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DETERMINATION OF THE ANTIRADICAL ACTIVITY OF THE LEAVES AND STEMS OF WATER PEPPER (PERSICARIA MINOR) AND COMMON CHICORY (CICHORIUM INTYBUS L).

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Keywords: Water pepper (*Persicaria minor*), leaf, common chicory (*Cichorium intybus L*) stem, extract, antioxidant activity, DPPH, ARA%, IC_{50}, free radicals

Annotation.

This article examines the leaves of water pepper (*Persicaria minor*) and common sprinkler (*Cichorium intybus L*) The anti-radical activity of alcohol extracts prepared from the stems in various proportions was assessed using the DPPX method. The ability of extracts to inhibit free radicals was determined by the decrease in light absorption by the DPPN solution. According to the results, leaf and stem extract showed the highest activity at a 1:1 ratio: ARF was 45.80%, and IC50 after 30 minutes was 108.77 µl. Extracts in 3:1 and 1:3 ratios also possessed antioxidant properties, however, the 1:1 ratio proved to be the most effective. The obtained results confirm the potential of water pepper extracts as a natural antioxidant.

How to Cite

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Introduction. Free radicals formed during the oxidation of proteins and lipids intensify oxidative stress in the human body and cause the development of various pathological conditions. They play an important role in the pathophysiological processes associated with diseases such as inflammatory processes, diseases of the digestive and urinary systems, hemorrhoids, circulatory insufficiency, tuberculosis [1,2]. Therefore, identifying natural plant-based antioxidants and assessing their potential applications in the food and pharmaceutical industries is one of the urgent scientific tasks today.

Water pepper (*Persicaria minor*) is a Polygonaceae family plant widely distributed in the Asian region and used for food and medicinal purposes [3]. The plant's leaves and stems contain flavonoids, phenolic compounds, and other biologically active substances, whose high antioxidant activity has been noted in several studies [4,5]. However, the activity of extracts prepared from a mixture of leaves and stems in various proportions against free radicals has not been sufficiently studied.

The DFPG (2,2-diphenyl-1-picrylhydrazyl) method is a spectrophotometric analysis based on a stable free radical and is widely used to evaluate the antiradical activity of plant extracts [6]. This method allows for quick and reliable determination of the extract's ability to inhibit free radicals.

Common chicory (*Cichorium intybus L*) is a perennial plant of the Asteraceae family, widely distributed in Europe and Asia. It grows mainly along roadsides, field edges, and meadows. The plant's root, stem, and leaves have healing properties.

Common locust (*Cichorium intybus L*) contains inulin, phenolic compounds, flavonoids, bitter glycosides, and vitamins that have antioxidant, anti-inflammatory, and digestive properties. In folk medicine, common chicory (*Cichorium intybus L*) is used as a diuretic, maintaining liver function and improving metabolism.

LITERATURE ANALYSIS AND METHODOLOGY

In recent years, oxidative stress associated with the action of free radicals has been considered an important factor in the development of various diseases in the body, including cardiovascular diseases, diabetes mellitus, inflammatory and oncological diseases. Therefore, finding antioxidant compounds from natural sources and evaluating their biological activity is one of the urgent scientific directions.

Extracts prepared based on plant raw materials contain phenolic compounds, flavonoids, ascorbic acid, terpenoids, and other biologically active substances that have the property of neutralizing free radicals. Studies show that alcohol and water extracts obtained from the leaves, stems, and above-ground parts of plants exhibit high antiradical activity.

One of the widely used methods for assessing antiradical activity is the spectrophotometric method based on the free radical of 2,2-diphenyl-1-picrylhydrazyl (DPPH). This method is distinguished by its simplicity, speed, and reproducibility of results. In the DPPN method, the discoloration of the violet solution of DPPN is observed based on the ability of antioxidant substances to donate a hydrogen atom or an electron.

The DPPH method proposed by Blois was subsequently improved by many scientists and successfully used to evaluate the antiradical activity of various plant extracts. According to literature data, extraction conditions, solvent type, raw material and solvent ratio, and extract concentration significantly influence antiradical activity.

A number of studies have established that extracts prepared by mixing plant parts in various proportions exhibit higher antioxidant activity compared to individual extracts. This is explained by the synergistic effect, which indicates the presence of a mutually enhancing effect of biologically active compounds.

