

EVALUATING THE THERAPEUTIC PROPERTIES OF QUINCE SEEDS THROUGH THEIR CHEMICAL COMPOSITION

Asqarov Ibrohim Rahmonovich

Doctor of Chemical Sciences, Professor, Department of Chemistry, Andijan State University,
Andijan, Uzbekistan

Khojiqulov Azizbek Sobirovich

PhD in Chemical Sciences, Associate Professor, Department of Chemistry, Andijan State
University, Andijan, Uzbekistan

E-mail: xojiqulov76@inbox.ru

Yuldasheva Maftuna Lutfullo kizi

Master's Student in Chemistry, Andijan State University, Andijan, Uzbekistan

Abstract

This article presents comprehensive data on the determination of phenolic compound concentrations within a 96% ethanol extract derived from quince (*Cydonia oblonga* Mill.) seeds, utilising the method of High-Performance Liquid Chromatography (HPLC). The experimental results reveal the distinct presence of salicylic acid, rutin, and quercetin within the extract, whereas gallic acid, apigenin, and kaempferol were not detected under the specified analytical conditions. Among the identified phenolic constituents, salicylic acid and rutin were found to be present in relatively higher concentrations. These findings demonstrate that quince seeds serve as a potent source of natural antioxidants and represent a highly promising raw material for the pharmaceutical and food industries, particularly for the development of antipyretic, anti-rheumatic, and anti-inflammatory agents.

Keywords: Quince seed extract, flavonoid compounds, salicylic acid, rutin, quercetin, HPLC analysis, antioxidant activity, natural anti-inflammatory agents.

Introduction

The medicinal efficacy of quince fruits has been acknowledged since ancient times. The fruits of this plant contain up to 12% sugars and approximately 5% organic acids, including malic, tartaric, and citric acids. Furthermore, they are rich in essential oils, pectin, tannins, vitamin C, and essential mineral salts such as iron, copper, and calcium. Quince seeds specifically contain up to 20% mucilage, the glycoside amygdalin, over 8% fatty oils, and various colouring agents. In traditional folk medicine, quince fruit juice has been extensively utilised to treat a variety of conditions, including asthma, cardiovascular disorders, jaundice, hiccups, abdominal pain, and dysentery. Moreover, quince has historically been employed in the treatment of general debility, anaemia, chronic coughs, as well as diseases affecting the stomach, liver, and kidneys [1].

The renowned scholar Abu Ali ibn Sino (Avicenna) utilised infusions prepared from quince fruit to treat dysentery and inflammation of the large intestine. He also applied quince juice to manage asthma, suppress haemoptysis (coughing up blood), and arrest vomiting, while also using it to alleviate thirst and cerebral headaches. By formulating medicinal preparations

based on quince seeds, he treated various ailments of the lungs and respiratory tract. In folk medicine, decoctions made from quince seeds and juice are highly regarded for their positive effects on anaemia, dysentery, and haemorrhoids. In modern clinical medicine, decoctions derived from quince seeds are utilised as an effective treatment for ophthalmic inflammations [2].

Salicylic acid — a 2-hydroxybenzoic or phenolic acid named after the willow tree (from the Latin *Salix*) — was first isolated from willow bark. Salicylic acid and its derivatives, including salicylates, esters, and other synthetic analogues, possess pronounced anti-inflammatory properties. Furthermore, salicylic acid exhibits mild antiseptic, irritant, and keratolytic characteristics, leading to its widespread topical application in ointments and solutions for treating various skin conditions. Several scientific studies have demonstrated that the topical application of salicylic acid reduces the proliferation rate of keratinocytes and inhibits cholesterol sulfotransferase, the enzyme responsible for the formation of cholesterol sulphate within keratinocytes [3].

Salicylic acid stands as one of the most well-known and extensively utilised analgesic, antipyretic, and anti-inflammatory agents in pharmacology. Due to its keratolytic, bacteriostatic, fungicidal, and photoprotective properties, it is frequently applied topically. Derivatives of salicylic acid are also integral to modern medicine, serving as vital components in treatments requiring antipyretic, anti-rheumatic, anti-inflammatory, and pain-relieving interventions [4].

Rutin (Vitamin P) is a natural bioflavonoid found in buckwheat, citrus fruits, various berries (such as blackcurrant and rowan), and tea. It functions by strengthening capillary walls and reducing their permeability; it also exhibits potent antioxidant and anti-inflammatory properties and enhances the physiological effects of Vitamin C within the body. Polyphenols hold a leading position among biologically active substances. Their biological impact is largely attributed to the vitamin-like activity of flavonoids and the antimicrobial properties of catechins. The entire polyphenol complex provides anti-radiation, anti-stress, and antioxidant protection. Consequently, phenolic substances play a crucial role in therapeutic and preventive nutrition.

