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The medicinal significance of *cydonia oblonga M* - A Review

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Abstract
A member of the Rosaceae family, *Cydonia oblonga M*. is a medicinal plant that is used to cure and/or prevent a number of illnesses, including diabetes, cancer, hepatitis, ulcers, lung, and urinary infections. Quince, or Cydonia oblonga, is a plant that is widely used for its secondary metabolites, which include sugars, tannins, organic acids, flavonoids, phenolics, steroids, and glycosides. Different components of C. oblonga have been linked to a broad range of pharmacological actions, including anti-inflammatory, hepatoprotective, antibacterial, antifungal, antidepressant, antidiarrheal, hypolipidemic, diuretic, and hypoglycemic effects. In order to treat wounds on the skin, glucuronoxylan, polysaccharide mucilage, is extruded from C. oblonga seeds. This review concentrates on in-depth analyses of the plant's pharmacological and phytomedicinal properties in addition to its highly valuable phytochemicals.

Keywords: Cydonia oblonga, phytomedicine, pharmacological attributes, folk medicinal uses, Quince.

Introduction

Distribution: Quince (Family: Rosaceae) is a tiny shrub or plant that grows to a height of 5 to 8 metres and a width of 4 to 5 metres. It is the only individual in the genus Cydonia. Its fruit is 7–12 cm long and 6–9 cm wide, with a vivid yellow colouring. Fruit contains a great number of plano-convex seeds organised in two vertical rows, along with a distinct scent and an astringent taste. The shrub bears pale pink, 5-cm-diameter flowers in the spring (Gholgholab, 1961). The leaves are 6–11 cm long, elliptical in shape, and covered in white hair on the surface. Originating in Iran and Turkey, it is grown in Europe, the Middle East, South Africa, and India (Yildirim*et al*., 2001 [48]; Evans *et al*., 2002). Quince (C. oblonga subsp. Maliformis and Polyformis) comes in two variants based on the shape of the fruit. The first species has apple-shaped fruits, but the second species has pear-shaped fruits. Compared to pear-shaped fruits, apples have firmer flesh and a more astringent flavour. Quince is considered harmless from a toxicological perspective; yet, because of the inclusion of nitrile components, its seeds may only have hazardous effects when consumed in large quantities (Huxley *et al*., 1999). Natural phenolic compounds with antibacterial, antioxidant, and anti-ulcerative properties can be found in its fruit (Wang *et al*., 2006; [45] Fattouch *et al*., 2007 [10, 11]; Hamauzu *et al*., 2008).

Since ancient times, quince fruit (*Cydonia oblonga M*iller) has been valued for its high nutritional content due to its high concentration of minerals (Na, K, Ca, Mg, Fe, Cu, Zn and Mn), essential oils (a mixture of aromatic aldehydes, fatty acids, oxygenated monoterpenes and sesquiterpenes), proteins and amino acids, lipids, and numerous vitamins (thiamine, riboflavin, niacin, ascorbic acid, carotene, and retinol) (Khoubnasabjafari M., Jouyban A., 2011) [17], (Al-Snafi A.E., 2016). Polyphenols, specifically tannins, flavonols (kaempferol and quercetin derivatives), and caffeoylquinic acid derivatives, as well as polyphenols' interaction with polysaccharide fractions, are the primary factors influencing the medicinal qualities of products obtained from Cydonia oblonga. Due to the essential oils they contain, Cydonia oblonga plant parts—such as fruit, pulp, peel, seed, and leaf—represent a significant source of natural medicines and functional foods. They are also a major source of flavouring for products used in the food and cosmetic industries (Muhammad U.A., Gulzar M., 2016) [22].