Also, in the literature, the IC_{50} indicator is noted as an important parameter in the quantitative assessment of antiradical activity. The low IC_{50} value indicates strong antioxidant properties of the extract. Therefore, in modern research, the DPPH method is widely used to determine the values of ARF (%) and IC_{50}.

Analysis of the above-mentioned literature indicates that the study of the antiradical activity of extracts prepared in various proportions based on plant raw materials has important scientific and practical significance, and their use as a natural source of antioxidants is a promising direction.

Natural antioxidants are widely used in food products, medicinal plants, and various natural products that protect the body from oxidative stress by neutralizing free radicals. Spices, various vegetable oils, teas, seeds, grains, cocoa peels, fruits, and vegetables are used as natural antioxidants. They contain ascorbic acid, tocopherols, carotenoids, flavonoids (quercetin, campferol, miricitin), catechins (carnosol, rosmanol, rosamyridifenol), as well as polyphenols and phenolic acids, which have high antioxidant activity.

Based on this, within the framework of this work, the anti-radical activity (ARF) of extracts prepared in various ratios - **X1 (1:3), X2 (3:1), X3 (1:1)** was evaluated against the stable free radical **DPPG (2,2-diphenyl-1-picrylhydrazyl)** . Extracts used in the work:

X1 extract (1:3) - Water pepper (*Persicaria minor*) and common chicory (*Cichorium intybus L*) leaves (*Cichorium intybus L*)

X2 extract (3:1) - Water pepper (*Persicaria minor*) and common chicory (*Cichorium intybus L*) leaves (*Cichorium intybus L*)

X3 extract (1:1) - Water pepper (*Persicaria minor*) and common chicory (*Cichorium intybus L*) leaves (*Cichorium intybus L*)

Preparation of the working solution of DPPN•. A 7.92 mM solution of DPPN• in ethanol was prepared in a 100 ml volumetric flask, wrapped in aluminum paper, and kept in a dark place at room temperature for 30 minutes.

Preparation of sample extracts. Preparation of sample extracts. Alcohol samples based on water pepper and common chicory (*Cichorium intybus L*) were prepared in various proportions to test antioxidant properties.

The preparation of the sample extracts was carried out by extracting 1 g of the plant sample in 25 ml of 96% ethanol for 20 minutes in an ultrasonic bath. The obtained extract was passed through a 0.45 µm syringe filter and used for analysis. [4]. All filtered samples were diluted by a factor of 10.

Determination of the anti-radical properties of the samples. 3 ml of DPFN solution and 100 µl of ethanol (empty sample) were added to a quartz cuvette with a volume of 4 ml, placed in a spectrophotometer, and the light absorption at a wavelength of 517 nm (D_1) was measured every 5 minutes for 30 minutes on a K7000 spectrophotometer manufactured by YOKE (China). To assess the antiradical properties of the sample, 25, 50, 75, 100 µl of the sample was mixed with 3 ml of DPPF solution and the light absorption at 517 nm (D_2) was measured in the above order. To bring the total volume of the solution in the cuvette to 3.1 ml, ethanol was added to the remaining portion. The anti-radical properties of the samples were calculated using the following formula:

$$ARF\% = \frac{D_1 - D_2}{D_1} \cdot 100\%$$

The obtained results are presented in the following table:

Table 1. Empty and examined **water pepper leaf,** added to DPFN solution **Common sprinkler (*Cichorium intybus L*)** Measured light absorption and calculated anti-radical activity values of samples extracted with **alcohol in a 1:1 ratio.**

Size, µl	Time, min.	sample					
		Abs, D	ARF%		Time, min.	Abs, D	ARF%
25.	0	0.869	0.00	75.	0	0.869	0.00
	5.	0.823	5.29		5.	0.657	24.40
	10.	0.806	7.25		10.	0.639	26.47
	15.	0.784	9.78		15.	0.621	28.54
	20.	0.769	11.51		20.	0.606	30.26
	25.	0.756	13.00		25.	0.591	31.99
	30.	0.742	**14.61**		**30.**	0.578	**33.49**
50.	0	0.869	0.00	100.	0	0.869	0.00
	5.	0.741	14.73		5.	0.579	33.37
	10.	0.722	16.92		10.	0.558	35.79
	15.	0.703	19.10		15.	0.541	37.74
	20.	0.688	20.83		20.	0.522	39.93

