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Quince (*Cydonia oblanga*) Fruits: A Rich Source of Nutrition, Phenolics, Flavonoids, Antioxidant and Antibacterial Activity

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Abstract

Natural products continue to play a significant role in drug discovery and development processes, and many plants have already provided valuable clues for potentially bioactive compounds. Additionally, in recent years it has become evident that significant health risks and benefits are associated with dietary food choices. Nutritional studies recommend the regular consumption of fruits and vegetables, which constitute an essential part of the Mediterranean diet, to favor a healthy life. Quince (*Cydonia oblonga* Mill.) is a native plant of Central Asia having a long history of ethnobotanical and medicinal use. This study was carried out to evaluate the nutritional composition, total phenolic and flavonoid contents, and biological activities of quince fruit. Nutritional profiling revealed the presence of fiber 0.8 g, protein 0.5 g, carbohydrate 0.19 g, lipid 2.7 g, ash 0.6 g, energy 176 kj and moisture content 80% in 100 g^{-1} of quince fruit. The mineral analysis showed Ca (68.83 mg 100 g^{-1}), Zn (0.704 mg 100 g^{-1}), K (205.01 mg 100 g^{-1}), Cu (0.51 mg 100 g^{-1}), Na (21.03 mg 100 g^{-1}), Mg (11 mg 100 g^{-1}), Fe (2.57 mg 100 g^{-1}) and Mn (1.43 mg 100 g^{-1}). This study showed that *C. oblanga* is a good source of phenolics and flavonoids. The methanolic and aqueous extracts of quince fruit showed the highest zone of inhibition 17.4 ± 0.15 and 17.53 ± 0.26 mm against *Pseudomonas aeruginosa* and *Staphylococcus aureus*, respectively, which showed their efficacy as a potent antimicrobial. The methanolic extract showed the highest antioxidant activity (IC_{50} 01.52 mg mL^{-1}). This study concludes that quince fruits are a potential source of bioactive metabolites and may be used in the pharmaceutical industry. Overall, this study exhibited that quince fruits were considered a promising, cheap, and natural source for nutritional or pharmaceutical applications with biological activity properties.

Keywords: Antibacterial; Antioxidant; Minimum inhibitory concentration; Nutrition analysis; Proximate analysis; Phenolic content; Quince

Introduction

Flowering plants are a rich source of different types of bioactive compounds (Naqvi *et al.* 2020; Altuntas and Koruklouglu 2024). Plant-derived compounds possess antifungal (Ferdosi *et al.* 2022; Jabeen *et al.* 2022), antibacterial (Saeed *et al.* 2023), insecticidal (Zafar *et al.* 2022), herbicidal (Javaid and Khan 2020), antioxidant, anticancer, and other health-related properties (Khan and Javaid 2023). Quince (*Cydonia oblonga* Mill.) is a member of the genus *Cydonia* belonging to the oldest cultural group of plants. These cultural plants are native to Central Asia in the Caucasus region and spread out to other regions of the world as well (Al-Snafi 2016). Quince is a small tree growing 3–6 m tall and has high genetic variability with 30 different cultivars). The fruit of quince is a golden pome with a downy and fleshy appearance (Leonel *et al.* 2016; Altuntas and Koruklouglu 2024). Quince fruits are not much appreciated for fresh eaten due to their sour taste and hardness in the unripe phase. Therefore, they are used as preserved or in cooked form (Leonel *et al.* 2016; Bellis *et al.* 2022). Several studies on the quince plant revealed that it is a good and cheap source of phytochemicals, minerals, and biological nutrients. The quince fruit extract is identified for its antioxidant potential linked to the presence of many phytochemicals like phenolic acid, flavonoids, rutin, quercetin, terpenoids and a high level of ascorbic acid (Bellis *et al.* 2022; Altuntas and Koruklouglu 2024).