Quince is the popular name for *Cydonia oblonga M*ill, a member of the Rosaceae family (also known as Cydonia vulgaris Pers, Cydonia maliformis Mill, and Pyrus cydonia L) (Ghasemi Dehkordi N. 2002). This little tree or shrub can grow up to 8 metres in height. Its leaves are elliptical to oblong, its flowers are pink or white, and its fruits are large (10–12 cm in diameter), aromatic, and covered in densely tomentullose material (Parsa A.1948) [29]. Silva BM, Andrade PB, 2004) [39, 40]. When it comes to shape, quince is divided into several kinds, including lusitanica (pear-shaped) but clearly ribbed, pyriform or typical (pear-shaped), without ribs, and maliformis (apple-shaped) (Duron M, Decourtye L, 1989),(GironÚs Vilaplana A, Baenas N, 2014) [12]. Raw white-yellow pulp is not suited for ingestion because it is solid, generally acidic, and astringent, and it readily oxidises when exposed to air (Silva BM, Andrade PB, 2004). Early on, this plant spread from its wild origin centre to the nations bordering the Himalayas to the east and throughout Europe to the west. However, it's likely that Quince first made its way to the Mediterranean during classical times, when the Romans used it (Silva BM, Andrade PB, 2005) [41]. This plant is found in Kashmir and Punjab as well (Silva BM, Andrade PB, Ferreres F, 2002) [42]. Grown and cultivated in warm climates, Cydonia oblonga reaches heights of up to 8 m and widths of up to 4 m. Young branches have wool that is somewhat grey in colour, elliptical leaves, pink or white flowers, and bright yellowish, typically pear-shaped fruits (Khoubnasabjafari, M. and A. Jouyban, 2011) [17].

Chemical Profile: Many substances, including organic acids, polyphenols, terpenes, amino acids, and glycosides, have been extracted and identified from a variety of plant components, including the leaves, fruits, stem, roots, seeds, and bark (Otakar, R., J. Balík, V. Reznícek, 2011) [28]

(Evans, W.C., 2006) [9]. Quince is high in procyanidins, a type of polyphenol (Nagahora, N., Y. Ito and T. Nagasawa, 2013) [24]. 26 distinct polyphenolic chemicals were discovered and obtained from quince tissues. Nine flavan-3-ols (procyanidin B2, (-)-epicatechin, three procyanidin dimers and trimers, and one tetramer); eight hydroxycinnamates, which are derivatives of coumaroylquinic and caffeoylquinic acid; and nine derivatives of kaempferol and quercetin (Wojdy³o.A, J. Oszmiañski and P. Bielicki, 2013) [46]. The phenolic profile of quince seeds included 3-O-, 4-O-, 5-O-, and 3-dicaffeoylquinic acids, as well as lucenin-2, vicenin-2, stellarin-2, isoschaftoside, and schaftoside. Chrysoeriol 6-C-glucosyl-8-C-pentosyl and 6-C-glucosyl-8-C-pentosyl (Khoubnasabjafari, M. and A. Jouyban, 2011) [17], (Silva, B.M., P.B. Andrade, F. Ferreres, 2005) [41], (Hamauzu, Y., H. Yasui, T. Inno,2005) [15]. Compared to other plant components, quince leaves have a higher overall content of phenolic chemicals (Oliveira, A.P, J.A. Pereira, P.B. Andrade, 2008) [25, 26]. A homo-monoterpenic molecule (trans-9-amino-8-hydroxy-2, 7-dimethylnona-2, 4-dienoic acid glucopyranosyl ester) was isolated and identified during a phytochemical analysis of Cydonia oblonga (Carla, S., B.M. Silva, B. Paula, 2007). Six organic acids were found in many quince fruit samples: fumaric, ascorbic, malic, quinic, and shikimic acids. Oxalic acid was also present in some of the samples (Oliveira, A.P, J.A. Pereira, P.B. Andrade, 2008) [25, 26], (Silva, B.M., P.B. Andrade, G.C. Mendes, 2002) [42]. There were 21 free amino acids found in quince seeds, with glutamic, aspartic, and asparagine being the three most prevalent (Silva, B.M., P.B. Andrade, F. Ferreres, 2005) [41]. Cydonia oblonga fruit has been found to contain the β-D-gentiobioside (β-D-glucopyranosyl (1-6) β-D-glucopyranoside) and the β-D-glucopyranoside of (3R)-3-hydroxy-β –ionone (Gueldner, A. and P. Winterhalter. 1992) [14]. Benzaldehyde (12.8%) was the most common main constituent of the essential oil extracted from C. oblonga leaves during the flowering period. It was followed by fatty acid (hexadecanoic acid, 7.2%), oxygenated monoterpene (linalool, 5.7%), and norisoprenoid ((E) -β -Ionone, 5.1%). Benzaldehyde (4.9%) and germmacrene D (8.6%), two aromatic aldehydes, were discovered to be the primary constituents in the essential oil extracted from C. oblonga leaves during the fruiting phase (Erdogan, T., T. Gonenc, Z.S. Hortoglu, 2012) [8], (Turkoz, S., S. Kusmenoglu and U. Koca, 1998) [43]. Cydonia oblonga leaves had a high calcium content (Jacek, L., K. Cibisz and A. Sadowski, 2004) [16].