	25.	0.666	23.36		25.	0.499	42.58
	30.	0.641	**26.24**		**30.**	0.471	**45.80**

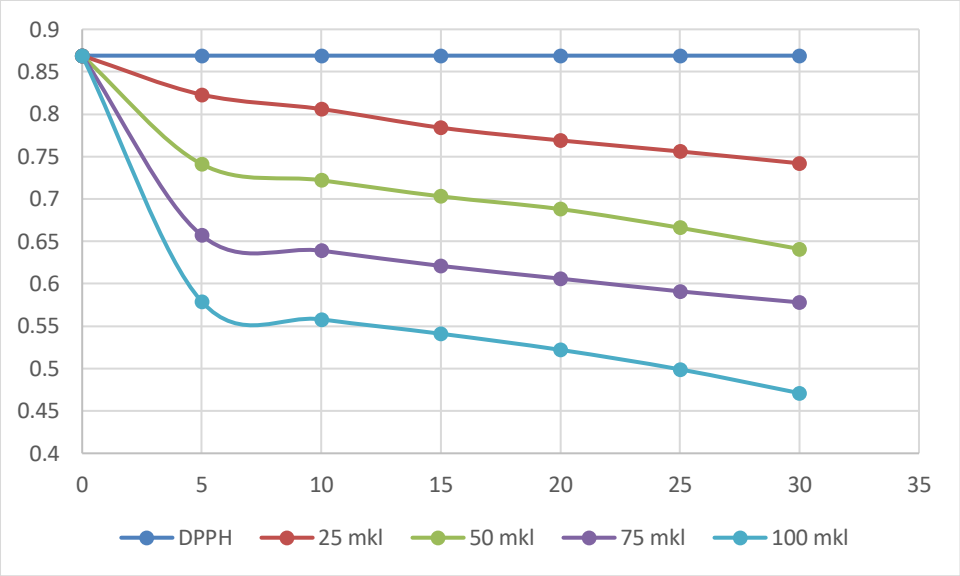


Figure 1. Graphical representation of the measured light absorption by solutions of empty and tested alcohol extraction samples added to the DPPH solution.

To calculate the inhibiting concentration of the samples $_{IC50}$ - 50% DPPN solution in each experiment, the following graph was constructed based on the anti-radical activity (ARA%) values at the 30th minute and the volume of added alcohol samples, and calculated based on the trend line function drawn on it.

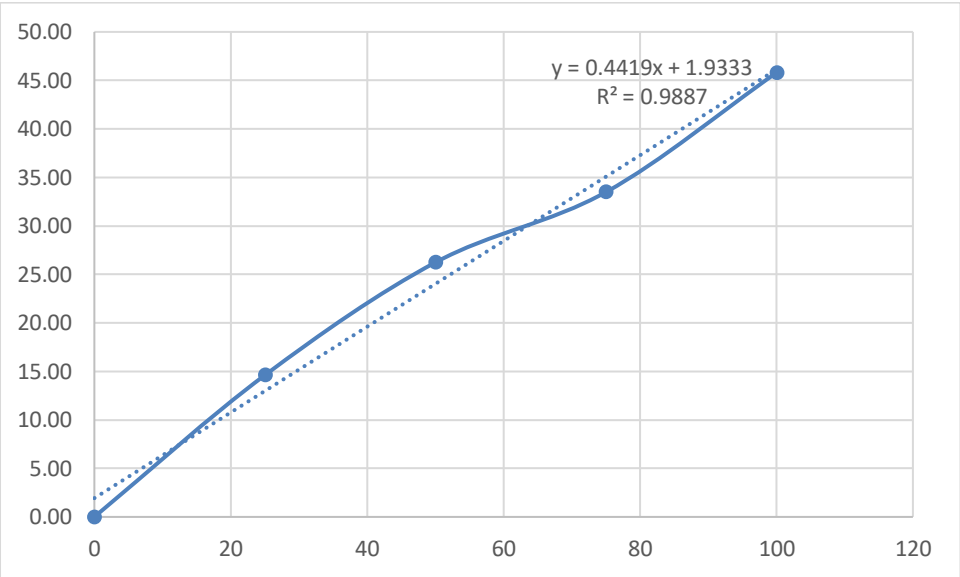


Figure 2. Graph of the dependence between ARA% and the volumes of the alcohol extracted sample, determined at the 10th minute.

