.56
№2	0.8		0.64
№2	0.9	10	0.77
№2	1.0		0.79
№2	1.1	5	0.88
№2	1.2		0.94
№2	1.3	0	1
№3	0.1	30	0.19
№3	0.2		0.28
№3	0.3	25	0.33
№3	0.4		0.44
№3	0.5	20	0.51
№3	0.6		0.58
№3	0.7	15	0.64
№3	0.8		0.74
№3	0.9	10	0.78
№3	1.0		0.89
№3	1.1	5	0.92
№3	1.2		0.97
№3	1.3	0	1

Based on non-linear regression. The concentration of DFPG is 0.1 mM. Measurements were performed at 20°C immediately after the addition of the tested extracts. The concentration of the studied extracts is 50 mkl of the previously given solution. X1 (1:3), X2 (3:1), X3 (1:1) samples were diluted 100-fold with appropriate solvents (water).

Changes in the optical density of the aqueous solution of DFPG with the addition of the tested plant extracts over time compared to the control.

According to experimental data, extracts number 1 have the highest ability to remove free radicals from the body. To quantify the antiradical activity, we used the stable radical 2,2-diphenyl-1-picrylhydrazyl (DFPG) as well as t50 indicators. The time required to reduce the initial concentration of the radical for the studied drugs has 50% inhibitory activity.

In the reaction of DFPG with extracts at 20 oS t50 № 1 9.1±0.34, for a sample №1 49.02±2.11 (dilute 100 times) for a sample. №2 9.8±0.42, for a sample №2 45.15±1.02 (dilute 100 times) for a sample. №3 9.9±0.71, for a sample №3 48.62±1.20 (dilute 100 times) for a sample (Table 2).

Table 2. 50% (IC50) inhibitory concentration values and time required to reduce DFPG concentration by 50% (t50) when reacting with tested extracts.

№ Extracts from plants	**IC_{50}, mkl**	**t_{50}, sec 50 mkl substance**
№1	9.1±0.69	9.18±0.33
№1 (diluted)	49.02±2.11	58.13±1.17
№2	7.1±0.57	11.7±0.80
№2 (diluted)	45.15±1.02	56.08±2.13

№3	9.9±0.71	7.9±0.66
№3 (diluted)	48.62±1.20	47.42±1.31

Analysis of the experimental results obtained in the study of the extracts showed that free radical №1 had the highest ARF compared to DFPG. Thus, the antiradical activity of plant extracts was studied. The highest antiradical activity was found in water X1 (1:3), aqueous extract of the extract was selected. There is sufficient data in the literature on the antiradical activity of medicinal plant extracts, and their maximum effect was found in the extracts containing the highest amount of polyphenols and flavonoids. Thus, further work and creation of the ARF mechanism requires a detailed study of the qualitative and quantitative composition of extracts for the composition of components (polyphenols, flavonoids, tannins, alkaloids, etc.). After conducting these tests, the goal was to create a separate dietary supplement from these medicinal plants, based on the data.

References

1. Gilca M., Stoian I., Atanasiu V., Virgolici B. The oxidative hypothesis of senescence // J. Postgrad. Med. 2007. N. 53(3). R. 207–213.
2. Клебанова Е.М., Балаболкин М.И., Креминская В.М., Смирнов Л.Д. Липиднижающее и антиоксидантное действие мексикора у больных сахарным диабетом // Терапевтический архив. 2006. №8. С. 67–70.
3. Федосеева А.А. Антиоксидантная активность настоев чая // Химия растительного сырья. 2008. №3. С. 123–127.
4. Chemistry, physiology and pathology of free radicals/L.Bergendi, L.Benes, Z.Durackova, M.Ferencik// Life Sci.-1999.-Vol.65, №18-19.-P.1865-1874.
5. Feher J., Lengyel G., Blazovics A. Oxidative stress in the liver and biliary tract diseases//Scand. J.Gastroenterol.-1998.-Vol.33.-P.38-46.
6. Juurlink B.H., Paterson P.G. Review of oxidative stress in brain and spinal cord injury: suggestions for pharmacological and nutritional management strategies//J. Spinal Cord. Med.-1998.-Vol.21, №4.-P.309-334.
7. Spector A. Review: Oxidative stress and disease //J.Ocul. Pharmacol. Ther.-2000.-Vol.16, №2.-P.193-201.
8. Рябинина Е.И., Зотова Е.Е., Пономарева Н.И., Рябинин С.В. Сравнителн ое исследование мелиссы лекарственной и шалфея лекарственного на содержание полифенолов // Вестник ВГУ. Серия: Химия. Биология. Фарматsiя. 2009. №2. С. 32–36.
9. Хайруллина В.Р., Гарифуллина Г.Г., Герчиков А.Я. Антиокислителная активност экстрактов растений сем. Геранласеае, Росасеае на примере модельной реакции окисления изопропилового спирта // Хим.-фарм. журн. 2005. № 3. С. 28–30.
10. Лапин А.А., Зеленков В.Н., Музычук А.С. Антиоксидантная емкость водорастворимых полисахаридов растительного сырья // Тезисы материалов ИВ Всеросс. научной конф. «Химия и технология растительных веществ». – Сыктывкар. 2006. С. 257.
11. Oxidative stress, antioxidants, aging and disease /Cutler R.G., Packer L., Bertram J., Mori A. (eds) // Oxidative Stress and Aging. Molecular and Cell Biology Updates.Birkhäuser Basel. 1995. R. 1–14. DOI.org/10.1007/978-3-0348-7337-6_1
12. Ames B.N., Shigenaga M.K., Hagen T.M. Oxidants, antioxidants, and the degenerative diseases of aging // Proc. Natl. Acad. Sci. USA. 1993. Vol. 90. R. 7915–7922.
13. Ананикян В.В., Ерибекян М.И., Топчян А.В., Ревазова Л.В. Изучение антирадикальной активности некоторых лекарственных и Хасанов В.В., Рыжова Г.Л., Малсева Е.В. Методы исследования антиоксидантов // Химия растительного сырья. 2004. № 3. С. 63–75.

14. Шутова, А. Г. Антиокислительные свойства экстрактов пряноаромати- ческих растений семейства Губоцветных / А. Г. Шутова, Т. Г. Шутова, В. Е. Агабеков // Весці НАН Беларусі. Сер. хім. навук. –2003. – № 1. – С. 41–47.
15. Антирадикальная активность растительных экстрактов и их оздоровительно-профилактичекие комбинации с фосфолипидным комплексом / В. С. Баранова [и др.] // Биомедицинская химия. – 2012. Т. 58. – Вып. 6. – С. 712–726.
16. Stress and Chronic Degenerative Diseases. A Role for Antioxidants, Intech Open Access Publisher, Croatia. 2013. R. 331–356 DOI: 10.5772/51609
17. Хасанов, В. В. Методы исследования антиоксидантов / В. В. Хасанов, Г. Л. Рыжова, Е. В. Мальцева // Химия растительного сырья. – 2004. – № 3. – С. 63–75.