Quince is mainly used in the food industry for making jelly, jams, and cakes (Leonel *et al.* 2016). It is characterized

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by low fat content and is a major source of dietary fiber, proteins, organic acids, carbohydrates, and minerals such as potassium, calcium, and sodium (Al-Snafi 2016; Leonel *et al.* 2016). Quince plant is considered highly medicinal having many beneficial secondary metabolic compounds like sugar, tannins, terpenoids, flavonoids, phenolics, glycosides, and organic acids which are used to prevent and cure many diseases such as ulcers, diabetes, cancer, respiratory, and urinary disorders (Sabir *et al.* 2015). Quince fruit flour is regarded as a significant source of organic acids, fiber, phenolics, sugars, and minerals like calcium, potassium, and phosphorus. It also has low-fat content. Owing to these health-endorsing ingredients, quince extract has historically been utilized for both therapeutic and nutritional purposes (Sabir *et al.* 2015; Bellis *et al.* 2022).

This study was focused on a detailed analysis of mineral elements, nutritional values, quantification of phenolic, and flavonoid content, and their biological activities like antioxidant and antibacterial activities of the fruit of *C. oblonga*. Quantitative analysis of minerals like Ca, K, Zn, Cu, Na, Mg, Mn, Fe and the five different extracts were chosen for analysis of the antioxidant and antibacterial potential of the *C. oblanga*. Although, the phytochemicals and biochemical composition of leaves and seeds have been reported previously a detailed study on phytochemicals, minerals bio-nutrients, and biological activities of fruit has not been done yet. Therefore, this study was designed to evaluate the proximate analysis, and quantification of minerals, phytochemical, antibacterial, and antioxidant potentials of quince fruit.

Materials and Methods

Collection of plant samples and extracts preparations

Collection of plant samples: The fruits of *C. oblanga* were investigated for nutritional, phytochemical, and biological activity because fruits are consumed as a source of nutrients (Altuntas and Koruklouglu 2024). The fresh fruits were collected and carried from district Kotli, Azad Jammu and Kashmir, Pakistan to the Biochemistry and Molecular Laboratory, department of Botany University of Azad Jammu and Kashmir Muzaffarabad. The plant was identified with the help of the flora of Pakistan and a voucher specimen was submitted to the AKASH Herbarium of UAJK. Except for the moisture contents which were determined in fresh sample, all other activities were performed on dry fruit material. For this, the fruits were cut into fine pieces and placed in the shade at room temperature for almost 6 weeks. The dry fruit material was then ground up to fine powder using a blender, packed in polythene bags, and stored until further use (Altuntas and Koruklouglu 2024).

Extract preparation: For phytochemical and biological activity, crude extract from dried fruit material was used. For extraction, the powder was soaked in 5 different solvents of different polarity such as acetone, chloroform, ethanol, methanol, and distilled water for the selection of the best suitable solvent extraction for phytochemical and biological activity. In each 300 mL solvent, 30 g powder was soaked and kept in a shaking incubator at 40ºC with a speed of 150 rpm for 72 h. After that, the mixture was filtered using Whatman filter paper, and the filtrate was evaporated into dried crude extract using a rotary evaporator.

Proximate analysis

For proximate analysis, moisture content, total ash, dry matter, total fats, crude fibers, and total proteins were analyzed. The moisture content in fresh fruit was measured by the given methodology defined by (Ferreira *et al*. 2022). In the pre-weighed Petri plate, 1 g fresh fruit sample was taken and placed in an oven at 100ºC to remove moisture for 4 h. The procedure was repetitive until the weight of the fruit sample became constant and then the sample was kept in desiccators for cooling and reweighed. The moisture content of the sample was calculated by using the following formula:

$$\text{Moisture } (\%) = (W1 - W2)/(\text{weight of sample}) \times 100$$

Where: W1= Weight of fresh sample (before drying)
W2= Weight of dried sample.

The total dry matter of fruit was calculated by the formula given by (Ferreira *et al*. 2022).

Total dry matter = 100 - moisture (%).

