



Medicinal Properties of *Cydonia Oblonga* Mill Fruit (Pulp and Peel) in Iranian Traditional Medicine and Modern Phytotherapy

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Received: 4 Mar 2016

Revised: 1 Apr 2016

Accepted: 15 Apr 2016

Abstract

Cydonia oblonga Mill is commonly known as quince. It seems to have been used since the ancient time. Quince is a popular fruit because of its health promoting properties. It is an undeniable fact that there is a positive relationship between a diet rich in plant foods and a diminish incidence of cancer, cardiovascular and other diseases. The aim of this study was demonstrating pharmacologic properties of quince (pulp and peel), view of Iranian traditional medicine (ITM) and modern phytotherapy. For this purpose, Pubmed, Elsevier, Scopus, SID and Google scholar were searched for the key terms "*Cydonia oblonga*" and "Quince" up to 20st June 2015, and also Iranian traditional medicine manuscripts and herbal medicine books were studied. All experimental and animal studies that included the evidences of fruit (pulp and peel) written in this article were selected for review. Quince has various pharmacological properties including antioxidant, anti-allergic, anti-inflammatory, anticancer, antibacterial, and anticolitis properties and effects on blood pressure and blood rheology, and also has several traditional medicine uses. In Iranian traditional medicine, quince pulp is effective on the most important and vital organs like brain, heart and liver. This fruit is a valuable source of compounds with health-promoting properties and can be used as good sources of antioxidants in our diet and may have use in the prevention and treatment of heart, brain and gastrointestinal diseases.

Keywords: *Cydonia oblonga*; Phytotherapy; Quince; Traditional medicine; Pharmacology; Phytochemistry

Citation: Aliasl F, Toliyat T, Mohammadi A, Minaee B, Samadi N, Aliasl J, et al. **Medicinal Properties of *Cydonia Oblonga* Mill Fruit (Pulp and Peel) in Iranian Traditional Medicine and Modern Phytotherapy.** Trad Integr Med 2016; 1(3): 122-8.

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1. INTRODUCTION

Cydonia oblonga Mill (Synonym: *Cydonia vulgaris* Pers, *Cydonia maliformis* Mill and *Pyrus cydonia* L) from the family Rosaceae is commonly known as quince [1]. It is a small tree or shrub up to 8 m in height and leaves are ovate to oblong, flowers are white or pink, and fruits are big (10-12 cm in diameter) [2], odorant and cover with densely tomentulose [3]. Considering of shape, quince is categorized to different varieties such as *pyriform* or typical (pear-shaped), without ribs, *maliformis* (apple-shaped), with roundish and *lusitanica* (pear-shaped) but obviously, ribbed [4], [5]. The white yellow pulp, easily oxidized to air exposition, is firm and generally acidic, and astringent; so, it is not suitable for consumption when it is raw [2].

The quince is native of western Asia from Iran (Persia) to Turkestan. It seems have been used since the ancient time, starting from Persia about 4000 years BC and spreading with the prosperous civilizations of that time all over the Mediterranean basin to the west and to Afghanistan to the east [4]. Nowadays, quince is cultivated in many parts of the world like many European countries (up to Scotland and Norway), North and South Africa, North and South America, Australia and Oceania [5], Mediterranean and some areas of the Asia. It is naturally growing wild in most parts of Iran such as Golestan, Gilan and Azarbaijan.

There are important various types in Isfahan such as Mazaheri, Haji Rafii, and Groten Shams [6]. Quince is called Safarjal in Iranian traditional medicine (ITM) books like Canon of Avicenna (Canon fi teb). This fruit has several traditional medicinal uses including brain, heart, and liver diseases, stomach tonic, nausea and vomiting, chronic headache, heart palpitation and moving sickness. Quince is attracting interest by reason of its health promoting properties, mostly related with its antioxidant capacity, phenolic composition, and anti-inflammatory, anti-carcinogenic, anti-allergic, antimicrobial and anti-ulcerative activities and also it might act as a tonic for

heart and brain [7]. Epidemiological studies have demonstrated relationships between consumption of polyphenol-rich foods and prevention of diseases such as cancer, coronary heart disease and osteoporosis [8].