The trend line transferred to the graph is calculated based on the formula of the function y=mx+b representing 50% of the volume ARA% (IC_{50}) using the formula x= (y-b) /m:

$$IC_{50} = \frac{(50 - 1{,}9333)}{0{,}4419} = 108{,}77\ mkl$$

Table 2. Empty and examined **water pepper leaf,** added to DPFN solution **Common sprinkler (*Cichorium intybus L*)** Measured light absorption values and calculated anti-radical activity values **alcohol** extraction in a ratio **3:1.**

Size, µl	Time, min.	sample					
		Abs, D	ARF%		Time, min.	Abs, D	ARF%
25.	0	0.866	0.00	75.	0	0.866	0.00
	5.	0.834	3.70		5.	0.667	22.98
	10.	0.803	7.27		10.	0.649	25.06
	15.	0.786	9.24		15.	0.633	26.91
	20.	0.765	11.66		20.	0.613	29.21
	25.	0.744	14.09		25.	0.598	30.95
	30.	0.728	**15.94**		**30.**	0.573	**33.83**
50.	0	0.866	0.00	100.	0	0.866	0.00
	5.	0.756	12.70		5.	0.607	29.91
	10.	0.737	14.90		10.	0.579	33.14
	15.	0.714	17.55		15.	0.544	37.18
	20.	0.697	19.52		20.	0.527	39.15
	25.	0.679	21.59		25.	0.505	41.69
	30.	0.657	**24.13**		**30.**	0.484	**44.11**

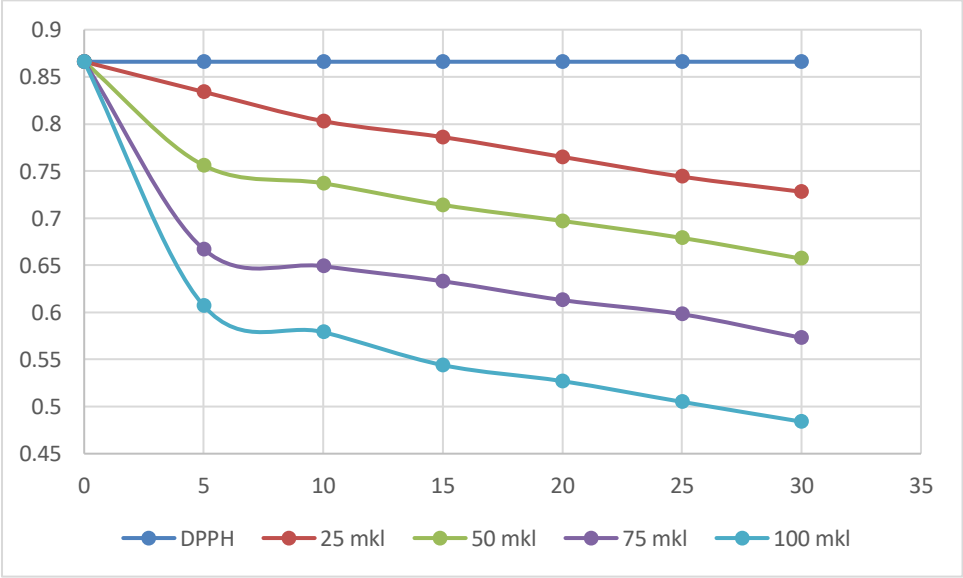


Figure 3. Graphical representation of the measured light absorption by solutions of empty and tested alcohol extraction samples added to the DPPH solution.

To calculate the inhibiting concentration of the samples IC_{50} - 50% DPPN solution in each experiment, the following graph was constructed based on the anti-radical activity (ARA%) values at the 30th minute and the volume of added alcohol samples, and calculated based on the trend line function drawn on it.