Flavonoids are instrumental in preventing the oxidation of low-density lipoproteins (LDL) in blood plasma and inhibiting the development of atherosclerotic lesions within arterial walls. They effectively suppress intracellular lipid peroxidation processes. Additionally, flavonoids inhibit platelet aggregation, which serves as a significant positive factor in the prevention of cardiovascular diseases. They prevent oxidative damage to nucleic acids and inhibit the progression of carcinogenesis. Amongst the flavonoid series, quercetin and rutin, which are found in numerous medicinal plants, are the most prevalent and effective bio-antioxidants (AO) [5, 6, 7].

Materials and methods

Reagents and Equipment Used. Gallic acid was sourced from "Macklin" (China), and salicylic acid was obtained from "Rhydburg Pharmaceuticals" (Germany). Quercetin, apigenin, and kaempferol were procured from "Regal" (China), while rutin was isolated from natural sources using extraction and column chromatography techniques. Deionised water and acetonitrile of HPLC grade, as well as acetic acid and sodium hydroxide of chemically pure (CP) grade, were utilised throughout the study.

The quantification of polyphenols within the plant material was performed using an LC-40 Nexera Lite High-Performance Liquid Chromatograph, manufactured by Shimadzu (Japan).

Preparation of Standard Solutions. Standard samples of gallic acid (5.2 mg), salicylic acid (5.2 mg), rutin (5 mg), quercetin (5 mg), apigenin (5 mg), and kaempferol (5 mg) were dissolved in 96% ethanol using an ultrasonic bath for 20 minutes. The solutions were then transferred into 50 ml volumetric flasks and diluted to the mark with ethanol. To create a multi-component standard, 200 μ l was taken from each primary solution and mixed. Subsequently, four different concentrations were prepared through serial dilution. Each resulting solution was transferred into a vial for chromatographic analysis.

Preparation of Plant Extract. To extract the phenolic compounds, 1 g of the test sample was accurately weighed to within 0.01 g using an NV222 analytical balance manufactured by OHAUS (USA). The weighed sample was placed into a 50 ml conical flask, to which 25 ml of 96% ethanol was added. The mixture underwent extraction in a GT SONIC-D3 (China) ultrasonic bath at a temperature of 60 °C for a duration of 20 minutes. Following extraction, the mixture was cooled and filtered, then adjusted to a final volume of 25 ml with ethanol in a volumetric flask. A 1.5 ml aliquot of the extract was centrifuged using a Mini-7 centrifuge (BIOBASE, China) at 7000 rpm. Finally, the supernatant was filtered through a 0.45 μ m syringe filter prior to analysis.

Chromatographic Conditions

Detection of Phenolic Compounds. The standard solutions and the sample extract were analysed using a Shim-pack GIST C18 reverse-phase column (150 \times 4.6 mm; 5 μ m, Shimadzu, Japan). A gradient mobile phase (Table 1) consisting of acetonitrile (A) and a 0.5% aqueous solution of acetic acid (B) was employed. The injection volume was set at 10 μ l, with a flow rate of 0.5 ml/min, and the column thermostat was maintained at 40 °C. The analytical signals (peak areas) for the phenolic compounds were recorded at a wavelength of 300 nm (Figure 1).

Table 1. Mobile phase gradient programme.

Time (min)	Solvent A (Acetonitrile, %)	Solvent B (0.5% Acetic Acid, %)
0	5	95
5	5	95
17	40	60
22	40	60
22,1	5	95
40	Completion	