Pharmacological Effects

Immunological and antiallergic effects: The effects of distinct citrus (0.01 g/ml) and cydonia (0.01 g/ml) products, as well as the combined Citrus medica ssp. limonum efructibus/Cydonia oblonga efructibus (Citrus medica ssp limonum and Cydonia oblonga: each 0.01 g/ml), were examined on the immunological pathways involved in seasonal allergic rhinitis (SAR). Following polyclonal and allergen-specific T cell stimulation in the presence of the three extracts, peripheral blood mononuclear cells (PBMCs) were extracted and subjected to in vitro analysis from five donors who were healthy and five who were allergic to grass pollen. The analyses showed no signs of toxicity and satisfactory cell survival. Citrus primarily impacted the induction of the allergen-specific Th1 pathway (IFN-γ; Cydonia and citrus/cydonia compared to citrus: 3.8 ($p<0.01$) and 3.0 ($p<0.01$), respectively), while Citrus primarily had a selective effect on reducing allergen-specific chronic inflammatory (TNF-α; Citrus compared to Cydonia and Citrus/Cydonia: −87.4 ($p<0.001$) and −68.0 ($p<0.05$) respectively) and Th2 pathway activity (IL-5; Citrus compared to Cydonia: −217.8 ($p<0.01$)).

When it came to treating SAR, citrus and cydonia showed distinct modes of action, and the combined product did not show any more benefits than the individual treatments (Huber R, Stintzing FC, Briemle D, Beckmann C, 2012). Preparations made from lemon, citrus medica, and Cydonia oblonga—which are utilised in pharmaceutical goods to treat patients with allergy disorders—were studied for their immunomodulatory and antiallergic qualities. The effects of preparations on the degranulation capacity of basophilic cells and mediator release (including TNF-α and IL-8) from activated human mast cells in vitro were examined. The outcomes demonstrated that basophilic cell degranulation was only inhibited when citrus was present, and this impact was contrasted with that of the synthetic medication azelastine. Moreover, it was found that at low doses, both Citrus and Cydonia had additive effects on human mast cells' production of IL-8 and TNF-α (-Shinomiya F, Hamauzu Y and Kawahara T. 2009) [38]. *In vivo* and *in vitro* studies were conducted to examine the impact of a crude hot-water extract (HW) of Cydonia oblonga fruit on type I allergy. When the quince HW-added meal was given orally to NC/Nga mice for 63 days, the development of skin lesions resembling atopic dermatitis under standard conditions was significantly reduced. Additionally, quince HW-fed mice had reduced blood IgE concentrations in a dose-dependent manner. Furthermore, during a 24-hour treatment, quince HW reduced the production of beta-hexosaminidase from the rat basophilic leukaemia cell line RBL-2H3.

The mRNA expression of the high-affinity IgE receptor (FcepsilonRI) gamma subunit was decreased by the reduced HW fraction of smaller than 3 kDa (Baars EW, Jong M, Nierop AFM, 2011). In a randomised, comparative clinical trial with two parallel groups, the effectiveness and safety of two methods of administration (subcutaneous injections versus nasal spray) of Citrus/Cydonia in seasonal allergic rhinitis were compared. Following a wash-out period of one or two weeks, twenty-three patients were randomised to a 6-week treatment term, during which time the safety, immunological, and symptom severity changes were assessed. Both administration methods were safe and showed immunological and clinical effects, with the subcutaneous route having more allergen-specific clinical effects and the nasal spray approach having greater innate and inflammatory immunological effects (Degen J, Seiberling M, Meyer I, 2000). The effects of a 1% and 3% solution of a standardised composition of Citrus Limon, succus, and extract from Cydonia oblonga, fructus (Gencydo) on the intranasal mucociliar clearance were examined after multiple administrations in a three-way crossover study involving eighteen healthy male and female subjects, ages 20 to 49.