For determination of total ash, 1 g dried powder of fruit was incinerated in a pre-weighed Muffle Furnace and charred at 550ºC until white ash was formed according to the AOAC method (Isra *et al.* 2022). Afterward, the covered crucible was taken out and placed in the desiccators for cooling to reduce any trace of moisture. Finally, the crucible was weighed on a weighing balance without a lid (cover). The ash (%) was calculated by using a formula and the results are represented as g 100 g^{-1} dry weight (DW).

$$\text{Ash}(\%) = (\text{weight of ash})/(\text{weight of sample}) \times 100$$

For quantification of total lipid content, 2 g powdered sample was added to the thimble and attached with a Soxhlet extractor. The flask (pre-weighed) was poured with 300 mL petroleum ether and refluxed for 10 to 12 h with a heating mantle. The Fats were extracted into a flask. After the cooling flask was placed in a desiccator, weight was taken (Islary *et al.* 2016; Ferreira *et al*. 2022). The percentage of fats was determined by formula and results are represented as g 100 g^{-1} DW.

$$\text{Fat } (\%) = (\text{weight of fat})/(\text{weight of sample}) \times 100$$

The dietary fiber was determined by taking a 1 g defatted sample, boiled with 200 mL sulfuric acid (1.25%) in a beaker for 30 min. Then the mixture was filtered and neutralized by washing with double-distilled water.

The same process (as with sulfuric acid) was repeated with sodium hydroxide. The material from the beaker was placed on a prepared Gooch crucible with an asbestos mat, rinsed, and washed with 15 mL of ethyl alcohol. The constant weight of the crucible was obtained by drying it in a hot air oven at the temperature of 110ºC. The crucible with fiber was cooled in a desiccator and weighed (w1) on weighing balance. The material on the crucible was ignited on low flame till charred and placed in the Muffle Furnace at a temperature of 550ºC and weighed (W2) (Ferreira *et al*. 2022). The fiber was calculated by a formula and the results are represented as g 100 g^{-1} DW.

$$\text{Fiber } (\%) = W1 - W2 \times 100$$

The protein was measured by using the Kjeldahl apparatus as defined by the AOAC method (Isra *et al.* 2022). A 0.5 g plant sample was digested by adding Kjeldhal catalyst (1 part copper sulfate and 9-parts potassium sulfate) and 20 mL of concentrated sulfuric acid (H_2SO_4) in the digestion chamber till the solution became transparent. The blank test was taken without sample material. When digestion was completed, it was distilled in the Kjeldahl apparatus distillation chamber. The condensed ammonia was titrated against the vaporized ammonia and titrated against the recognized concentration (0.1 N) of hydrochloric acid (HCL). The total nitrogen concentration was calculated by using the following formula:

$$\text{Nitrogen } (\%) = ((A - B) \times N \text{ of HCl x } 14) / (\text{weight of sample}) \times 1000$$

Where: A = Volume (mL) of HCl used in sample titration
B = Volume of (0.1 N) HCl used in blank titration
14 = atomic weight

Finally, the protein content was calculated by multiplying the obtained nitrogen content by the protein conversion factor.

$$\text{Protein } (\%) = \text{nitrogen } (\%) \times 6.25$$

The total carbohydrate content was evaluated by the formula described (Isra *et al.* 2022) given below and the results are represented as g 100 g^{-1} DW. The caloric value or total energy was determined (Isra *et al.* 2022) by the following equation.

$$\text{Total energy } \left(\frac{kj}{100\ g}\right) = 4 \times \text{carbohydrate } (\%) + 4 \times \text{protein } (\%)$$

Mineral analysis

The minerals like Mg, Fe, Ca, Na, K, Zn, Ni, Cd and Pb were measured by using an Atomic Absorption V-730 UV-visible spectrophotometer and the results are presented as mg 100 g^{-1} DW (Ferreira *et al*. 2022).