This study aimed to assess the pharmacologic properties of quince (pulp and peel) from the view of ITM and modern phytotherapy.

2. METHODS

In this review, information about quince was collected via the scientific databases as Pubmed, Elseveir, Scopus, SID and Google scholar up to 20st June 2015. The key terms of search were “*Cydonia oblonga*” and “Quince”. All in-vitro, animal and clinical studies that evaluated medicinal properties of fruit (pulp and peel) were included. Agriculture studies and studies evaluating seeds and leaves of quince were excluded from the review. Duplication was avoided by excluding reviews of multiple copies of the same article in several databases.

In addition, we used Flora of Iran, and websites like “www.itis.gov” and “www.theplantlist.org” for family and scientific names of quince. We searched Safarjal (Quince) in ITM books including The Canon of Medicine by “Avicenna” (10th and 11th centuries) and Makhzan-al-advia (18th century) and also botanical books were studied for botany of quince.

The resources were selected through consensus of research team members and all included papers were reviewed by the first author of the article.

3. RESULTS

3.1. Phytochemistry

Among the various studies, phenolic compounds, organic acids and free amino acids are principal components of quince [9]. Silva et al. demonstrated that main phenolic compounds of quince pulps are caffeoylquinic acids (3-,4-,and 5-O-caffeoylquinic acids and 3,5-dicaffeoylquinic acid), quercetin glycoside, and rutin (in low amount). The peels have the same caffeoylquinic acids and

several flavonol glycosides and several unidentified compounds. Glucosides of procyanidin polymers have been previously identified in this fruit [10].

Twenty-one free amino acids are found in several samples of quince fruit (pulp and peel) [11]. Three major free amino acids of the fruit are asparagine, aspartic acid, and glycine; generally, the free amino acids profiles are similar in pulp and peel. However, the hydroxyproline content is significantly higher in pulp [9], [12], [13]. Silva et al. showed the pulp and peel had similar profiles according to organic acids including oxalic, citric, ascorbic, malic, quinic, shikimic, and fumaric acids [12], [14], [15].

Recently, Szychowski et al. identified phytic and tartaric acids [7]. Sousa et al. isolated and identified a homo-monoterpenic compound in pulps and peels [7]. It has been demonstrated that fructose and glucose are the main sugars of ripe quince fruits [7]. Moreover, quince contain minerals such as Ca, Fe, Mg, P, K, Na, Zn, Cu, Se and vitamins like A, E, B6, thiamine, riboflavin, niacin, and pantothenic acid [17].

3.2. Medicinal properties

3.2.1. View of ITM

Quince is called Safarjal in ITM books like Canon. Its other names are Beh in farsi and Heva in Azari [18]. According to taste, quince is divided in to three types in ITM, sweet, sour and sweet- sour. This fruit has several traditional medicine uses. In ITM, quince pulp is effective on the most important and vital organs like brain, heart and liver as well as stomach. It is brain tonic, heart tonic, liver tonic and cardiac tonic and gives people cheerfulness and vitality and is useful in chronic headache, heart palpitation and removing sickness. The other effects of this fruit are stomach tonic and improving nausea and vomiting, hangover and appetite. It is useful in pregnancy as preserves embryos and removes pica. The other uses are in jaundice, thirst, and dysuria. Smell of three types of quince is useful for obsession. The stomach tonic properties of sour quince

are more potent than sweet quince. Consuming raw quince is harmful and should be cooked as jam and also roasted quince (color turns dark) is used in chronic diarrhea. Quince has cosmetic use as deodorants [18], [19].

3.2.2. View of modern phytotherapy

3.2.2.1. Antibacterial

Antibacterial activity of quince has been demonstrated in different studies. Elsadig Karar et al. showed that the quince crude extract has a growth inhibitory effect on *Escherchia coli* [20]. In another study, quince showed the highest antimicrobial activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa*; although it did not demonstrate inhibitory activity against *Salmonella* species and *Aspergillus niger*. Both quince pulp and peel extracts showed bacteriostatic and bactericidal activities; however the antibacterial activity of peel extract was stronger than that of the pulp [21], [22].