A prolongation of the perception time was not seen following the intra-nasal administration of the 1% and 3% Citrus/Cydonia solution or the placebo solution. It was possible to determine that the test goods had no discernible impact on the function of the intranasal cilia (Kawahara T and Iizuka T. 2011). Using an in vitro system, the impact of

a crude hot-water extract (HW) of quince (*Cydonia oblonga Mi*ller) fruit on mast cell immunoglobulin E (IgE)-dependent late-phase immunological reactions was assessed. After quince HW treatment, mast cell-like RBL-2H3 cells were stimulated with IgE + Antigen to produce a late-phase response. The level of interleukin-13 and tumour necrosis factor-α expression was lowered by Quince HW. Additionally, mouse bone marrow-derived mast cells' (BMMCs) expression of these cytokines was decreased by quince HW. After one and six hours of stimulation, quince HW treatment also decreased the synthesis of leukotriene C4 and prostaglandin D2 in BMMCs. Quince HW also decreased the induction of intracellular cyclooxygenase (COX)-2 expression in BMMCs, but not COX-1 expression (Costa RM, Magalhães AS, Pereira JA, 2009) [4, 5, 6].

Antimicrobial and antioxidant activity

The antibacterial properties of quince were investigated against several microbiological strains. Bacterial growth was significantly reduced by fruit peel extracts, with minimum inhibitory doses falling between 102 and 5 × 103 µg polyphenol/mL. It is believed that chlorogenic acid is the main ingredient that coordinates with other extract ingredients to inhibit (Fattouch S, Caboni P, Coroneo V, 2007) [10, 11]. It was discovered that the quince phenolic fraction had higher antioxidant activity than the methanolic extract in its crude form. It indicates that quince fruit and jam's capacity to scavenge radicals is better represented by the phenolic fraction (Kirtikar KR, Basu BD.1999) [18]. By using the Folin-Ciocalteu reducing capacity assay, the 2, 2′-diphenyl-1-picrylhydrazyl assay, and the ability to prevent the 2, 2′-azobis (2-amidinopropane) dihydrochloride-induced oxidative hemolysis of human erythrocytes, quince's antioxidant properties were compared to those of green tea. Compared to green tea, the main phenolic component 5-O-caffeoylquinic acid in quince leaf extract produced a noticeably higher reduction power. Quince leaf extract works as a preventative or remedial measure against radiation (Costa RM, Magalhães AS, Pereira JA, 2009) [4, 5, 6].

Healing activity

The T-2 toxin-induced skin lesions were used to study the quince seed mucilage's healing properties. Five groups were created out of the rabbits. Groups 3 to 5 received 5%, 10%, and 15% mucilage therapy, respectively; Group 1 received the poison as a positive control; Group 2 received eucerin as a negative control. T-2 toxin (83 mg/mL) solution in methanol was made and administered to the skin twice, separated by 24 hours. On the eighth day, Groups 1, 2, and 3 showed signs of erythema and inflammation, whereas Groups 4 and 5 showed signs of full healing of the skin injury treated with 10% and 15% quince seed. Treatment with quince seed mucilage resulted in normal skin with hair growth. The following effects are part of the quince seed mucilage's healing mechanisms: (1) inhibiting the T-2 toxin's ability to impair protein synthesis; (2) blocking the toxin's ability to penetrate the skin and evaporate water; (3) functioning as an antioxidant and growth factor; (4) influencing fibroblast activity and boosting the production of collagen; (5) facilitating the formation of granulation tissue and enhancing blood circulation; and (6) counterbalancing the toxin's dermal toxicity (Ghazarian B 2009),(Aslam M, Sial AA. 2014) [3].

Ethnobotanical uses

Quince plant is used as a source for candies, liqueurs, flavouring for jam, marmalade, and brandy, and it also serves as a preservative (Aslam M, Sial AA.2014). However, because of its astringent, acrid, and stiff qualities, raw fruit is not very pleasant to consume. Thus, it is prized for its ability to make jam, or "marmalade," and for its use as a topping for main courses and flavouring for pies. Apple (Malus communis Lamk), which is affordable and of a quality similar to quince, is simply added to the jam when quince output is poor. However, the presence of phloretin 2′-glucoside and phloretin xylosyl glucoside identifies this kind of adulteration. Apples include both dihydrochalcones, which are thought to be chemical identifiers (Andrade PB, Carvalho ARF, 1998).

