Journal of Chemistry of Goods and Traditional Medicine

J Chem Good Trad Med, Volume 3, Issue 6, 2024 Traditional Medicine

DETERMINING THE ANTIOXIDANT ACTIVITY OF MIXTURES OF HAZELNUT, CINNAMON, AND BARBERRY

Shakhobiddin M. Kirgizov
Andijan State University Professor of the Department of Chemistry, Doctor of Chemical Sciences
https://orcid.org/0009-0009-4718-5077

Sevara F. Abdullaeva
Andijan State University 2nd year PhD student in the specialty "Chemistry of Goods"
https://orcid.org/0009-0004-9331-438X
E-mail: angel228709@gmail.com

DOI: https://doi.org/10.55475/jcgtm/vol3.iss6.2024.433

Keywords:
cinnamon, barberry, hazelnut, antioxidant activity, biologically active compounds

Annotation

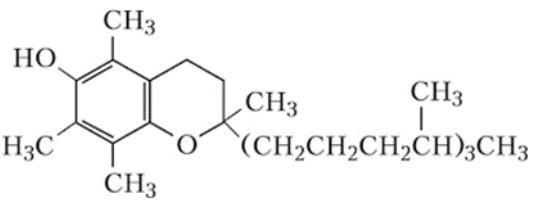
Modern food chemistry and folk medicine focus on creating biologically active supplements based on natural antioxidants. The study analysed the antioxidant properties of hazelnut, cinnamon, and barberry extracts. The results showed that mixing these substances enhances their antioxidant activity. This research provides valuable information for developing supplements based on natural antioxidants.

How to Cite

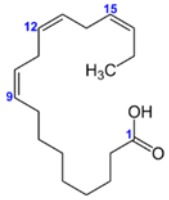
Kirgizov, S. M., & Abdullaeva, S. DETERMINING THE ANTIOXIDANT ACTIVITY OF MIXTURES OF HAZELNUT, CINNAMON, AND BARBERRY. Journal of Chemistry of Goods and Traditional Medicine, 3(6). https://doi.org/10.55475/jcgtm/vol3.iss6.2024.433

Introduction. The modern food industry strives to develop new technologies and products aimed at improving human health and preventing diseases. Among them, food supplements based on natural antioxidants are one of the rapidly developing areas [1]. Natural antioxidants play a crucial role in reducing the formation of free radicals in the body, preventing oxidative damage and protecting cells. Therefore, food supplements made from bioactive plant products can be an effective means of preventing liver diseases, cardiovascular disorders, and metabolic diseases [2].

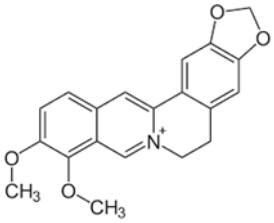
Traditional medicine and modern scientific research show that hazelnut (Corylus avellana), cinnamon (Cinnamomum verum), and barberry (Berberis vulgaris) contain a high concentration of biologically active compounds with antioxidant and hepatoprotective effects. The omega-3 fatty acids and tocopherols in hazelnuts play an important role in protecting liver cells from oxidative damage [3]. Cinnamon is rich in antioxidant and anti-inflammatory properties, and its extracts help reduce liver fat accumulation and improve metabolic processes [4]. Barberry contains berberine, which has been scientifically proven to exhibit hepatoprotective effects and stimulate bile secretion [5].



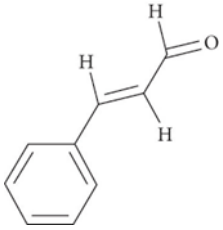
α-tocopherol (vitamin E)



α-linolenic acid (Omega-3)



Berberine



Cinnamaldehyde

In this study, the antioxidant activity of mixtures prepared in different ratios of hazelnut, cinnamon, and barberry was evaluated. The ability of these mixtures to neutralize free radicals was examined using the inhibition of adrenaline autoxidation in vitro. The results of the study help determine the optimal ratio and provide a scientific basis for assessing the effectiveness of these natural products as food supplements.