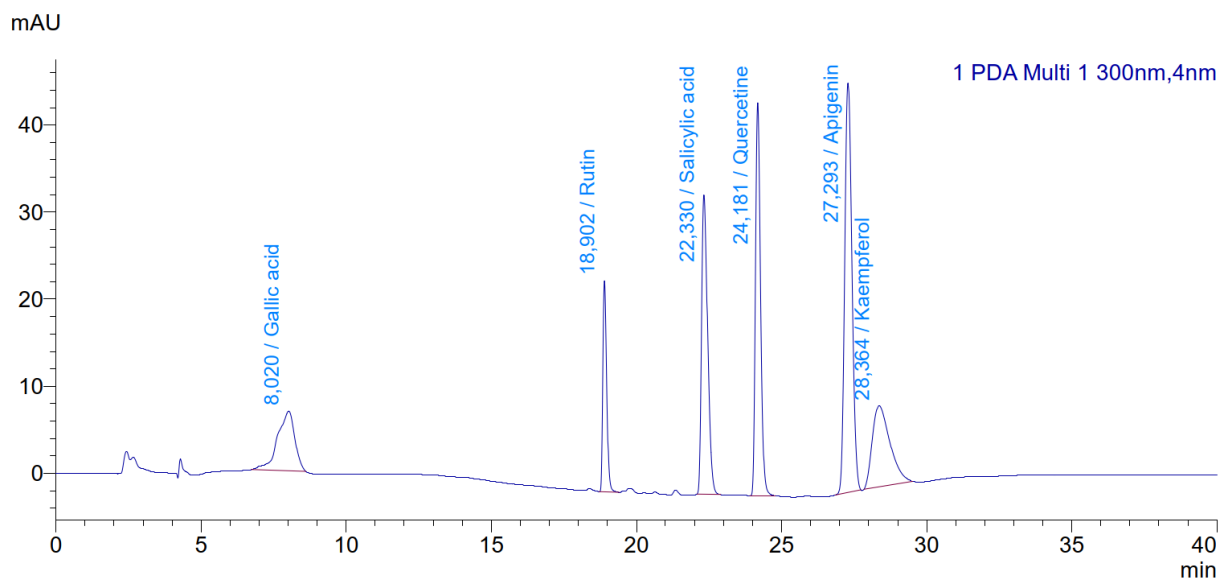


Figure 1. Chromatogram of standards at 300 nm.

Results and their discussion

A group of Russian scientists led by E.E. Kurdyukov developed a method for the quantitative determination of flavonoids in the leaves of *Moringa oleifera* using differential spectrophotometry in the presence of aluminium chloride. Their research established the optimal conditions for extracting flavonoids from this plant raw material, including the use of 70% ethyl alcohol as an extractant, a raw material-to-solvent ratio of 1:200, an extraction duration of 90 minutes, and a raw material particle size of 1.0 mm [8].

Determination of Phenolic Compound Content in the Sample Extract. In the present study, we successfully determined the concentrations of polyphenols within the fruit seed extract of the quince plant grown under the specific climatic conditions of the Andijan region using the HPLC method. For this purpose, a chromatogram of the extract derived from a 1 g sample of quince fruit seeds was obtained (Figure 2). Based on the analytical results, the quantities of phenolic compounds per 100 g of the sample were calculated using the following formula and are presented in Table 2:

$$X = \frac{C_{phen} \cdot V_{ekstrakt}}{m_{sample}} \cdot 100 \text{ g}$$

Where:

X – represents the quantity of phenolic compounds contained within 100 grams of the sample, mg;

C_{phen} – enotes the concentration of the specific phenolic compound in the extract as determined by the HPLC method, mg/l;

$V_{ekstrakt}$ – signifies the total volume of the sample extract, l;

m_{sample} – indicates the initial mass of the sample taken for the preparation of the extract, g.