Quince fruit is used in numerous recipes. Paste prepared from quince is highly prized throughout Europe, particularly in Spain, and in several regions of Latin America. Cut into bits, this sugary, sweet-smelling, jelly-like dessert is sometimes served with hot cheese. Quince is frequently cooked with lamb in Armenia and is used in a variety of sweet and salty recipes (Ghazarian B.2009). Before 1500 years ago, it was used as pear rootstock in several parts of France, particularly Angers. By the early 1600s, the French started cultivating quince plants from the healthy cuttings, piling them in stool beds. France provides the globe with significant rootstocks (Prajapati ND, Purohit SS, 2007) [32], (De Tommasi N, De Simone F, 1996) [7]. Cydonia vulgaris seeds are commonly known as quince seeds in English and as "Beedana" in Gujarati. A large amount of mucilage, derived from the seed coat, is present in seeds and is used as a gum arabic substitute for glossing materials. It can also be employed as a suspending agent and in tablet formulations (Sharma R, Joshi VK, and Rana JC.2011) [37]. Quince is also widely utilised in agriculture, mostly as a pear rootstock that enhances fruit quality and productivity and is readily propagated through the use of both conventional and contemporary methods (Rumpunen K, Kviklys D.2003) [36].

Cardioprotective and Hypolipidemic Activities

Diabetes, high blood pressure, atherosclerosis, cardiac inflammation, and blood clotting are linked to cardiovascular diseases (CVD). Reactive oxygen species (ROS)-induced oxidative stress is a major factor in the development of CVD in all of the physiological conditions previously discussed (Griendling and FitzGerald, 2003 [13]; Madamanchi *et al*., 2004; Mueller *et al*., 2005 [21]; Pashkow, 2011) [30]. Using specific antioxidants, the ROS generating oxidative stress are trapped to avoid CVDs (Rocha *et al*., 2010) [33, 34]. Consuming fruits and vegetables, which are the greatest food sources of antioxidants (Murcia *et al*., 2001) lowered risk of degenerative diseases such as CVDs (Fattouch *et al*., 2007) [10, 11]. Quince leaves contain phenolics, specifically 5-O-caffeoylquinic acid, which has been shown in one study to have significant cardioprotective potential by capturing reactive oxygen species (Vaez *et al*., 2014) [44]. Quince leaves also contain flavonoids, quercitin, kaempferol-3-O-glucoside (astragalin), and kaempferol-3-O-rutinoside, which have cardioprotective properties (Khoubnasabjafari and Jouyban, 2011) [17]. By regulating the activation of T cells, B cells, mast cells, neutrophils, and basophils, flavonoids also regulate cardiac inflammation. Quince leaves may therefore be used as a cheap, natural

remedy to prevent cardiovascular diseases (Middleton and Kandaswami, 1992; Middleton *et al*., 2000).

According to the WHO, hypertension is a chronic elevation in blood pressure and is a leading cause of cardiovascular diseases (Rubin *et al*., 2012) [35]. A WHO estimate from 2002 states that 7 million or more people die from hypertension each year [World Health Organization (WHO), 2002]. A variety of medication regimens, including vasodilators, calcium channel blockers, ACE inhibitors, b-blockers, and diuretics with adverse effects, are used to treat hypertension (Ahmad *et al*., 2005). In a study, it was found that captopril (25 mg/kg) decreased blood pressure after two weeks, but ethanolic extract of quince fruit and leaves at doses of 80 and 160 mg/kg body weight did so after four weeks. Rats treated with captopril (167 ± 7) and ethanolic extract (166 ± 4) had similar blood pressure after 8 weeks compared to model rats (193 ± 7). In comparison to aspirin (1.91 and 2.58), the effects of aqueous extracts (20, 40, and 80 mg/kg dosage) of quince leaves and fruit increased coagulation (1.44, 2.47, and 2.48) and bleeding times (2.17, 2.78, and 3.63). When compared to aspirin (47%), the extracts showed a promising reduction in mortality from pulmonary emboli (27, 40, and 53%). Quince aqueous extracts (45, 55, and 63%) enhanced thrombolysis in addition to aspirin (56%).

