Phytochemical Screening by FTIR Spectroscopic Analysis and Anti-Fungal Activity of Fruit Extract of Selected Medicinal Plant of *Ruta graveolens*

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ABSTRACT

Ruta graveolens (the common rue) has been used for various therapeutic purposes, including relief of rheumatism and treatment of circulatory disorder. The purpose of our research were analysis of the bioactive chemical compounds of selected medicinal plant of *Ruta graveolens* using fourier transform infrared spectrophotometer analysis and evaluation of anti-fungal activity. Thirteen bioactive compounds were identified in the methanolic extract of *Ruta graveolens*. The Fourier transform infrared spectrophotometer analysis of *Ruta graveolens* proved the presence of alkenes, alkanes, and alkyl halides which shows major peaks at 667.37, 873.75, 921.97, 1004.91, 1014.56, 1242.16, 1317.38, 1595.13, 1614.42, 2330.01, 2357.01, 3228.84 and 3282.84. In the current study, the anti-fungal activity of *Ruta graveolens* methanolic extract was evaluated by determining the zone of inhibition against fungi. *Ruta graveolens* was very highly active against *Aspergillus fumigatus* (5.39±0.21).

Keywords: *Phytochemical screening, FTIR spectroscopic, Medicinal plant, Ruta graveolens*

INTRODUCTION

In recent years there has been a great scientific advance regarding chemical and pharmacological studies of medicinal plants aimed at obtaining new compounds with biological properties. Among the countless species of medicinal interest, there are plants belonging to the Rutaceae family, which has species of economic, ecological and therapeutic importance. The Rutaceae family, also named as Rutaceae, belongs to the order of Sapindales with about 150 genders and over 1600 species. In recent years, there has been a growing interest in researches looking for possible uses of plant products as antimicrobial instead of several synthetic antibacterial which can cause several side effects. Historically, natural products and their derivatives have been an invaluable source of therapeutic agents. When in vitro, antimicrobial assays have effectively served as reliable methods to detect several classes of secondary metabolites with high antimicrobial activity[1-4]. *Ruta graveolens* commonly known as rue, is a dicot herb, belongs to Rutaceae family and native to Mediterranean region but widely distributed all over the tropical regions. The leaves are bipinnate or tripinnate with a feathery appearance and green to strongly glaucous blue-green in colour [5-9]. This plant is used by the Iraqian populations, systemically for its antispasmodic and analgesic effects and externally for its anti-rheumatic activity. The methanol, petroleum ether, ethyl acetate and water-methanol extracts of R. graveolens were found to possess antimicrobial and cytotoxic activities. Ruta in combination with Ca3(PO4)2 is found to be effective in treatment of brain cancers, particularly glioma. Leaf extracts also reported to possess strong anti-inflammatory activity [10-16]. However, no significant reports are available about the antimicrobial activity of *Ruta graveolens* stem; therefore, present investigation

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was undertaken to examine the antimicrobial activities of stem extract of *Ruta graveolens* using various pathogenic microbial strains.

MATERIALS AND METHOD

Collection and preparation of plant material

The leaves were purchased from local market in Hilla city, middle of Iraq. After thorough cleaning and removal foreign materials, the leaves were stored in airtight container to avoid the effect of humidity [17-25] and then stored at room temperature until further use.

Preparation of sample

About 20 grams of the plant sample powdered were soaked in 100 ml methanol for 16 hours in a rotatory shaker. Whatman No.1 filter paper was used to separate the extract of plant. The filtrates were used for further phytochemical analysis. It was again filtered through sodium sulphate in order to remove the traces of moisture [26-31].

Fourier transform infrared spectrophotometer (FTIR)

The powdered sample of *Ruta graveolens* was treated for FTIR spectroscopy (Shimadzu, IR Affinity, Japan). The sample was run at infrared region between 400 nm and 4000 nm [32-39].

