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PLANTÁGO (PLANTAGO MAJOR) LEAF EXTRACT AS A NATURAL SOURCE OF ANTIOXIDANTS

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Plantágo (Plantago major), antiradical activity, antioxidant, DPPH assay, phenolic compounds, natural bioactive substance.

Annotation
This study investigated the antiradical activity (ARF%) of Plantágo (Plantago major) leaf extract at different concentrations (0.25, 0.5, 0.75, and 1.0 mg/ml) and time intervals (0–30 min). The results showed that the extract exhibited strong antioxidant activity in a concentration- and time-dependent manner. At the initial stage (0 min), the average ARF% was 66.4%, while at 15–30 min the values stabilized in the range of 73-77%. The highest antioxidant activity was observed at 0.75 mg/ml (85.0%). The overall average ARF% was 73.67%. These findings demonstrate the ability of Plantágo extract to effectively neutralize free radicals and confirm its potential as a natural antioxidant for use in pharmaceuticals and nutraceuticals.

How to Cite
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Introduction. Plantago major has long been widely used in folk medicine as an anti-inflammatory, antiseptic, and wound-healing agent [1]. Recent studies have shown that this plant contains phenolic acids, flavonoids, and iridoids, which exhibit strong antioxidant and immunomodulatory activities [2]. Antioxidant activity protects cells from oxidative stress by neutralizing free radicals. This process is important in the prevention of cardiovascular diseases, cancer, and chronic inflammation [3]. Therefore, the study of the antiradical activity (ARF%) of plant extracts is of current scientific interest. The aim of this study was to evaluate the ARF% of Plantágo leaf extract grown in Uzbekistan at different concentrations and time intervals and to substantiate its antioxidant potential.

Materials and Methods. Sample preparation. A dry extract of Plantágo leaves was used in this study. The extract was prepared in aqueous solution and tested at concentrations of 0.25, 0.5, 0.75, and 1.0 mg/ml.

Determination of antiradical activity. Antioxidant activity was assessed using the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay. The decrease in absorbance of the DPPH solution after reaction with the extract was measured spectrophotometrically at 517 nm.

Calculation formula

$$ARF\% = \frac{D1 - Dt}{D1},$$

where, D1 is the optical density of the control solution and Dt is the optical density after addition of the extract. Such methods are widely used internationally to evaluate the antioxidant properties of plant extracts [4, 5].

Results. The results showed that the Plantágo leaf extract exhibited significant antiradical activity (ARF%) at all tested concentrations (0.25, 0.5, 0.75, and 1.0 mg/ml). The activity increased with concentration and stabilized over time (Table 1).

0 min: ARF% averaged 66.4%, indicating that the extract neutralized more than half of the free radicals even at the initial stage. 5 min: ARF% rose to 72.7%, reflecting a rapid antioxidant response, with the most pronounced effect at 0.75 mg/ml. 10–15 min: values stabilized at 73–74.5%. 20–30 min: ARF% reached 75–77%. The maximum level (86.6%) was observed at 0.75 mg/ml. Increasing concentration led to a marked rise in activity: from 55.6% at 0.25 mg/ml to 85.0% at 0.75 mg/ml. The overall mean ARF% across all conditions was 73.67%, confirming that Plantágo extract is a potent natural antioxidant source.

Table 1.

Antiradical activity of Plantágo extract

Namuna	0,25	0,5	0,75	1	o`rtacha
D1	0,877	0,877	0,877	0,877	
0 min	0,480	0,273	0,188	0,236	
differences	0,397	0,604	0,689	0,641	
ARF%	45,268	68,871	78,563	73,090	66,448
5 min	0,425	0,212	0,127	0,193	
differences	0,452	0,665	0,750	0,684	
ARF%	51,539	75,827	85,519	77,993	72,719
10 min	0,412	0,203	0,126	0,187	
differences	0,465	0,674	0,751	0,690	
ARF%	53,022	76,853	85,633	78,677	73,546
15 min	0,387	0,197	0,122	0,188	
differences	0,490	0,680	0,755	0,689	
ARF%	55,872	77,537	86,089	78,563	74,515
20 min	0,362	0,193	0,121	0,188	
differences	0,515	0,684	0,756	0,689	
ARF%	58,723	77,993	86,203	78,563	75,371
25 min	0,340	0,189	0,119	0,188	
differences	0,537	0,688	0,758	0,689	
ARF%	61,231	78,449	86,431	78,563	76,169
30 min	0,319	0,186	0,117	0,188	
differences	0,558	0,691	0,760	0,689	
ARF%	63,626	78,791	86,659	78,563	76,910

Overall	55,612	76,332	85,014	77,716	73,668

Discussion. The obtained results are consistent with previous research findings. In particular, the phenolic compounds of Plantágo (such as chlorogenic acid, ferulic acid, and flavonoids) have been scientifically proven to bind free radicals and reduce oxidative stress [6, 7]. The high antioxidant activity, especially evident at the concentration of 0.75 mg/ml, indicates the potential of this plant for broad applications in the pharmaceutical and nutraceutical fields. Natural antioxidants are known to play a crucial role in the prevention of chronic diseases such as atherosclerosis, diabetes, and cancer [8, 9]. Therefore, the leaf extract of Plantágo can be considered not only as a traditional folk remedy but also as a promising natural antioxidant supplement in modern medicine.

Conclusion. This study demonstrated that the extract of Plantágo (Plantago major) leaves growing in Uzbekistan possesses high antiradical activity, which increases with concentration and time. The maximum ARF% value (85.0%) was achieved at 0.75 mg/ml. Stabilization of activity occurred within 15–30 minutes, with an overall mean value of 73.67%. These findings confirm that Plantágo extract is a promising source of natural antioxidants. Due to its antioxidant properties, Plantágo extract may be used in the prevention of diseases associated with oxidative stress (inflammation, atherosclerosis, diabetes, cancer). Future research should focus on isolating its bioactive components (flavonoids, phenolic acids, iridoids) and studying their pharmacological activities in greater depth.

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