3.2.2.2. Anti-*Helicobacter pylori* (*H. pylori*)

Babarikina et al. examined anti-*H. pylori* potential of 33 individual substances, juices and plant extracts and 35 of their combinations. Quince juice was combined with bilberry, black choke-berry, red currant juice, green tea, sweet flag rhizome or apple pomace extract. The strongest anti-*H. pylori* activity was related to the combinations of quince juice and cranberry juice [23]. In another study, Zaidi et al. showed aqueous-ethanol extracts of quince fruit inhibited the growth of *H. pylori* [24].

3.2.2.3. Anti-influenza activity

Hamauzu et al. investigated anti-influenza viral activities of quince fruit. Results showed a moderate anti-influenza activity of quince fruit extract due to the presence of polymeric procyanidins [25].

3.2.2.4. Antioxidant activity

Antioxidant activity of quince is demonstrated in various studies. Silva. et al measured antioxidant activity of methanolic extract of quince fruit (pulp and peel) via evaluating the inhibitory activity against 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical. Antiradical

activity of peel was stronger than pulp [2]. In another study, antioxidant activity of methanolic extract of pulp and peel quince was demonstrated using DPPH assay [26]. Pacifico et al. showed the antioxidant activity of quince aqueous fermented extract via DPPH assay [27]. Szychowski et al. determined antioxidant activity of six Spanish quince clones. Total antioxidant activity was measured in both peel and pulp of quince fruits, separately, in hydrophilic and lipophilic fractions; and results showed highly significant differences among quince clones and also pulp and peel [7]. Yilmaz and Karadeniz determined antioxidant activity of quince nectar during 9 months of storage at 5, 20, 30 and 40 °C. The amount of antioxidant activity was significantly declined during storage at all temperatures [28].

3.2.2.4. Anticancer activity

Carvalho et al. reported antiproliferative properties of quince (pulp and peel) against human kidney and colon cancer cells. The pulp extract significantly reduced the proliferation of human renal epithelial cancer cells and human colon cancer, but no significant effect was observed with the peel extract [29]. Pacifico et al. evaluated the cytotoxic effects of a lipophilic quince wax extract (QWE) and a quince aqueous fermented extract (QAFE) on three human cancer cell lines including hepatoblastoma cell line (HepG2), lung epithelial cell line (A549) and cervical carcinoma cell line (HeLa). These extracts had different effects on the proliferation of the three tested cell lines. The proliferation of cells was inhibited by both preparations in dose and time-dependent manner. QAFE was almost always more active than QWE; but, sometimes, its effects seemed to be strongly dependent on exposure time [27].

3.2.2.5. Effect on blood pressure, blood rheology and blood count

Zhou et al. demonstrated the effect of quince fruit extracts on blood pressure and blood rheology in renal hypertensive rats. Results indicated the similar antihypertensive effect of quince and captopril. Moreover, quince

reduced whole blood viscosity and improved erythrocyte deformability. Ethanol extracts seemed to be stronger than aqueous extracts [30]. Aslam and Sial assessed the effect of Hydro-alcoholic extract of quince on blood cells in New Zealand white rabbits and showed that quince increased hemoglobin, red blood cell count and hematocrit. This extract demonstrated significant hematopoietic and hematinic potential [31].