Determination of antimicrobial activity of crude bioactive compounds of *Ruta graveolens*

The test pathogens were swabbed in Müller-Hinton agar plates. Sixty μL of plant extract was loaded on the bored wells. Antifungal activity was evaluated by measuring the zone of inhibition against the test microorganisms. Methanol was used as solvent control. Amphotericin B and fluconazole were used as reference antifungal agent. The tests were carried out in triplicate. The antifungal activity was evaluated by measuring the inhibition-zone diameter observed after 48 h of incubation.

RESULTS AND DISCUSSION

Analysis of compounds was carried out in methanolic extract of *Ruta graveolens*, shown in **Table 1.** Chromatogram GC-MS analysis of the methanol extract of *Ruta graveolens* showed the presence of thirteen major peaks and the components corresponding to the peaks were determined as follows. The Fourier transform infrared spectrophotometer analysis of *Ruta graveolens* proved the presence of alkenes, alkanes, and alkyl halides which shows major peaks at 667.37, 873.75, 921.97, 1004.91, 1014.56, 1242.16, 1317.38, 1595.13, 1614.42, 2330.01, 2357.01, 3228.84 and 3282.84. In the current study, the anti-fungal activity of *Ruta graveolens* methanolic extract was evaluated by determining the zone of inhibition against fungi. *Ruta graveolens* was very highly active against *Aspergillus fumigatus* (5.39±0.21). Herbal drugs are being proved as effective as synthetic drugs with lesser side effects. WHO encourages countries to provide safe and effective traditional remedies and practices in public and private health services and it also published two monographs on medicinal plants with information on pharmacopoeial summaries for quality assurance: botanical features, distribution, identity tests, purity requirements, chemical assays, and active or major chemical constituents, clinical applications, pharmacology, contraindications, warnings, precautions, potential adverse reactions, and posology. The presence of antimicrobial activity in a particular part of a particular species may be due to the presence of one or more bioactive compounds such as alkaloids, glycosides, flavonoids, steroids, saponins etc.

Table 1. FT-IR peak values of *Ruta graveolens* methanolic extract.

No.	Peak (Wave number cm-1)	Intensity	Type of Intensity	Bond	Type of Vibration	Functional group assignment	Group frequency
1.	667.37	56.899	Strong	C-Cl	Stretch	alkyl halides	600–800
2.	873.75	73.673	Strong	=C–H	Bending	Alkenes	650-1000
3.	921.97	71.567	Strong	=C–H	Bending	Alkenes	650-1000
4.	1004.91	52.162	Strong	C-F	Stretch	alkyl halides	1000-1400

***Cont...* Table 1. FT-IR peak values of *Ruta graveolens* methanolic extract.**

5.	1014.56	51.019	Strong	C-F	Stretch	alkyl halides	1000-1400
6.	1242.16	77.325	Strong	C-F	Stretch	alkyl halides	1000-1400
7.	1317.38	77.311	Strong	C-F	Stretch	alkyl halides	1000-1400
8.	1595.13	73.531	Medium	C=C	Stretch	Aromatic	1400-1600
9.	1614.42	72.276	Bending	N-H	Stretch	Amide	1550-1640
10.	2330.01	83.341	Unknown	-	-	-	-
11.	2357.01	77.583	Unknown	-	-	-	-
12.	3228.84	73.851	Bending	N-H	Stretch	Amide	3100-3500
13.	3282.84	72.556	Bending	N-H	Stretch	Amide	3100-3500

CONCLUSION

The Fourier transform infrared spectrophotometer analysis of *Ruta graveolens* proved the presence of alkenes, alkanes, and alkyl halides which shows major peaks at 667.37, 873.75, 921.97, 1004.91, 1014.56, 1242.16, 1317.38, 1595.13, 1614.42, 2330.01, 2357.01, 3228.84 and 3282.84. In the current study, the anti-fungal activity of *Ruta graveolens* methanolic extract was evaluated by determining the zone of inhibition against fungi. *Ruta graveolens* was very highly active against *Aspergillus fumigatus* (5.39±0.21).

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: In our research, all protocols were approved under the Department of Biology, College of Science for women, University of Babylon, Hillah city, Iraq and all methods were carried out in accordance with approved guidelines.

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