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**ARAŞTIRMA MAKALESİ** **RESEARCH PAPER**

# Phenolic Compound Profile of *Allium pervariensis*: Phytochemical Analysis by LC-HRMS and Potential Applications

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**Abstract:** *Allium pervariensis* is an endemic plant species native to the Southeastern Anatolia Region of Turkey. Phenolic compounds are important secondary metabolites in plants, known for their diverse biological activities, including antioxidant, anticancer, and anti-inflammatory effects. This study aimed to determine the phenolic compound contents of *A. pervariensis*. Plant samples were analyzed using the LC-HRMS (Liquid Chromatography-High Resolution Mass Spectrometry) method. In this context, a total of 22 phytochemical compounds were detected, and their concentrations were determined. LC-HRMS analysis revealed that apigenin (45705.91 ng/g), vanillic acid (2336.86 ng/g), and ferulic acid (1644.26 ng/g) were the compounds with the highest concentrations. The data obtained indicate that *A. pervariensis* is a rich source of phenolic compounds. These findings suggest that *A. pervariensis* may have potential applications in the pharmaceutical, cosmetic, and food industries. However, further studies are needed to better understand the biological activities of the plant.

**Keywords:** *Allium pervariensis*, apigenin, ferulic acid, phytochemicals, vanillic acid.

# *Allium pervariensis*'in Fenolik Bileşik Profili: LC-HRMS ile Fitokimyasal Analiz ve Potansiyel Uygulamaları

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**Öz:** *Allium pervariensis*, Türkiye'nin Güneydoğu Anadolu Bölgesi'ne özgü endemik bir bitki türüdür. Fenolik bileşikler, bitkilerde çeşitli biyolojik aktiviteleri, özellikle antioksidan, kanser karşıtı ve anti-enflamatuar etkileriyle bilinen önemli ikincil metabolitlerdir. Bu çalışmada *A. pervariensis* bitkisinin fenolik bileşik içeriklerinin belirlenmesi amaçlanmıştır. Bitki örnekleri LC-HRMS (Sıvı Kromatografisi-Yüksek Çözünürlüklü Kütle Spektrometrisi) yöntemi kullanılarak analiz edilmiştir. Bu kapsamda toplam 22 fitokimyasal bileşik tespit edilmiş ve konsantrasyonları belirlenmiştir. LC-HRMS analizi, en yüksek konsantrasyona sahip bileşiklerin apigenin (45705,91 ng/g), vanilik asit (2336,86 ng/g) ve ferulik asit (1644,26 ng/g) olduğunu ortaya koymuştur. Elde edilen veriler, A. pervariensis'in fenolik bileşikler açısından zengin bir kaynak olduğunu göstermektedir. Bu bulgular, *A. pervariensis*'in farmasötik, kozmetik ve gıda endüstrilerinde potansiyel kullanım alanlarına sahip olabileceğini düşündürmektedir. Ancak, bitkinin biyolojik aktivitelerinin daha iyi anlaşılabilmesi için ileri çalışmalara ihtiyaç duyulmaktadır.

**Anahtar Kelimeler:** *Allium pervariensis*, apigenin, ferulik asit, fitokimyasallar, vanilik asit.

## INTRODUCTION

Medicinal plants have been used in the treatment of human and animal diseases for thousands of years and continue to play a significant role in modern pharmacology (Özdenefe et al., 2024; Sak et al., 2024; Sharifi-Rad et al., 2015; Yolbaş, 2024b). According to the World Health Organization, approximately 20,000 plant species are used for medicinal purposes (Bellikci, 2011). Among them, species of the genus *Allium* have garnered considerable interest due to their pharmacological and economic importance (Mnayer et al., 2014).