The outcomes demonstrated Quince's potential utility in thrombosis prevention and lowering the risk of cardiovascular diseases (Zhou *et al*., 2014) [49]. Low density lipoproteins (LDL) induce hypercholesterolemia, which results in atherosclerosis, which is thought to be one of the main causes of cardiovascular diseases (Hansson, 2005; Rocha *et al*., 2010 [33, 34]; Moore and Tabas, 2011 [20]; Poredos and Jezovnik, 2011) [31]. Statins, such as atorvastatin, are used in current treatment plans to lower blood cholesterol levels; however they come with risks of causing damage to the muscles. In order to treat atherosclerosis, researchers are searching for medicinal plants like quince. Quince is considered to be rich in nutrients and a good source of flavonoids and phenolics, both of which have therapeutic benefits (Oliveira *et al*., 2007 [27]; Costa *et al*., 2009) [4, 5, 6]. In a study, Khademi *et al*., 2013 investigated the impact of a methanolic leaf extract fraction on atherosclerosis in white albino rabbits that had been given a high-cholesterol diet for eight weeks in order to induce atherosclerosis. Following the eighth week, serum cholesterol, triglycerides, aspartate transaminase (AST), alanine phosphatase (AP), and the histology of the aorta in rabbits fed normal and high cholesterol were measured in blood samples. Quince extract appears to have a preventive effect against atherosclerosis based on a significant reduction in serum cholesterol levels. Additionally, the animals in the control and treatment groups had nearly identical atheroma thicknesses, indicating the effectiveness of Quince extract in preventing the formation of plaque.

The ability of quince fruit aqueous extract to prevent problems related to diabetes was also assessed. Male Sprague–Dawley rats were given the extract orally at once daily doses of 80, 160, and 240 mg/kg body weight for a period of six weeks. The rats were given a single intraperitoneal dose of streptozotocin (60 mg/kg) mixed in citrate buffer (1 mL, pH 4.5) to induce diabetes. Quince fruit extract successfully lowered serum triglycerides, ALT, AST, ALP, HDL, LDL, urea, and creatinine, as the data unequivocally showed (Mirmohammadlu *et al*., 2015) [19]. Quince leaf extract was found to be effective in lowering serum triglycerides (TG), total cholesterol (TC), low density lipoproteins (LDL), and liver stenosis while raising lipoprotein lipase (LPL) and high density lipoproteins (HDL). After 56 days of administration, the extract reduced the activity of ALT, AST, and LPS while increasing the activity of hepatic lipase (HL), glutathione peroxidase (GSH-PX), and superoxide dismutase (SOD) in hyperlipidemic rats. The outcomes were similar to those of simvastatin, with the exception of elevated LPL and HL quince leaf extract (Abliz *et al*., 2014) [1].

Conclusion

Because of its high-value bioactives and traditional medicinal usage, Cydonia oblonga, a member of the Rosaceae family of medicinal plants, has drawn interest from researchers. The plant is well-known for its renoprotective, hepatoprotective, antidiabetic, anti-proliferative, anti-hemolytic, anti-inflammatory, anti-allergic, geno-protective, and cardioprotective properties in addition to its medicinal qualities. Its leaves have a proven protective impact on male fertility. Therefore, it is imperative to extract any bioactive compounds from Quince in order to create better, more affordable, and safer medications. Additionally, plants are a significant source of pectin, which is utilised in the food sector to make jellies and jams. Additionally, the plant produces PPO enzyme, which is utilised to decolorize industrial waste and offer an affordable alternative for treating industrial water.To commercially isolate pectin and PPO enzyme, the plant needs be grown. Dermal films have been prepared using the plant seed polysaccharide glucuron oxylan to treat wounds. In order to prepare dermal patches, cytotoxic research is necessary to determine its safety profile. Furthermore, following toxicological research, glucuronoxylan may prove to be a viable option for targeted, prolonged, and regulated drug delivery.

Antibiotic resistance in microorganisms is a developing problem. New antibiotics must therefore be developed in order to treat a variety of illnesses. Quince is rich in micro bistatic agents, according to a number of literature findings, and it can be used to isolate novel phytochemicals that could lead to the introduction of new medications. Numerous cytotoxic studies have demonstrated the potential of plants to treat cancer. Before conducting human trials, further *in vivo* models should be used to validate its anti-proliferative potential. It is also difficult to isolate active secondary metabolites that prevent cancer. Quince is a functional food that is high in essential oils and minerals including phosphorus, potassium, sodium, and others.As a possible source of nutraceuticals, it is necessary to standardise and validate its medical applications.

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