Total phenolic content (TPC)

The total phenolic content of the sample was determined by the Folin-Ciocalteu procedure as reported by (Isra *et al.* 2022). By the Folin Ciocalteu method, test tubes were filled with 1 mL of each fruit extract sample and 1 mL of Folin Ciocalteu. After 3 min, 1 mL of a sodium carbonate solution was added to the mixture and added distilled water to make the final volume 10 mL. The mixture was left at room temperature for 30 min in the dark. The absorbance was recorded at 725 nm in comparison to the blank reagent. The calibration curve employed gallic acid with a concentration of 1 to 10 mg mL^{-1}. The results were expressed as mg of gallic acid equal to 100 g of DW (mg GAE 100 g^{-1}). The triplet of all the tests was performed to record significant data.

Total flavonoid content (TFC)

The Total flavonoid content was determined by the aluminum chloride procedural method as reported by (Isra *et al.* 2022) with a little modification. A volume of 0.5 mL of each extract (acetone, chloroform, ethanol, methanol, and aqueous) of fruit was added and shaken with 0.5 mL of double distilled water. After dilution, aluminum chloride 0.5 mL (10% P/V) and 0.5 mL of sodium acetate (1 M) were mixed. 2 mL distilled water was added again into the solution and absorption was recorded after 30 min at 415 nm against the blank containing 4 mL of each extract lacking aluminum chloride. The calibration curve of quercetin was used with a concentration of 1 to 10 mg mL^{-1}. The results were expressed as mg of Quercetin equal to per 100 g DW (mg QE 100 g^{-1}).

Antioxidant activity by DPPH Free radical scavenging assay

The antioxidant potential of *Cydonia oblonga* fruit in each extract (acetone, chloroform, ethanol, methanol, and aqueous) was performed by using the methodology described by (Isra *et al.* 2022). The different volume concentrations of each 10 mg mL^{-1} extract (1, 1.5, 2, 2.5 mL) were added in 1 mL of working solution of DPPH (3 mM DPPH solution in each solvent) and kept in the dark for incubation at 25ºC for 30 min. After that, the absorbance for all extracts was measured at 517 nm with a UV-VIS spectro-photometer and compared to standard ascorbic acid of similar concentrations (Islary *et al.* 2016). For a blank sample, 1 mL of each solvent was mixed with 3 mL of working solution of DPPH. The absorbance was changed to the DPPH radical scavenging rate using the equation.

$$\text{DPPH radical capacity } \frac{[(\text{A control}) - (\text{A sample})]}{(\text{A control})} \times 100$$

Antibacterial activity by agar well diffusion assay

Antibacterial activity of fruit extracts was determined by using the agar well diffusion method against bacterial strains *Pseudomonas aeruginosa*, *Xanthomonas* sp. (Gram-positive), *Staphylococcus aureus* and *Streptococcus pneumoniae* (Gram-negative) (Isra *et al.* 2022). The pure

cultured bacterial strains were obtained from the Microbiology Laboratory of Sheikh Khalifa Bin Zahid combined military hospital, Muzaffarabad. A fresh culture of each strain was prepared by streaking them on nutrient agar Petri plates followed by incubation at 37ºC for 24 h in an incubator for maximum growth. To create a spreadable media and achieve uniform development, the revived cultures were injected into nutrient broth in test tubes. This was followed by a 24 h incubation period at 37ºC in an incubator shaker.

Then, these tubes filled with microbial colonies in nutritional broth were used for the well-diffusion method. Extracts were reconstituted to final concentrations of 10 mg mL^{-1}. The nutrient agar was inoculated with 100 μL of 24 h inoculum of bacterial strains. Using a sterile cork borer, wells (6 mm in diameter) were punched in agar medium and filled with 80 μL of fruit extracts. After that, the plates were incubated for the next 24 h at 37ºC. By measuring the zone of inhibition in millimeters, the antibacterial activity was assessed. One well in each plate was treated with ampicillin as a control. The data was examined using an analysis of variance. Duncan's mean Multiple Range test was used to compare all mean values and significance was accepted at $\leq$ 0.05 level (Isra *et al.* 2022; Altuntas and Koruklouglu 2024).