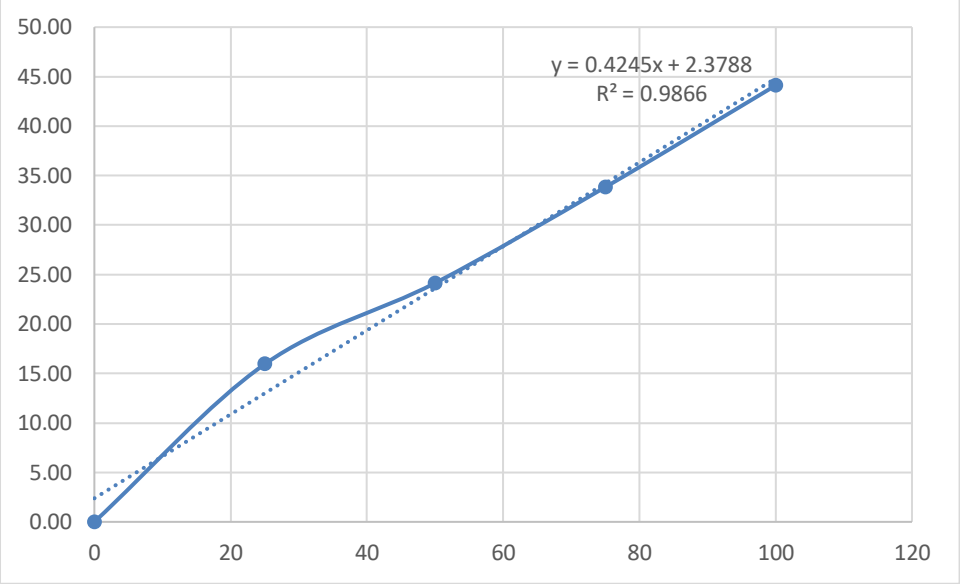


Figure 4. Graph of the dependence between ARA% and the volumes of the alcohol extracted sample, determined at the 10th minute.

The trend line transferred to the graph is calculated based on the formula of the function y=mx+b representing 50% of the volume ARA% (IC_{50}) using the formula x= (y-b) /m:

$$IC_{50} = \frac{(50 - 2{,}3788)}{0{,}4245} = 112{,}18\ mkl$$

Table 3. Empty and examined **water pepper leaf,** added to DPFN solution **Common sprinkler (*Cichorium intybus L*)** Measured light absorption values and calculated anti-radical activity values of samples extracted with **alcohol in a 1:3 ratio.**

Size, µl	Time, min.	sample					
		Abs, D	ARF%		Time, min.	Abs, D	ARF%
25.	0	0.867	0.00	75.	0	0.867	0.00
	5.	0.852	1.73		5.	0.76	12.34
	10.	0.836	3.58.		10.	0.738	14.88
	15.	0.827	4.61		15.	0.719	17.07
	20.	0.815	6.00		20.	0.699	19.38
	25.	0.794	8.42		25.	0.681	21.45
	30.	0.776	**10.50**		**30.**	0.664	**23.41**
50.	0	0.867	0.00	100.	0	0.867	0.00
	5.	0.803	7.38		5.	0.692	20.18

	10.	0.785	9.46		10.	0.673	22.38
	15.	0.76	12.34		15.	0.647	25.37
	20.	0.739	14.76		20.	0.625	27.91
	25.	0.726	16.26		25.	0.604	30.33
	30.	0.706	**18.57**		**30.**	0.586	**32.41**