Phenolic compounds are one of the most important secondary metabolite groups of plants and have various

biological activities such as antioxidant, anticancer, anti-inflammatory, neuroprotective and antibacterial (Ganesan & Xu, 2017; Roleira et al., 2018; Yolbaş, 2024c). These compounds play a critical role in the prevention of oxidative damage through their ability to inhibit free radicals (Digrak et al., 1999). In recent years, phenolic compounds have been extensively used in cosmetics, pharmaceuticals and food industry owing to their beneficial effects on health (Uğurlu & Bakkalbaşı, 2023; Yolbaş, 2024a).

*Allium pervariensis* is a new species of the genus *Allium*, described from Southeastern Anatolia, Turkey and has a limited distribution (Firat et al., 2018). The genus *Allium* includes more than 800 species globally, of which 180 are found in Turkey, including 70 endemic species (Choi & Oh, 2011; Ekşi et al., 2020). This plant, which attracts attention with its odor and taste, is also consumed as food, particularly in cheese production, due to its health benefits. Species of the genus *Allium*, especially garlic (*Allium sativum L.)* and onion (*Allium cepa*), provide great health benefits as they contain sulfur compounds with antimicrobial, antioxidant, anti-inflammatory and anticancer properties (Mnayer et al., 2014; Ndoye Foe et al., 2016).

This is the first study on the determination of phenolic content of *A. pervariensis*. The analysis of phenolic compounds will contribute to a better understanding of the pharmacological and industrial potential of this plant. In this context, it is aimed to determine the potential bioactive properties of *A. pervariensis*.

## MATERIAL AND METHOD

***Collection of plant materials:*** *A. pervariensis* is a naturally growing species in Pervari district of Siirt province, Turkey. The above-ground parts of the plant, including stems, leaves and flowers were collected in early May 2024. These plant samples were dried at 24 °C in a dark room for 20 days. The dried plant samples were ground and homogenized for analysis.

***LC-HRMS analysis of A. pervariensis***

***Sample preparation:*** 10 mg of grounded powdered plant material samples were dissolved in a solution composed of methanol and water (10 mL each, 1:1 v/v). The mixture was filtered using a 0.22 µm polytetrafluoroethylene (PTFE) syringe filter and transferred to 1.5 mL vials for analysis.

***Chromatography and high-resolution mass spectrometry conditions:*** The chromatographic analyses were conducted using a Phenomenex Gemini 3 µm NX-C18 110 Å (100 mm × 2 mm) column (Phenomenex, Torrance, CA, USA) and the column temperature was set at 30 °C. Elution was performed with 2% (v/v) glacial acetic acid solution in ultrapure water from the GFL 2004/Human power 1 ultrapure water system (Tokyo, Japan) as mobile phase A and 99.9% pure methanol (Sigma-Aldrich, St. Louis, MO, USA) as mobile phase B. The separation was carried out at a flow rate of 0.3 mL/min with an injection volume of 20 µL, and the total run time was 20 minutes. Analysis was performed on an Orbitrap HRMS instrument (Exactive Plus™; Thermo Fisher Scientific, Waltham, MA, USA) with a heated electrospray ionization interface and the instrument was operated in positive (full MS/all ion fragmentation [AIF]) and negative (full MS/AIF) modes. The analysis parameters used were: automatic gain control target 3e6, spray voltage 3.5 kV, S-lens RF level 50, maximum ion deposition time (per scan) 2 ms, ionization interface sheath gas flow rate 35 mL/min, auxiliary gas temperature 350 °C, auxiliary gas flow rate 7 mL/min, MS scan range 60-800 m/z, capillary temperature 350 °C, resolution 17,500x, and collision energy set to less than 25 V.