Results

Nutritional analysis

It was found that the fruit contained 80% moisture content and 20% dry weight as shown in Table 1. The increased amount of moisture affects the physical and mechanical properties of the fruit (Al-Snafi 2016). The measurement of ash is the actual quantity of minerals of fruit was found to be 0.6 g 100 g^{-1} in DW. The fruit also has 0.8 g 100 g^{-1} in DW dietary fiber as an important constituent. Dietary fibers have several benefits for human health *e.g*., lowering the total cholesterol, ability to relieve constipation, increasing weight and also lowering the risk of diabetes. As fruits ripen, carbohydrates are stored in fruit.

Although the dried fruits were not very sweet, they contained a reasonable amount of carbohydrates *i.e.*, 0.19 g 100 g^{-1} DW. The calorific value was determined as 176 kj. The total protein content was found as 0.5 g 100 g^{-1} DW, like a previous study where they were observed as 0.6 g 100 g^{-1} DW (Leonel *et al.* 2016). The building blocks of proteins are amino acids that play a major part in the development and growth of the human. Proteins are also used as fuel in the deficiency of carbohydrates and lipids.

In our study, a higher amount of potassium (205.01 mg), calcium (68.83 mg), Sodium (21.03 mg), zinc (0.704 mg), magnesium (11 mg), manganese (1.43 mg), copper (0.51 mg), and Iron (2.57 mg) in per mg 100 g^{-1} DW were reported while cadmium, nickel and cobalt were not detected in quince fruits (Table 2). The result shows that the fruit of quince is a good source of mineral intake.

Table 1: Profile of nutritional components in the fruit of *Cydonia oblonga*

Nutritional profile	Concentration (MV)
Total Moisture content (%)	80%
Dry Matter of fruit (%)	20%
Total Ash content (g 100g^{-1} DW)	0. 6
Total Fat content (g 100g^{-1} DW)	2.7
Total dietary fiber (g 100g^{-1} DW)	0.8
Protein (g 100g^{-1} DW)	0.5
Carbohydrate (g 100g^{-1} DW)	0.19
Caloric value or energy (kj)	176

Abbreviations: DW = dry weight, MV = mean values

Table 2: Concentration of mineral elements present in fruit of *Cydonia oblanga*

Minerals	Concentration mg 100 g^{-1} DW, n = 10, MV
Na	21.03
Ca	68.83
K	205.01
Zn	0.704
Mg	11
Mn	1.43
Cu	0.51
Fe	2.57
Cd	ND
Co	ND
Ni	ND

Abbreviations: Mean value; DW = dry weight; n = number of samples, MV = mean values

Total phenolic content (TPC), total flavonoid content (TFC) and antioxidant activity

The fruit extracts with different solvents acetone, chloroform, ethanol, methanol, and distilled water) of *C. oblanga* have shown a good amount of TPC and TFC (Table 3) in it. However, the higher TPC (80.45 ± 0.67 mg GAE 100 g^{-1} DW) and TFC (70.68 ± 0.67 mg QE 100 g^{-1} DW) contents were found in methanol extract. It has already been noted that ethanol and methanol solvents are the best for extracting phenolic chemicals.

The quince fruit was found to have a good antioxidant potential which is represented in terms of IC_{50} value in (Table 3). The lowest IC_{50} value reflects the highest antioxidant activity. Among all the fruit extracts with different solvents used in this study, methanol extract showed the lowest IC_{50} value (01.52 ± 0.07 mg mL^{-1}) which suggested its highest antioxidant activity. As already mentioned, methanol extracted higher TPC and TFC, therefore, it is clear that the presence of bioactive components (TPC, TPC) correlates with DPPH-free scavenging activity exhibits high antioxidant activity in methanolic extract.

Antibacterial activity

All the fruit extracts have shown antibacterial activity against both gram (+) and gram (-) bacterial but the most active extracts having higher antibacterial activity were aqueous extract against *S. aureus* and methanol extract against *P. aeruginosa* with a zone of inhibition of 17.53 ± 0.26 mm and 17.40 ± 0.15 mm, respectively (Fig. 1).