3.2.2.6. Immunomodulatory and anti-allergic properties

Anti-allergic effect of quince is demonstrated by various studies. Shinomiya et al. evaluated the effect of crude hot-water extract of quince fruit on type I allergy in vivo and in vitro. The results demonstrated that this extract had an inhibitory effect on type I allergy by suppressing immunoglobulin E (IgE) production and IgE-mediated degranulation [32]. In another study, Kawahara et al. assessed the inhibitory effect of hot-water extract of quince on IgE-dependent late-phase immune reactions of mast cells in vitro. The result showed that quince hot-water extract causes decrease of histamine release from bone marrow-derived mast cells and also reduces the expression of interleukin (IL)-13 and tumor necrosis factor-alpha (TNF- α) [33]. Gencydo® (a combination of lemon juice and an aqueous quince extract) inhibited degranulation and histamine release of basophilic cells and mast cells in comparison with azelastine. Moreover, Gencydo® affected the secretion of inflammatory cytokines (IL-8 and TNF- α) from activated mast cells compared to the elected doses of dexamethasone [34].

3.2.2.7. Antihemolytic activity

Magalhaes et al. observed that pulp and peel methanolic extracts suppressed radical-induced oxidative hemolysis of erythrocytes in vitro. Results showed the significant protection of pulp and peel extracts on the erythrocyte membrane from hemolysis, in a time- and concentration-dependent manner [26].

3.2.2.8. Anti-inflammatory effect

Essafi-Benkhadir et al. assayed the anti-

inflammatory effect of polyphenolic extract from the Tunisian quince peel. Results showed that quince polyphenols extract enhanced the level of the anti-inflammatory cytokines (IL-10 and IL-6) secreted by lipopolysaccharide (LPS)-treated macrophages [35].

3.2.2.9. Sexual behavior

Aphrodisiac activity of the hydroalcoholic extract of quince fruit has been investigated in Wistar rats. The results showed that after administration of the extract mounting, frequency and the mating performance of the rats increased significantly [31].

3.2.2.10. Anticolitis effect

Minaiyan et al. studied the effects of quince juice and quince hydroalcoholic extract on ulcerative colitis in rats. The result demonstrated that quince was effective to reduce total colitis index [36].

3.2.2.11. Hypolipidemic, hepatoprotective and renoprotective effects

Mirmohammadlu et al. evaluated the effect of aqueous extract of quince fruit on lipid profile and also serum levels of alanine transaminase (ALT), aspartate transaminase (AST), and alkaline phosphatase (ALP) and serum urea and creatinine in rats. The results demonstrated that the oral administration of aqueous extract of quince fruit improve serum lipid profile in diabetic rats by lowering cholesterol, triglyceride, and low-density lipoprotein cholesterol (LDL-C) and raising high-density lipoprotein cholesterol (HDL-C) and also reduced serum levels of ALT, AST, and ALP in the diabetic treated rats. The extract also improved renal function in diabetic rats via decreasing serum urea and creatinine [37]. The effect of hydro-alcoholic extract of quince on liver enzymes was evaluated in New Zealand White Rabbits. The results showed that serum levels of liver enzymes including ALT, AST, and ALP decreased non-significantly [31].

3.2.2.12. Effect on reflux and nausea and vomiting

In a pilot study, extract of quince was administered to 5 infants with reflux and

without any response to routine management. Four of 5 infants had significant changes in the symptoms of reflux including vomiting, cough, agitation and low appetite [38]. In a clinical study, the effect of syrup from quince fruit was evaluated in nausea and vomiting during pregnancy. The result of this study make it clear that quince syrup is significantly more useful than B6 in reducing nausea and vomiting [39].

4. DISCUSSION

According to ITM, quince plays an important role in vital organs like brain, heart, liver and stomach. It is better to be used in prevention because of its tonic properties. Quince fruit is a well-known dietary source of health promoting compounds and has various pharmacological properties including anti-bacterial, antioxidant, anticancer, antiallergic, anticolitis and antiulcerative activities [40]. Various pharmacologic properties of quince have been evaluated during in vitro and animal studies and unfortunately, there are few clinical studies about its medicinal properties. Hence, more clinical trials are suggested for assessment of medicinal properties of *Cydonia oblonga* fruit (pulp and peel).

5. CONFLICT OF INTERESTS

This study was A part of Fatemeh Aliasl's PhD dissertation in Tehran University of Medical Sciences, Iran.

6. ACKNOWLEDGMENTS

None

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