***Chromatography and high-resolution mass spectrometry equipment:*** LC-HRMS analysis was performed using an Exactive Plus Orbitrap (Thermo Fisher Scientific, Waltham, MA, USA) equipped with a DIONEX UltiMate 3000RS autosampler with high-resolution MS composition function, LC system with a DIONEX UltiMate 3000RS pump, DIONEX UltiMate 3000RS column oven and heated electrospray ionization interface. Calibration of the Orbitrap-LC-MS instrument was performed with negative (Pierce™ Negative Ion Calibration Solution; Rockford, MA, USA) and positive (Pierce™, LTQ Velos ESI Positive Ion Calibration Solution) calibration solutions via an automatic syringe injector (Thermo Fisher Scientific, Waltham, MA, USA). For LC-HRMS analyses, simultaneous LC and MS were performed using TraceFinder 3.2 software (Thermo Fisher Scientific, Waltham, MA, USA) and data acquisition and processing were performed using Xcalibur software version 2.1.0.1140 (Thermo Fisher Scientific, Waltham, MA, USA).

## RESULTS AND DISCUSSION

As a result of LC-HRMS analysis, a total of 22 different phytochemical compounds were identified in *A. pervariensis* (Table 1). The highest concentrations of these compounds were apigenin (45705.91 ng/g), vanillic acid (2336.86 ng/g), 3-(4-hydroxyphenyl) propionic acid (2889.39 ng/g), ferulic acid (1644.26 ng/g) and p-coumaric acid (1392.08 ng/g). Some of the phytochemical compounds detected were also reported for other *Allium* species in the literature.

The phytochemical compounds identified in this study indicate that *Allium* species are a rich source of phenolic content. For example, quercetin has the potential to inhibit the growth of cancer cells (Zhang et al., 2015). Cinnamic acid derivatives show various pharmacological effects against lung, colon and breast cancer (Wang et al., 2019). Luteolin exhibits anticarcinogenic and

antiproliferative effects in human cancer cell lines (Yao et al., 2019), while apigenin shows similar properties (Imran et al., 2020). Caffeic acid may be effective in treating dermal diseases, preventing premature aging and increasing collagen production (Magnani et al., 2014).

The 22 phenolic compounds determined as a result of the analysis performed by the LC-HRMS method showed more phytochemical diversity than previously reported *Allium* species. While 12 phenolic compounds were determined in the methanol extract of *Allium tuncelianum*; (Takım et al., 2018); 13 phenolic compounds were determined in black garlic (Eyupoglu, 2019). Our findings reveal that *A. pervariensis* is rich in phenolics and may have a broader compound profile compared to other species.

Similarities and differences were observed between the phenolic compounds identified in our study and other Allium species in literature. In a study, 3-hydroxybenzoic acid, coumaric acid and epigallocatechin gallate were reported as major components in *Allium nigrum L.* and *Allium subhirsutum L.* (Emir et al., 2020). In our study, 3-hydroxybenzoic acid was not detected, while coumaric acid (1392.08 ng/g) was determined as an important component. Para-coumaric acid and ferulic acid were reported as major constituents in *Allium sativum L.* grown in Australia (Phan et al., 2019). Similarly, ferulic acid (1644.26 ng/g) was detected at high concentration in our study. In addition to components such as ferulic, coumaric, caffeic and protocatechic acids, flavonoids such as rutin, quercetin and kaempferol have been reported as major components in *Allium flavum* (Simin et al., 2013). In our study, caffeic acid (657.22 ng/g), protocatechic acid (434.56 ng/g), quercetin (1289 ng/g) and kaempferol (5531.81 ng/g) were detected. However, rutin and epigallocatechin gallate were not detected. Vanillic acid, previously reported as the highest in black garlic at 750.95 mg/L, was found to be 2336.86 ng/g in our study (Eyupoglu, 2019). It was reported that the highest analyte value in *Allium scorodoprasum subsp.* rotundum was malic acid (637 µg/g), while malic acid (3304.12 µg/g) was found at the highest rate in *Allium vineale* (İzol, 2016). Malic acid was not detected in our study. Quercetin (13.6±0.06 µg/g) was found to be the highest phenolic compounds in red onion, p-hydroxybenzoic acid (18.6±0.6 µg/g and 10.5±0.07 µg/g) in green and white onion, and myricetin (4.5±0.10 µg/g) in garlic (Yünlü & Kır, 2016). Although quercetin (1289 ng/g) and p-hydroxybenzoic acid were detected in our study, myricetin was not detected. It is thought that these differences may be due to the genetic structure of the species, growing conditions and the analysis methods used.