Table 3: Total phenolic content, total flavonoid contents, and antioxidant activity in terms of IC_{50} of fruit extracts of *Cydonia oblonga*

Fruit extracts	TPC (mg GAE 100 g^{-1} DW)	TFC (mg QE 100 g^{-1} DW)	Antioxidant Activity				IC_{50} (mg mL^{-1})
			2.5 mL	2 mL	1.5 mL	1 mL	
Acetone	25.32 ± 0.33 E	52.75 ± 0.58 D	80.89	74.85	69.55	62.35	62.62 ± 0.58 A
Chloroform	56.75 ± 0.58 C	46.32 ± 0.33 E	69.55	59.3	51.22	38.44	29.38 ± 0.33 B
Ethanol	65.68 ± 0.67 D	65.75 ± 0.58 B	82.37	80.42	76.66	72.01	11.56 ± 0.67 C
Methanol	80.45 ± 0.67 A	70.68 ± 0.67 A	88.58	84.73	85.08	80.22	01.52 ± 0.07 D
Distilled water	52.13 ± 0.33 B	62.32 ± 0.33 C	51.95	45.23	42.92	40.63	02.41 ± 0.11 D
Ascorbic acid			79.51	69.99	62.08	57.63	01.74 ± 0.07 D

Different letters in a column indicate significant difference in the mean values at *P = 0.05* by one way ANOVA; DW = dry weight; TPC = total phenolic content; GAE = gallic acid equivalent; TFC = total phenolic content, QE = quercetin equivalent; IC_{50} = inhibitory concentration requires to scavenge free radicals (DPPH) by 50%. The lowest IC_{50} indicated the highest antioxidant activity

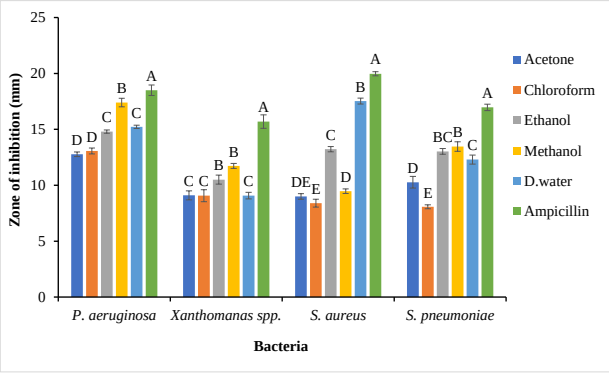

Fig. 1: Antibacterial activity of fruit extracts of *Cydonia oblanga* against Gram-positive and Gram-negative bacteria. The means that have the same letter (s) are non-significant to each other at *P = 0.05* by Duncan's Multiple Range Test, n = 3

Discussion

The dietary fibers also play a vital role in exercising "gastrointestinal functions" through their hydration capacity, physical action, and ability to enhance the velocity and volume of fecal matter (Abed *et al.* 2022). In contrast to our result, a higher amount of fat was found in cloned quince fruit such as 0.93 g 100 g^{-1} DW and 1.6 g 100 g^{-1} (Sharma *et al*. 2011; Islam *et al*. 2023). The dried fruits have a substantial amount of lipids *i.e*., 2.7 g 100 g^{-1} DW. Lipids are major constituents of food and are responsible for many nutritional characteristics. The most widespread organic matter in nature is carbohydrate, a quick source of energy. They are synthesized in the leaves of plants by photosynthesis and stored in fruit in the form of starch (Islam *et al.* 2023).

Minerals play an important role in the functioning of the human body. The concentration of minerals in the fruit depends upon the availability of nutrients in the soil, the stage of development of the fruit, and the physical age of the fruit. The mineral in the highest amount found was potassium as it is a predominant mineral element in most fruit tree species. It is well known that the quince tree has a great ability to absorb salts from saline soil as we observed a good amount of sodium in quince fruit. Different minerals perform many beneficial functions such as calcium, magnesium, and phosphorus make the structure of bones in addition to constituting teeth, blood, muscle, nerve cells, and water balance (Ferreira *et al.* 2022; Isra *et al.* 2022). The body can take them only from an external source because they are not synthesized. After the intake of minerals in the organism's body, they are transported throughout the body and then eliminated by excretion (Brasil 2008). Therefore, an organism must take IDR's "recommended daily intake" and quantity of lipids, protein, minerals, and vitamins to attend to their nutritional demand for their healthy body (Islam *et al*. 2023).

