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In vitro study of the antibacterial effects of the *Cydonia oblonga* extract

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Abstract

Cydonia oblonga is effective against many infections and has medicinal properties that are useful in the treatment of many other diseases. The aim of this study was to elucidate the antimicrobial activity (in the form of anti-adherence and anti-biofilm formation) of the aqueous *Cydonia oblonga* extract. The biological activity of the extract was compared to that of imipenem. All bacterial isolates of Gram-positive and Gram-negative bacteria assessed were found to be susceptible to the *Cydonia oblonga* extract and the zone of inhibition ranged from 24 to 34 mm. Most bacterial isolates were resistant to the antibiotic, and some bacterial isolates were sensitive to imipenem. The adherence and biofilm formation inhibitory activities in the presence of the aqueous extract of *Cydonia oblonga* were found to be moderate or elevated in most of the Gram-negative bacteria assessed. According to our findings, the aqueous *Cydonia oblonga* extract displays great effectiveness (and promise) against many pathogenic bacterial isolates.

KEYWORDS
Cydonia oblonga, antibacterial, biofilm formation, adherence inhibition, *in vitro*

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1. INTRODUCTION

Cydonia oblonga (quince) is a species of the family of Rosaceae that can be used as a whole or part for food and for the treatment for many diseases [1]. The seeds of *Cydonia oblonga* contain triterpenes, sterols, and tannins as active components, and can be used as an anti-diarrhoeal medication [2]. The presence of organic acids, phenolic component, and amino acids has been determined in the seeds of quince [3], while phenolic compounds, essential oils, organic acids, ionone glycosides, and tetracyclic sesterterpenes can be found in many plant parts of quince [4]. The aim of this study was to conduct a comprehensive *in vitro* characterization of the antibacterial activity of the aqueous *Cydonia oblonga* extract.

2. MATERIALS AND METHODS

The preparation of the aqueous extract of *Cydonia oblonga* at a concentration of 30% and that of imipenem were performed as previously described [5]. The bacterial isolates used in this study were *Aggregatibacter actinomycetemcomitans*, *Prevotella intermedia*, *Porphyromonas gingivalis*, *Pseudomonas fluorescens*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus mirabilis*, *Proteus vulgaris*, *Acinetobacter*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Serratia* spp., *Salmonella typhi*, *Salmonella typhimurium*, *Staphylococcus saprophyticus*, *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Streptococcus mutans*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Streptococcus agalactiae*, and *Streptococcus faecalis*. Isolates of bacteria were cultured three times on agar nutrient and were then kept at 4ºC as slants. The isolates were determined by many biochemical tests. A total of 14 types of Gram-negative bacteria and 8 types of Gram-positive bacteria were tested. The antimicrobial effectiveness was assessed through agar-well diffusion [6]. The antimicrobial activity was determined by using a disc-diffusion assay for the drug; a test performed in triplicate. The assessment of the bacterial adherence to the membrane of human epithelial cells (one of the principal factors of a microorganism's virulence) was documented on Gram-negative bacteria only. The biofilm formation assay was performed as previously described [6], and the output was determined as "none" (<0.120), "medium" (0.120–0.240), and "strong" (>0.240) based on the mean OD value obtained at 630 nm.

3. RESULTS AND DISCUSSION

The antibacterial effect of the aqueous *Cydonia oblonga* extract at a 30% concentration against a number of bacteria was studied (Table 1). All bacterial isolates were sensitive to this extract, and the range of the zone of inhibition was between 24 and 34 mm. We noted that the plant extract exerted potent antibacterial action against black-pigmented bacteria (i.e., *Aggregatibacter actinomycetemcomitans*, *Prevotella intermedia*, and *Porphyromonas gingivalis*). On the other hand, the herein assessed Gram-negative bacteria showed similar responses to the Gram-positive ones (i.e., *Staphylococcus saprophyticus*, *Streptococcus mutans*, and *Streptococcus faecalis*) by obtaining the same result in terms of their zone of inhibition (34 mm); other Gram-positive bacteria recorded a 29–32-mm zone of inhibition, which can be attributed to the chemicals found in quince seeds. The effect of imipenem on Gram-positive and Gram-negative microorganisms, as shown by a disc diffusion assay, revealed that most bacterial isolates were resistant to this antibiotics and that some isolates were sensitive (Table 1).

Table 1. Effects of the *Cydonia oblonga* extract and of imipenem against bacterial isolates, and the inhibitory effects of the aqueous *Cydonia oblonga* extract on Gram-negative bacterial adherence and biofilm formation.