The detection of high concentrations of flavonoids such as apigenin (45705.91 ng/g) and luteolin (5649.57 ng/g) reveals the potential importance of *A. pervariensis* in terms of biological activities. However, the study has some limitations. First, only the concentrations of phenolic compounds were determined, and further in vitro and in vivo studies are required to confirm the biological activity of these compounds. Environmental factors and genetic variation can influence the compound profiles of the plant. The LC-HRMS method used may be limited to determine the chemical structures of the compounds; therefore, additional validation methods could be used. Furthermore, toxicological analyses are required to determine the therapeutic potential of *A. pervariensis*.

This study provides important data on the analysis of phenolic compounds of *A. pervariensis* and sheds light on the pharmacological potential of this plant. The antioxidants, anticarcinogenic and anti-inflammatory effects of the phytochemical compounds identified suggest that this plant is a potential source of natural health. However, further in vivo and in vitro studies are needed to determine the exact biological activities of phenolic contents. Furthermore, the development of methods to increase bioavailability and the isolation and standardization of phenolic compounds are critical for future research. These findings emphasize that the plant may be a valuable raw material for the pharmaceutical and food industry.

**Table 1.** Phenolic compounds identified from *A. pervariensis*.

| No | Target Compounds | RT | Quan Peak | Response | Curve Type | Average RF Response Ratio | Calculated Conc | Units |
|---|---|---|---|---|---|---|---|---|
| 1 | 4-Hydroxybenzoic acid | 7,65 | 137.02442 mz | 847110047 | Quadratic | 0,000 | 1720,28 | ng/ 1 g plant |
| 2 | Salicylic acid | N/F | 137.02442 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 3 | 3-hydroxybenzoic acid (3-HBA) | N/F | 137.02442 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 4 | 3-hydroxyphenylacetic acid (3-HPA) | N/F | 107.05053 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 5 | Syringic acid | 8,81 | 197.04555 mz | 162855318 | Quadratic | 0,000 | 677,13 | ng/ 1 g plant |
| 6 | Gallic acid (3,4,5-trihydroxybenzoic acid) | N/F | 169.01425 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 7 | Protocatechuic acid (3,4-Dihydroxybenzoic acid) | 6,22 | 153.01933 mz | 278339871 | Quadratic | 0,000 | 434,56 | ng/ 1 g plant |
| 8 | Protocatechuic acid ethyl ester (Ethyl 3,4-Dihydroxybenzoate) | N/F | 181.05063 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 9 | 3,4-dihydroxybenzaldehyde (Protocatechuic aldehyde) | N/F | 137.02442 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 10 | 2,4-dihydroxybenzoic acid (beta-Resorcylic acid) | N/F | 153.01933 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 11 | Vanillic acid | 8,42 | 167.03498 mz | 415968211 | Quadratic | 0,000 | 2336,86 | ng/ 1 g plant |
| 12 | Homovanillic acid (4-Hydroxy-3-methoxyphenylacetic acid) | N/F | 181.05063 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 13 | Vanillin | N/F | 151.04007 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 14 | Gentisic acid | N/F | 153.01933 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 15 | 3,4-Dihydroxyphenylacetic acid (DOPAC, Homoprotocatechuic acid) | N/F | 167.03498 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 16 | Trans Cinnamic acid | N/F | 147.04515 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 17 | Coumaric acid (trans-3-Hydroxycinnamic acid) | 9,67 | 163.04007 mz | 911093456 | Quadratic | 0,000 | 1392,08 | ng/ 1 g plant |
| 18 | Caffeic acid | 8,59 | 179.03498 mz | 643277143 | Quadratic | 0,000 | 657,22 | ng/ 1 g plant |