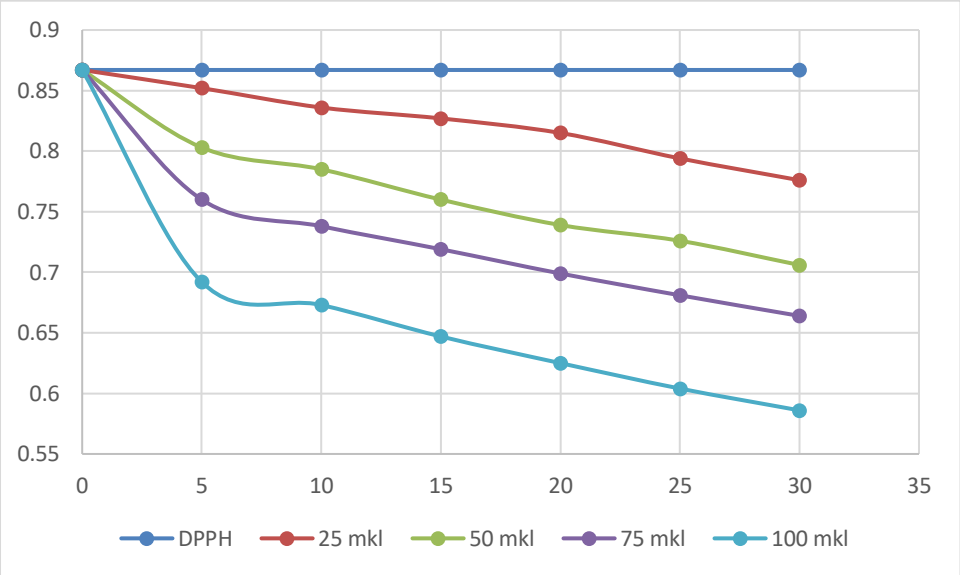


Figure 5. Graphical representation of the measured light absorption by solutions of empty and tested alcohol extraction samples added to the DPPH solution.

To calculate the inhibiting concentration of IC_{50} samples - DPPN solution up to 50% in each experiment, the following graph was constructed based on the anti-radical activity (ARA%) values at the 30th minute and the volume of added alcohol samples, and calculated based on the trend line function drawn on it.

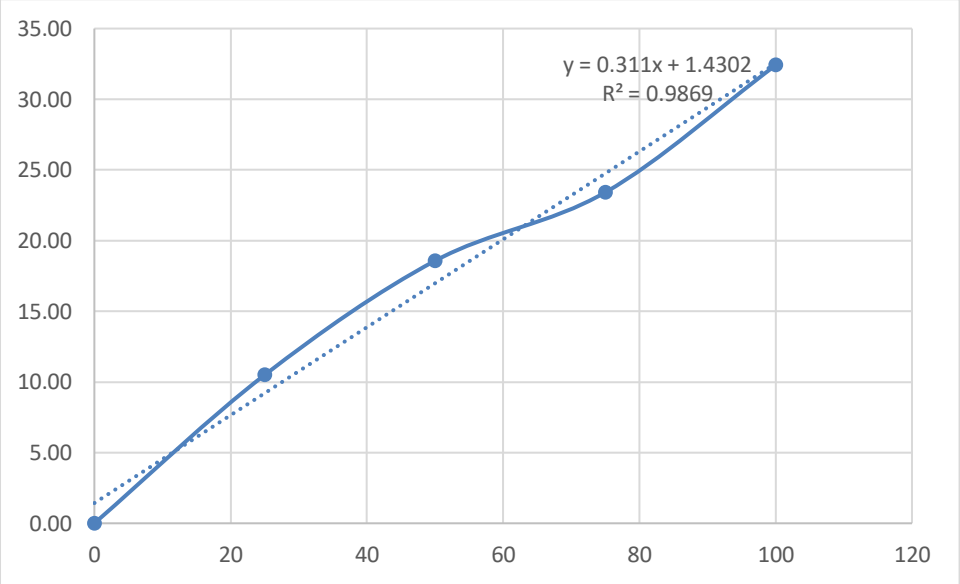


Figure 6. Graph of the dependence between ARA% and the volumes of the alcohol extracted sample, determined at the 10th minute.

The trend line transferred to the graph is calculated based on the formula of the function y=mx+b representing 50% of the volume ARA% (IC_{50}) using the formula x= (y-b) /m:

$$IC_{50} = \frac{(50 - 1{,}4302)}{0{,}311} = 156{,}17\ mkl$$

Table 4. Anti-radical activity values of 100 µl of alcohol extract samples for 30 minutes (ARA%)

Time	ARA%		
	Water pepper leaves - Common chicory (*Cichorium intybus L*) 1:1	**Water pepper leaves - Common chicory (*Cichorium intybus L*) 3:1**	**Water pepper leaves - Common chicory (*Cichorium intybus L*) 1:3**
30th minute	**45.80**	**44.11**	**32.41**

Table 5. IC_{50} of aqueous extracts of samples - inhibiting concentration (µl) of DPPN solution up to 50%

Time	IC_{50}		
	Water pepper leaves - Common chicory (*Cichorium intybus L*) 1:1	**Water pepper leaves - Common chicory (*Cichorium intybus L*) 3:1**	**Water pepper leaves - Common chicory (*Cichorium intybus L*) 1:3**
30th minute	**108.77**	**112.18**	**156.17**

Conclusion.Conducted studies have shown that extracts prepared from water pepper (*Persicaria minor*) leaves and common chicory (*Cichorium intybus L*) stems in various proportions exhibit natural antioxidant properties. When recalculating the results measured with a 10-fold dilution, it was found that the ability of extracts to inhibit free radicals (ARF%) increased 10 times, and IC50 was 10 times lower, which further increased their effectiveness as natural antioxidants. According to the 30-minute analysis results, among alcohol extracts, the highest anti-radical activity was observed in the extract of water pepper leaves and common chicory stem mixed in a 1:1 ratio: free radical inhibition showed the best results at ARF 45.80% and IC_{50} 108.77 µl.