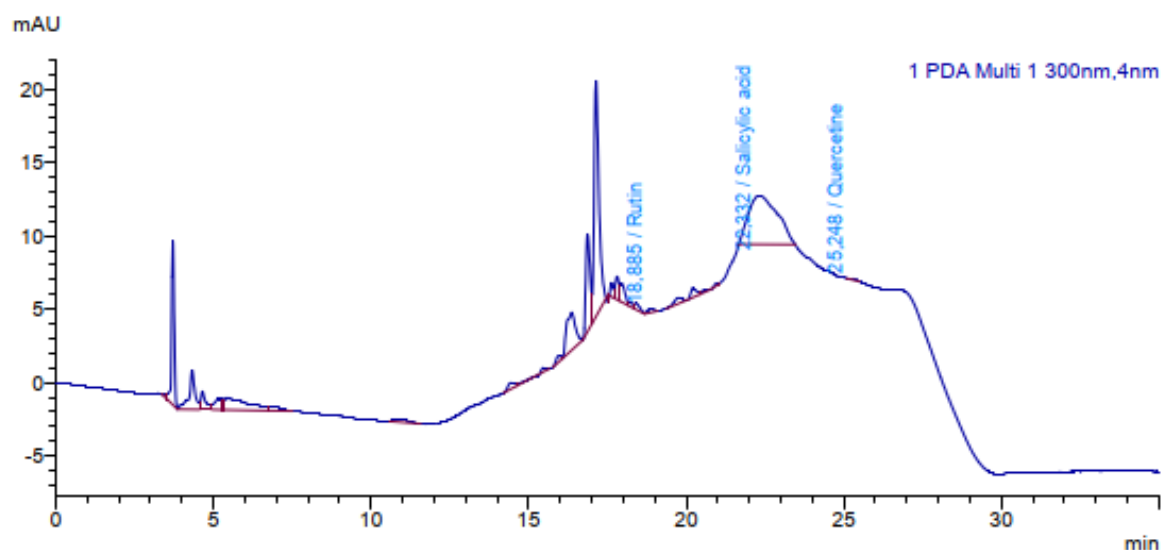


Figure 2. Chromatogram for the determination of polyphenols in gooseberry seed extract.

Table 2. Amount of polyphenols in the extract and retention times.

Name of Phenolic Compound	Retention Time (min)	Concentration (mg/l)	Amount in 100 g of Sample (mg)
— Gallic acid	Not detected	0	0.000
— Rutin	18.885	0.298	0.745
— Salicylic acid	22.332	7.469	18.673
— Quercetin	25.248	0.039	0.098
— Apigenin	Not detected	0	0.000
— Kaempferol	Not detected	0	0.000

Upon analysing the chromatogram of the polyphenols identified within the 96% ethanol extract of quince seeds (Figure 2), it is evident that among the peaks corresponding to the detected phenolic compounds, those for salicylic acid and rutin are most prominently displayed. Conversely, the chromatogram confirms the absence of peaks for gallic acid, apigenin, and kaempferol within this specific extract.

The experimental analysis conducted on the chemical composition of the quince seeds (Table 2) demonstrates that among the six types of polyphenols analysed in the ethanol extracts prepared from 100 g of the sample, salicylic acid exhibited the highest concentration at 18.673 mg. This was followed by rutin at 0.745 mg and quercetin at 0.098 mg. Given that even low doses of polyphenols have been shown to protect melanocytes from lipid peroxidation, these findings indicate that quince seeds possess significant potential as a raw material for the production of therapeutic dietary supplements.

Conclusion

As a result of the comprehensive studies conducted, it has been established that the chemical composition of quince seeds is significantly enriched with specific phenolic compounds, namely flavonoids. The quantitative data obtained via the High-Performance Liquid Chromatography (HPLC) method demonstrated that the concentration of salicylic acid



is substantially higher in comparison to the other detected constituents, such as rutin and quercetin.

Owing to this elevated content of salicylic acid — and taking into account its well-documented antipyretic, anti-rheumatic, anti-inflammatory, and analgesic properties — quince seeds offer substantial potential for the pharmaceutical and nutraceutical sectors. These findings expand the possibilities for utilizing quince seeds as an effective and promising raw material in the industrial production of dietary and therapeutic food supplements aimed at managing inflammatory conditions and general health maintenance.

References

1. Ibrohimov, A. N., & Rahimjonova, M. I. (2021). Scientific basis of the medicinal properties of the quince plant and its significance in folk medicine. *Scientific Progress*, 2(6), 1579–1582.
2. Asqaov, I. R. (2019). *Encyclopaedia of Medicine*. Tashkent, pp. 124–126.
3. Madan, R. K., & Levitt, J. (2014). A review of toxicity from topical salicylic acid preparations. *Journal of the American Academy of Dermatology*, 70(4), 788–792. <https://doi.org/10.1016/j.jaad.2013.12.005>
4. IUPAC. (2014). *Nomenclature of Organic Chemistry: IUPAC Recommendations and Preferred Names 2013 (Blue Book)*. The Royal Society of Chemistry, p. 64. <https://doi.org/10.1039/9781849733069-FP001>
5. Kochetova, M. V., Semenistaya, E. N., Larionov, O. G., & Revina, A. A. (2007). Determination of biologically active phenols and polyphenols in various objects by chromatographic methods. *Russian Chemical Reviews*, 76(1), 89–100.
6. Burlakova, E. B. (2007). Bioantioxidants. *Russian Chemical Journal*, 51(1), 3–12.
7. Budnikov, G. K., & Ziyatdinova, G. K. (2005). Antioxidants as objects of bioanalytical chemistry. *Journal of Analytical Chemistry*, 60(7), 678–691.
8. Kurdyukov, E. E., Vodopyanova, O. A., Moiseeva, I. Y., & Semenova, E. F. (2021). Methodology for the quantitative determination of the total flavonoids in the leaves of *Moringa oleifera*. *Moscow University Chemistry Bulletin*, 62(4).