| 19 | Caffeic acid phenhyl ester (CAPE) | N/F | 283.09758 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 20 | Ferulic acid | 9,93 | 193.05063 mz | 695343275 | Linear | 0,000 | 1644,26 | ng/ 1 g plant |
| 21 | Sinapic acid | 9,96 | 223.06120 mz | 27994844 | Linear | 0,000 | 61,68 | ng/ 1 g plant |
| 22 | Chlorogenic acid | 8,12 | 353.08781 mz | 9432021 | Linear | 0,000 | -160,57 | ng/ 1 g plant |
| 23 | Quinic acid | 0,82 | 191.05611 mz | 2955940692 | Linear | 0,000 | 8132,96 | ng/ 1 g plant |
| 24 | 3-(4-Hydroxyphenyl) propionic acid | 9,17 | 165.05572 mz | 98568802 | Linear | 0,000 | 2889,39 | ng/ 1 g plant |
| 25 | α-Cyano-4-hydroxycinnamic acid | N/F | 188.03532 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 26 | Catechin (Cianidanol)-p | N/F | 289.07176 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 27 | Epigallocatechin | N/F | 305.06668 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 28 | Epigalloca echin gallate | N/F | 457.07763 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 29 | Chrysin (5,7-Dihydroxy-2-phenyl-4H-chromen-4-one) | N/F | 253.05063 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 30 | Apigenin (5,7-Dihydroxy-2-(4-hydroxyphenyl)-4H-chromen-4-one) | 13,21 | 269.04555 mz | 3,1957E+10 | Linear | 0,000 | 45705,91 | ng/ 1 g plant |
| 31 | Acacetin (5,7-Dihydroxy-2-(4-methoxyphenyl)-4H-chromen-4-one) | N/F | 283.06120 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 32 | Rhoifolin (Apigenin 7-O- neohesperidoside) | 11,18 | 431.09891 mz | 602081592 | Quadratic | 0,000 | 2380,18 | ng/ 1 g plant |
| 33 | Vicenin 2 | 9,21 | 593.15119 mz | 16079959 | Linear | 0,000 | 100,18 | ng/ 1 g plant |
| 34 | Apigenin 7-glucuronide | N/F | 445.07763 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 35 | Apigenin 7-glucoside | N/F | 431.09837 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 36 | Genkwanin (4',5-Dihydroxy-7-metthoxyflavone, Apigenin 7-O-methyl ether) | N/F | 283.06120 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 37 | Apiin (Apigenin-7-(2-O-apiosylglucoside) | N/F | 563.14063 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 38 | Schaftoside | N/F | 563.14063 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 39 | Rutin hydrate M-OH2 | N/F | 609.14611 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 40 | Luteolin | 12,59 | 285.04046 mz | 4338089066 | Quadratic | 0,000 | 5649,57 | ng/ 1 g plant |
| 41 | Luteolin-7-O-glucuronide (Luteolin-7-O-β-D-glucuronide) | N/F | 461.07255 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 42 | Diosmetin (Luteolin 4′-methyl ether) | 13,29 | 299.05611 mz | 5741892418 | Linear | 0,000 | 12857,23 | ng/ 1 g plant |
| 43 | Orientin | N/F | 447.09328 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 44 | Isoorientin | N/F | 447.09328 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 45 | Luteoloside (Luteolin 7-glucoside) | N/F | 447.09328 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 46 | Luteolin 7-rutinoside | N/F | 593.15119 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 47 | Galangin (3,5,7-Trihydroxy-2-phenyl-4H-chromen-4-one) | N/F | 269.04555 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 48 | Quercetin | 12,26 | 301.03538 mz | 1015612646 | Linear | 0,000 | 1289 | ng/ 1 g plant |
| 49 | İsoquercitrin (Quercetin 3-glucoside) | 10,87 | 463.08820 mz | 451138933 | Linear | 0,000 | 1977,59 | ng/ 1 g plant |
| 50 | Narcissin (Narcissoside, Isorhamnetin 3-rutinoside) | N/F | 623.16176 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 51 | Quercetin 3-rutinoside 7-glucoside | 11,45 | 447.09296 mz | 875180561 | Quadratic | 0,000 | 7873,8 | ng/ 1 g plant |
| 52 | Isorhamnetin (Quercetin 3′-methyl ether) | 13,2 | 315.05103 mz | 603955536 | Quadratic | 0,000 | 1492,95 | ng/ 1 g plant |