Many significances of having higher phenols and flavonoids in plants have already been reported (Kanwal *et al.* 2010, 2011; Abed *et al*. 2022). Polyphenols can stabilize electrons (unpaired) and have a structure that prevents harmful oxidation through "free radical-scavenging" activities. Phenol content has shown more antioxidant activity than Vitamin C and E (Bellis *et al.* 2022). The flavonoids play a role in the induction of apoptosis, inhibition of cell proliferation, and enzyme inhibition. Flavonoids also possess biological activities such as antibacterial and antioxidant activities. These chemical compounds retain many hydroxyl groups which have a strong radical scavenging effect and antioxidant potential (Altuntas and Koruklouglu 2024). It has been suggested that antioxidants block the action of free radicals which are responsible for the pathogenicity of many diseases. No doubt, on one side, free radicals play a crucial role in implicating cell-signaling mechanisms in our bodies but at the same time, they are very harmful to our bodies and cause many diseases (Abed *et al.* 2022; Isra *et al.* 2022). The damage caused by free radicals is repaired with the help of various enzymes such as glutathione, catalase, peroxidase, dismutase, e dismutase, and glutathione. These antioxidant compounds play a significant role in many defensive mechanisms which are generally ascorbic acid (vitamin C) retinol (vitamin A) and tocopherol (vitamin E) many phenolics components (Altuntas and Koruklouglu 2024).

The DPPH (diphenylpicyl-hydrazyl) radical scavenging method is a very easy, sensitive, and rapid way to examine the antioxidant potential of plant extracts or a specific chemical compound (Islam *et al*. 2023). The DPPH free radical scavenging activities of extracts depended on the plant type and their extraction solvent and antimicrobial activities of plants are correlated with secondary metabolites

in them. The major secondary metabolites are polyphenols, terpenoids, and flavonoids. It was suggested that the phytochemicals present in quince fruit extracts may deactivate many cellular enzymes which play a significant role in the metabolic pathways of these microorganisms (Bellis *et al.* 2022). Previously, 34 polyphenols were identified in quince fruit (Islam *et al*. 2023). It has been suggested that bioactive compounds of plants disrupt the cell walls of microorganisms, promote lysis, and inhibit microbial DNA replication, resulting in the inhibition of microbial growth (Isra *et al.* 2022). The finding of the current study supports the traditional usage of quince fruits and proposes that the presence of chemical compounds having antimicrobial potential can be used in novel drugs for the treatment of microbial diseases (Yisa 2009; Altuntas and Koruklouglu 2024).

Conclusion

At the end of this study, we conclude that quince fruit can be a good source of food and a potential medicinal agent. Fruit is rich in proteins, lipids, dietary fibers, and carbohydrates. In addition to this, quince fruit also possesses a large amount of Fe, Ca, K, Na, Mg, Mn and Zn. The strong antioxidant activity of fruit was also recorded and can be used as a natural alternative preventive. The fruit extracts, particularly, aqueous and methanol, were marked with high values of antibacterial activity against both gram (+) and gram (-) bacterial strains. Thus, they can be used in the management of resistant microbes caused by many infectious diseases. A detailed biological investigation and phytochemicals quantification and Ethnobotanical significance of quince plant will be performed for a better scientific interpretation of traditional knowledge of these plants.

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Author Contributions

SS drew this draft completely, MQK supervised the research, AM co-supervised the research KH assisted in formatting and proofreading, MS helped in statistical analysis, AL and MS reviewed the article.

Conflicts of Interest

All authors declared no conflict of interest.

Data availability

Data will be available on a fair request to the corresponding author.

Ethical Approval

Not applicable in this paper

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