Experimental Section. In this experiment, we used hazelnuts and barberries grown in Uzbekistan, as well as cinnamon samples imported from India as a food product. The compositions of the samples in various ratios are presented in Table 1.

Equipment and Reagents Used.

Ground and dried hazelnut kernels, Indian cinnamon, barberry, adrenaline tartrate (0.18%), ethanol (96%), buffer solution (Na_2CO_3-$NaHCO_3$, pH=10.65), syringe filter, spectrophotometer cuvette K7000 (YOKE, China).

Determination of Antioxidant Activity of the Samples

The antioxidant activity of the given samples was assessed using the inhibition method of adrenaline autoxidation in vitro. The ability of the samples to inhibit adrenaline autoxidation and prevent the formation of reactive oxygen species (ROS) was evaluated. The antioxidant activity of the tested samples was expressed as a percentage of adrenaline autoxidation inhibition (AA%) [6, 7].

Preparation of Sample Extracts

The extracts of the samples were prepared using two different methods [8]:

1. Aqueous Extraction: 0.75 g of the plant sample was boiled in 25 ml of water for 10 minutes in a flask equipped with a reflux condenser. The obtained extract was filtered through a 0.45 µm syringe filter and used for analysis.
2. Ethanolic Extraction: 0.75 g of the plant sample was subjected to ultrasonic extraction in 25 ml of 96% ethanol at 60°C for 20 minutes. The obtained extract was filtered through a 0.45 µm syringe filter and used for analysis.

Spectrophotometric Analysis

A total of 3 ml of 0.2 M carbonate buffer (Na_2CO_3-$NaHCO_3$, pH=10.65) and 0.14 ml of 0.18% adrenaline tartrate solution were mixed quickly and placed in a 10 mm thick spectrophotometer cuvette (K7000, YOKE, China). The optical density (D1) was measured at 347 nm every 30 seconds for 10 minutes. The measured optical densities of adrenaline and the aqueous and alcoholic extracts of the samples are presented in Table 2.

For the plant extract analysis, 45 µl of the tested plant extract, 3 ml of buffer solution, and 0.14 ml of 0.18% adrenaline tartrate solution were mixed using the same method. The optical density (D2) was measured at 347 nm.

Table 1

Composition of samples in different ratios

Sample Name	Sample №1	Sample №2	Sample №3	Sample №4
Hazelnut	1	2	1	1
Cinnamon	1	1	2	1

Barberry	1	1	1	2

Table 2

Measured Optical Densities of Adrenaline, Aqueous and alcoholic Extracts of Samples

Time (sec)	Adrenaline (D_1)	Sample №1 (Water)	Sample №2 (Water)	Sample №3 (Water)	Sample №4 (Water)	Sample №1 (Ethanol)	Sample №2 (Ethanol)	Sample №3 (Ethanol)	Sample №4 (Ethanol)
0	0,037	0,102	0,058	0,105	0,068	0,002	0,021	0,022	0,022
30	0,063	0,199	0,165	0,217	0,152	0,018	0,03	0,042	0,038
60	0,09	0,287	0,262	0,311	0,226	0,04	0,038	0,062	0,056
90	0,117	0,365	0,342	0,388	0,289	0,059	0,046	0,082	0,078
120	0,144	0,427	0,41	0,45	0,342	0,079	0,053	0,102	0,092
150	0,172	0,481	0,465	0,497	0,386	0,098	0,062	0,121	0,11
180	0,198	0,522	0,509	0,534	0,421	0,116	0,07	0,141	0,128
210	0,222	0,555	0,543	0,561	0,449	0,133	0,078	0,158	0,146
240	0,248	0,582	0,568	0,583	0,474	0,148	0,086	0,176	0,162
270	0,271	0,604	0,588	0,6	0,494	0,163	0,094	0,192	0,18
300	0,294	0,622	0,606	0,614	0,513	0,178	0,102	0,207	0,195
330	0,314	0,636	0,62	0,63	0,53	0,193	0,109	0,222	0,209
360	0,332	0,648	0,632	0,64	0,546	0,208	0,118	0,236	0,222
390	0,347	0,658	0,642	0,651	0,56	0,222	0,127	0,248	0,237
420	0,363	0,666	0,651	0,659	0,575	0,233	0,134	0,261	0,25
450	0,378	0,672	0,66	0,668	0,588	0,247	0,142	0,273	0,262
480	0,393	0,679	0,669	0,674	0,601	0,26	0,149	0,285	0,274
510	0,408	0,684	0,677	0,675	0,612	0,272	0,156	0,295	0,283
540	0,422	0,688	0,682	0,668	0,622	0,284	0,163	0,306	0,295
570	0,44	0,69	0,681	0,663	0,631	0,298	0,169	0,316	0,306
600	0,462	0,685	0,675	0,657	0,635	0,31	0,176	0,325	0,316