| 53 | Kaempferol | 13,04 | 285.04046 mz | 3136046786 | Quadratic | 0,000 | 5531,81 | ng/ 1 g plant |
| 54 | Afzelin (Kaempferol 3-rhamnoside) | N/F | 431.09837 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 55 | Kaempferide | N/F | 299.05611 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 56 | Nicotiflorin (Kaempferol 3-rutinoside, Kaempferol 3-O-β –rutinoside) | N/F | 593.15119 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 57 | Astragalin (Kaempferol 3-glucoside) | 11,45 | 447.09328 mz | 590940754 | Quadratic | 0,000 | 3858,79 | ng/ 1 g plant |
| 58 | Myricetin | N/F | 317.03029 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 59 | Fisetin hydrate | N/F | 285.04046 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 60 | Naringenin | N/F | 271.06120 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 61 | Sakuranetin (Naringenin 7-O-methyl ether) | N/F | 285.07685 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 62 | Narirutin (Narirutinsa, Naringenin rutinoside) | N/F | 579.17193 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 63 | Oleuropein | N/F | 539.17633 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 64 | Hesperidin | N/F | 301.07138 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 65 | Eriodictyol (3,4,5,7-Tetrahydroxyflavanone) | N/F | 287.05501 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 66 | Liquiritigenin | N/F | 255.06628 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 67 | Genistein (5,7-Dihydroxy-3-(4-hydroxyphenyl)-4H-chromen-4-one) | N/F | 269.04555 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 68 | Daidzin | N/F | 415.10346 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 69 | Formononetin (Neochanin) | N/F | 267.06628 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 70 | Ellagic acid | 11,28 | 300.99899 mz | 1691942678 | Linear | 0,000 | 8848,5 | ng/ 1 g plant |
| 71 | Esculin hydrate | N/F | 339.07216 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 72 | Phloridzin | N/F | 435.12967 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 73 | Rosmarinic acid | N/F | 359.07724 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 74 | Glabridin | N/F | 323.12888 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 75 | Arbutin | N/F | 271.08233 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 76 | Emodin | N/F | 269.04555 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |
| 77 | Pinocembrin | N/F | 255.06694 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 78 | Doxorubicin Hydrchloride | N/F | 542.16678 mz | N/F | Quadratic | 0,000 | N/F | ng/ 1 g plant |
| 79 | Ethylgallate | N/F | 197.04555 mz | N/F | Linear | 0,000 | N/F | ng/ 1 g plant |

Note: N/F, not f

## CONCLUSION

In this study, the phenolic compound profile of *A. pervariensis* was investigated in detail and it was determined that the species is a potential source of bioactive compounds for pharmaceutical, cosmetic and food industries. Especially the high concentrations of compounds such as quercetin, vanillic acid and ferulic acid are remarkable. The findings indicate that *A. pervariensis* is a rich source of phenolic compounds and has an important place among endemic Allium species. However, further in vivo and in vitro studies are recommended to confirm the biological activities and possible applications of these compounds.

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***Conflict of Interest:*** The author declared that there is no conflict of interest.

***Ethical Consideration:*** Ethics committee approval was not required for this study because of there was no study on animals or humans.

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