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QALQONSIMON BEZ O‘SMALARINING ZAMONAVIY TASNIFI VA ULARNI DAVOLASH USULLARI

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Kalit so'zlar: qalqonsimon bez, adenokarsinoma, qalqonsimon bez o‘smasi, radioterapiya, ximioterapiya

Annotatsiya

Qalqonsimon bez o‘smalari endokrin tizim kasalliklari ichida eng ko‘p uchraydigan onkologik kasalliklardan biri hisoblanadi. Keyingi yillarda dunyo bo‘yicha ushbu kasalliklarning aniqlanish ko‘rsatkichi sezilarli darajada oshdi. Bu holat, bir tomondan, diagnostika usullarining takomillashuvi, ayniqsa ultratovush tekshiruvlarining ommalashuvi bilan bog‘liq bo‘lsa, ikkinchi tomondan, atrof-muhit omillari, genetik va nurlanish ta’siri orqali tushuntiriladi.

Zamonaviy tibbiyotda qalqonsimon bez o‘smalarini erta bosqichda aniqlash, morfologik va molekulyar xususiyatlarini to‘g‘ri baholash hamda individuallashtirilgan davolash taktikasini tanlash bemor hayotini saqlab qolish va uning sifatini yaxshilashda hal qiluvchi ahamiyatga ega. Bugungi kunda ushbu sohada ilmiy tadqiqotlar olib borish nihoyatda dolzarb muammolardan biri hisoblanadi.

Jahon sog‘liqni saqlash tashkiloti ma’lumotlariga ko‘ra, so‘nggi 30 yilda ushbu kasallikning tarqalishi bir necha barobar oshgan. Ayniqsa, karsinoma kabi sinflangan shakllar yoshlar orasida ham keng uchrayotganligi qayd etilgan. Qalqonsimon bez o‘smalari klinik jihatdan ko‘p hollarda belgisiz yoki yengil simptomlar bilan kechganligi uchun, kasallikka tashxis qo‘yish kechikishiga olib keladi.

Havola uchun

Asqarov, I. R., & Toshpulatov, A. M. QALQONSIMON BEZ O‘SMALARINING ZAMONAVIY TASNIFI VA ULARNI DAVOLASh USULLARI. Tovarlar Kimyosi Va Xalq Tabobati Jurnali, 5(1). https://doi.org/10.55475/jcgtm/vol5.iss1.2026.596

Ushbu ilmiy tadqiqotni olib borishda quyidagi vazifalar bajarildi:

1. Qalqonsimon bezning anatomik va fiziologik xususiyatlari o‘rganildi;
2. Genetik va molekular omillarni o‘rganishni o‘z oldimizga maqsad qilib qo‘ydik;
3. Zamonaviy davolash usullarini qiyosiy tahlil qilish.

Ushbu olib borilgan tadqiqot natijalari shifokor-endokrinologlar, onkologlar va umumiy amaliyot vrachlari uchun amaliy qo‘llanma bo‘lib xizmat qilishi mumkin.

Qalqonsimon bez inson organizmidagi eng muhim endokrin a’zolardan biri bo‘lib, bo‘yinning old qismida, traxeyaning yuqori bo‘limlarini qoplab joylashgan. U ikki yon qism (o‘ng va chap) hamda ularni bog‘lovchi istmusdan iborat. Ayrim insonlarda uchinchi qism — piramidal o‘sma ham uchraydi.

Katta odamda qalqonsimon bezning og‘irligi o‘rtacha 15–25 grammni tashkil etadi. Bez yupqa kapsula bilan o‘ralgan bo‘lib, ichki qismi fibroz septalar orqali bo‘lakchalarga bo‘lingan. Har bir bo‘lakcha ko‘plab follikulalardan tashkil topgan. Follikulalar — qalqonsimon bezning asosiy funksional birligi