Results and Discussions

The antioxidant activity of the tested samples was expressed as the percentage of adrenaline autoxidation inhibition (AA%) and calculated using the following formula. The obtained results are presented in Table 3.

$$AF = \frac{(D_1 - D_2) \cdot 100}{D_1}$$

Here, D_1 is the optical density of the adrenaline tartrate solution added to the buffer, and D_2 is the optical density of the sample extract with adrenaline tartrate added to the buffer.

Table 3

Antioxidant Activity Values of Aqueous and alcoholic Extracts of Samples

Time	AF, %							
	N1 water	N2 water	N3 water	N4 water	N1 Ethanol	N2 Ethanol	N3 Ethanol	N4 Ethanol
1-minute	-	-	-	-	55.6	57.78	31.1	37.8
3-minute	-	-	-	-	41.4	64.65	28.8	35.4
5-minute	-	-	-	-74.5	39.5	65.31	29.6	33.7
10-minute	**-48.3**	**46.1**	**-42.2**	**-37.4**	**32.9**	**61.90**	**29.7**	**31.6**

The increase in the optical densities of adrenaline and sample extracts is presented in the following diagrams.

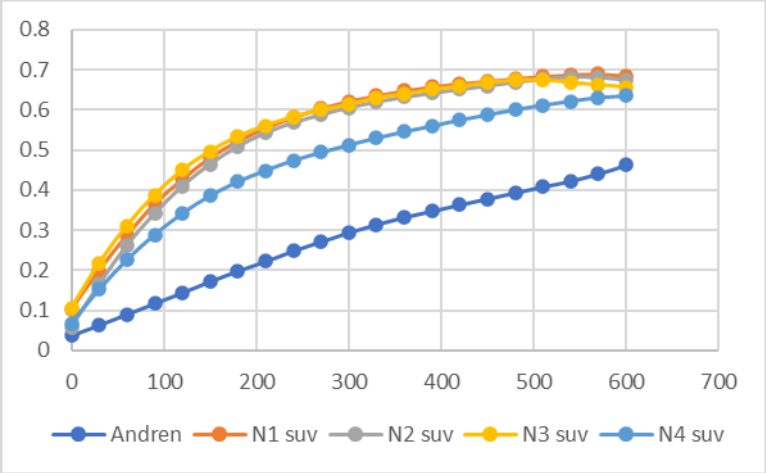


Figure 1. Growth diagram of optical densities of adrenaline and aqueous sample extracts with adrenaline (λ = 347 nm).