	Zone of inhibition (in mm)		Inhibitory effect of *Cydonia oblonga* extract	
Isolates	***Cydonia oblonga* extract**	**Imipenem**	**Adherence**	**Biofilm formation**
Aggregatibacter actinomycetemcomitans	33	18	moderate	elevated
Prevotella intermedia	33	18	elevated	moderate
Porphyromonas gingivalis	32	17	elevated	elevated
Pseudomonas fluorescens	29	13	moderate	moderate
Pseudomonas aeruginosa	28	12	moderate	moderate
Escherichia coli	30	14	moderate	elevated
Proteus mirabilis	30	15	moderate	moderate
Proteus vulgaris	30	15	moderate	moderate
Acinetobacter	30	14	elevated	moderate
Enterobacter aerogenes	30	13	moderate	moderate
Klebsiella pneumoniae	31	15	moderate	moderate
Serratia spp.	28	14	elevated	elevated
Salmonella typhi	27	13	moderate	moderate
Salmonella typhimurium	30	15	moderate	elevated
Staphylococcus saprophyticus	34	18	---	---
Staphylococcus epidermidis	32	19	---	---
Staphylococcus aureus	31	18	---	---
Streptococcus mutans	34	17	---	---
Streptococcus pneumoniae	30	15	---	---
Streptococcus pyogenes	29	16	---	---
Streptococcus agalactiae	31	15	---	---
Streptococcus faecalis	34	16	---	---

The adherence and biofilm formation inhibitory activities in the presence of the aqueous extract of *Cydonia oblonga* were found to be moderate or elevated in most of the Gram-negative bacteria assessed (Table 1).

Previous studies have found that the chemicals in *Cydonia oblonga* seeds are highly effective at inhibiting a variety of pathogenic bacteria. The tannins of quince are used as an antiseptic in respiratory infections because they kill bacteria, fungi, and viruses [7]. Furthermore, the extract of quince seeds can also be used in the treatment of coughs, diarrhoea, constipation, dysentery, and bronchitis. The analysis of the phytochemicals of the quince fruits has revealed numerous secondary metabolites [8].

Lipopolysaccharide, found in Gram-negative bacteria's outer membranes, prevents phenolic compounds from adherence to the surface of the bacteria [9], resulting in lower activity against Gram-negative bacteria. Moreover, the Gram-positive bacteria are highly sensitive to polyphenols [10]. On the other hand, the herein assessed extract was found to exert a potent anti-adherence and anti-biofilm formation activity, and to stop the formation of biofilm. Hindi *et al*. [6] have shown that plant extracts can inhibit the bacteria's ability to form biofilms and to adhere. The aqueous extract of *Cydonia oblonga* assessed in our study was found to be very effective against many pathogenic isolates, with an elevated inhibitory activity against biofilm formation and bacterial adherence.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

REFERENCES

1. Usmanghani K., Saeed A., Alam M.T.: Indusyunic Medicine. Karachi: University of Karachi Press (1997).

2. Ammar S., Edziri H., Mahjoub M.A., Chatter R., Bouraoui A., Mighri Z.: Spasmolytic and anti-inflammatory effects of constituents from *Hertia cheirifolia*. *Phytomedicine* 16(12): 1156-1161 (2009).
DOI: **10.1016/j.phymed.2009.03.012**
PMID: **19403291**

3. Silva B.M., Andrade P.B., Ferreres F., Seabra R.M., Oliveira M.B., Ferreira M.A.: Composition of quince (*Cydonia oblonga* Miller) seeds: phenolics, organic acids and free amino acids. *Nat. Prod. Res*. 19(3): 275-281 (2005).
DOI: **10.1080/14786410410001714678**
PMID: **15702641**

4. De Tommasi N., De Simone F., Pizza C., Mahmood N.: New tetracyclic sesterterpenes from *Cydonia vulgaris*. *J. Nat. Prod*. 59(3): 267-270 (1996).
DOI: **10.1021/np9600513**

5. Hindi N.K.K., Al-Mahdi Z.K.A., Chabuck Z.A.G.: Antibacterial activity of the aquatic extract of fresh, dry powder ginger, apple vinegar extract of fresh ginger and crud oil of ginger (*Zingiber officinale*) against different types of bacteria in Hilla City, Iraq. *Int. J. Pharm. Pharm. Sci*. 6(5): 414-417 (2014).

6. Hindi N.K.K., Al-Shalah L.A.M., Mohammed H.A., Judea S.A., Althahab A.O.: Antibacterial activity (anti-adherence and anti-biofilm) of plants extracts against black-pigmented bacteria (*Prevotella intermedia*): an *in vitro* study in Hilla city, Iraq. *Biochem. Cell. Arch*. 21(1): 1437-1442 (2021).

7. Adel A.M., Abd El-Wahab Z.H., Ibrahim A.A., Al-Shemy M.T.: Characterization of microcrystalline cellulose prepared from lignocellulosic materials. Part I. Acid catalyzed hydrolysis. *Bioresour. Technol*. 101(12): 4446-4455 (2010).
DOI: **10.1016/j.biortech.2010.01.047**
PMID: **20185300**

8. Benahmed Djilali A., Mehraz R., Bouacem K., Benseddik A., Moualek I., Nabiev M., *et al.*: Bioactive substances of *Cydonia oblonga* fruit: insecticidal effect of tannins on *Tribuliumm confusum*. *Int. J. Fruit Sci*. 21(1): 721-731 (2021).
DOI: **10.1080/15538362.2021.1926395**

9. Al-Khazraji S.K.: Phytochemical screening and antibacterial activity of the crude extract of *Cydonia oblonga* seeds. *Glob. Adv. Res. J. Microbiol*. 2(8): 137-140 (2013).

10. Benzarti S., Hamdi H., Lahmayer I., Toumi W., Kerkeni A., Belkadhi K., *et al.*: Total phenolic compounds and antioxidant potential of quince (*Cydonia oblonga* Miller) leaf methanol extract. *Int. J. Innov. Appl. Stud*. 13(3): 518-526 (2015).