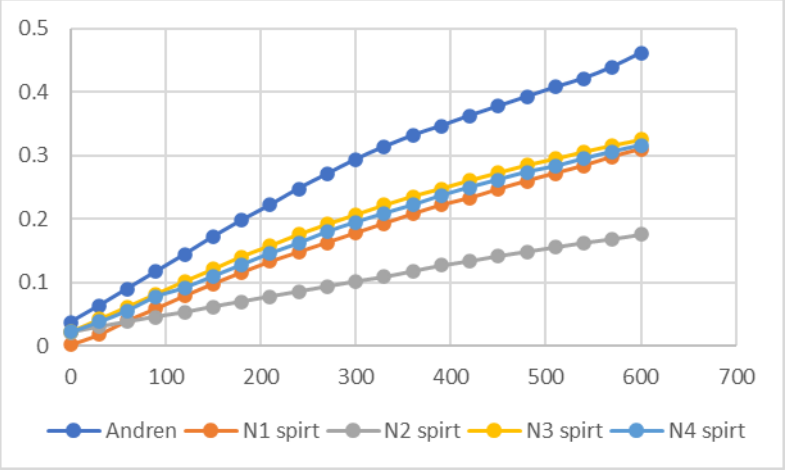


Figure 2. Growth diagram of optical densities of adrenaline and ethanol sample extracts with adrenaline (λ = 347 nm).

From the obtained results, it can be observed that in the initial minutes, the aqueous extracts exhibited prooxidant activity, whereas all ethanol extracts demonstrated antioxidant activity exceeding 10% within 10 minutes. Additionally, in the aqueous extracts, the prooxidant activity decreased over time compared to the initial minutes. The highest antioxidant activity was observed

in Sample №2 (N2), with 46.1% in the aqueous extract and 61.9% in the ethanol extract. Thus, as an optimal alternative, the hazelnut, cinnamon, and barberry ratio can be 2:1:1.

Conclusion. In this study, the antioxidant activity of various ratios of mixtures prepared from hazelnut (Corylus avellana), cinnamon (Cinnamomum verum), and barberry (Berberis vulgaris) was evaluated by inhibiting the in vitro autoxidation of adrenaline. The results showed that Sample №2 exhibited the highest antioxidant activity and was selected as the optimal ratio. This natural blend serves as a source of antioxidants, with its combination effectively neutralizing free radicals.

We believe that future research should focus on the chemical composition, biological activities, and potential applications of this mixture in traditional medicine and the food industry. This approach demonstrates the promising potential of developing food supplements based on natural antioxidants.

References

1. World Health Organization. Traditional Medicine Strategy: 2014-2023. Geneva: WHO, 2013.
2. Zhao, X. et al. Hepatoprotective effects of natural antioxidants: A systematic review. Journal of Functional Foods, 2019, №57, P.317-328.
3. Ghorbanian, A. et al. Effect of omega-3 fatty acids on liver function and oxidative stress markers. Nutrition Research, 2021, №85, P.19-28.
4. Zhang, Y. et al. Cinnamon extract and its effect on metabolic disorders and fatty liver disease. Phytomedicine, 2020, №68, P.152-176.
5. Singh, R. et al. Berberine and its hepatoprotective properties: Mechanisms and clinical applications. Biomedicine & Pharmacotherapy, 2018, №108, P.1876-1885.
6. Патент. RU2144674C1. Способ определения антиоксидантной активности супероксиддисмутазы и химических соединений. 2000. Url: https://patentimages.storage.googleapis.com/4b/17/a7/c0848d28409d60/RU2144674C1.pdf.
7. Рябинина, Е. И., Зотова, Е. Е., Ветрова, Е. Н., Пономарева, Н. И., & Илюшина, Т. Н. Новый подход в оценке антиоксидантной активности растительного сырья при исследовании процесса аутоокисления адреналина. Химия растительного сырья-2011- №3, С-117-121.
8. Askarov, I. R., Abdullaev, S. S., Mamatkulova, S. A., & Abdulloev, O. S. ANTIOXIDANT ACTIVITY AND ELEMENTAL COMPOSITION OF MIXTURES OF FIG AND COMMON UNABI FRUITS. Journal of Chemistry of Goods and Traditional Medicine, 2024, Vol 3, №3, P.179–205., https://doi.org/10.55475/jcgtm/vol3.iss3.2024.320.