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Research article

Chemical analysis and antibacterial activity of grape (*Vitis vinifera*) seed extracts

Khalid Abdul kreem Mohammed[1]*, Saba Zuhair Hussein[1], Sawsan I. Noori1

ABSTRACT

Grape seed extracts have several effects on hosts in terms of anti-inflammatory and antimicrobial effects. The many international studies focused on different species. The present study focused on the local species of grape (*Vitis vinifera*). The seeds were collected from local plants and alcoholic and aquatic extracts were obtained from grape (*V. vinifera*) seeds. The antibacterial effect of these extracts was evaluated against different bacterial species. The results showed that the alcoholic extract has antibacterial ability while, aquatic extract do not have this attribute. Alcoholic extract was examined by Fourier Transform Infrared Spectroscopy (FTIR) and it was found that the extract has many main bonds at 3450 /cm which represent NH2 groups, 3008 /cm that represents frequency asymmetrical patterns of aromatic group C-H, 2925/cm represented frequency patterns of alphatic bond of CH group, 1745/cm which is the patterns match the frequency of the ester anhydrate group (C=O) and at 1649/cm and 1618 /cm represent the frequency of pattern of group C=C [12]. It can concluded that the compounds that mentioned above pay an important role in biological activity of alcoholic grape seed extracts in terms of antibacterial activity.

Keywords: Antibacterial, Chemical omposition, Extract, *Vitis vinifera*.

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INTRODUCTION

The historical studies included many articles on grapes. During the ancient Greek and Roman civilizations, grapes were revered for their use in winemaking. Nowadays, there are three main species of grapes: European grapes (*Vitis vinifera*), North American grapes (*Vitis labrusca* and *V. rotundifolia*) and French hybrids. Grapes are classified as desk grapes, wine grapes (used in viniculture). People prefer the different grape products, such as fruit, raisins and juice. Grape fruit composed of different nutrient elements, such as vitamins, minerals, carbohydrates, edible fibers and phytochemicals [1].

The chemical compounds of grapes include anthocyanins, flavanols, flavonols, stilbenes (resveratrol) and phenolic acids [2]. Anthocyanins are represents the pigments, and mostly exist in grape skins. Flavonoids are broadly distributed in grapes, especially in seeds and stems, and principally contain (+)-catechins, (−) epi-

*Correspondence: Mohammed.KAK.Khalid.kreem@yahoo.com.
Department of Chemistry, College of Science, University of Baghdad, Baghdad, Iraq.
Full list of author information is available at the end of the article.

catechin and procyanidin polymers [3]. Several studies dealt with antibacterial activity of extracts obtained from whole fruits, seeds, pomaces and skins [4]. Thimothe et al. (2007) demonstrated inhibition of glucosyl transferases B and C in *Streptococcus mutans* by all the grape extracts studied. Organic extracts from seeds showed bacteriostatic activity against anaerobic bacteria responsible for different diseases [5], and they were also able to inhibit hydrofolate reductase activity in *Staphylococcus aureus* [6]. Moreover, grape seeds extracts extracted by different solvents have demonstrated differnt polyphenolic content [7]. The wastes of grape are demonstrated antibacterial activity; they represent vast potential for controlling pathogens transmitted through food. However, their capability to control the pathogens has not been explored previously in details. Since grape extract composition varies according to grape species, climate and location of agriculture [4]. Previous study reported the antioxidant activity of grape seed extracts using b-carotene-linoleate and linoleic acid peroxidation methods. The procyanidin composition of grape seeds has been determined [8]. Other investigators have reported 17 chemical constituents in *V. vinifera* (Tintal del pais) grape seeds such as presence of monomers, dimers, trimers, tetramers, pentamers, hexamers, heptamers and their gallates in grape seeds [9]. It is important to show that the composition and antibacterial activity of local variety of grape. In this study, Fourier Transform Infrared Spectroscopy (FTIR) was used to demonstripted the chemical fine structure and compositions of grapes. Furthermore, the antibacterial activity of water and alcoholic extract of seed of grape collected from Baghdad farms against different pathogenic bacteria were evaluated.

MATERIALS AND METHODS

Study Plant

Seeds of grape (*Vitis vinifera*) were collected from grape that obtained from local markets in Baghdad. The plant was classified at College of Science, University of Baghdad, Baghdad, Iraq. The seeds were dried at 25°C, then ground by a blender (rotel coffee grinder type 24) and kept in plastic containers at room temperature until they were used [10].

Aqueous extracts of grape (*V. vinifera*) seeds

Fifty grams of dried ground of grape (*V. vinifera*) seeds were refluxed in 250 ml of distilled water for 24 h, the precipitate was removed by filtration, through filter paper no.1, and then filtrates were concentrated in rotary evaporator [10].

Preparation of alcoholic extracts of grape (*V. vinifera*) seeds

Fifty grams of dried ground of grape (*V. vinifera*) seeds were refluxed in 250 ml of 70 % ethanol for 24 h, the precipitate was removed by filtration, through filter paper no.1, and then filtrates was concentrated under vacuum using freeze drier [11].

Antibacterial activity of supernatant of extract

The antibacterial activity of the extract was done on two Isolates of bacteria, *Bacillus* and *Serratia marcescens*. Both of isolates were cultured into Muller Hinton broth prior to experiment [11]. The disc diffusion method was used to assessment the antibacterial activity of the extract against *Bacillus* and *Serratia marcescens*. Briefly, filter paper of Whatman no1 was cut to circles with 0.5 cm in diameter and then sterile by autoclave. The piece of papers were dried and submerged in different dilution of the extract (1, 1/2, 1/3 and 1/4; V/V). After overnight the paper s were dried by oven at 37 ^{o}C for 20 min. Each bacterial isolate was spread onto Muller Hinton agar and left upright for 2 h. The prepared papers were put onto plates and incubated at 37 ^{o}C for overnight. The results were observed by clear zone around the discs [14].

Fourier Transform Infrared Spectroscopy (FTIR)

FTIR (FT-IR-Prestige shimadzu spectrophotometer) and US spectrum (shimadzu visible UV) analysis were done in the instrument laboratory, Department of Chemistry, College of Science, University of Baghdad, Baghdad, Iraq.

RESULTS AND DISCUSSION

In current study, the antibacterial activity of both extracts, alcoholic and aquatic were evaluated against four bacterial isolates (*Escherichia coli, Proteus, Bacillus, Staphylococcus aureus*). **Table 1** showed the effect of alcoholic extract of grape (*V. vinifera*) seeds in terms of diameter of inhibition zone on the bacterial isolates. Four concentrations of the extract were used. The highest effect of extract was observed at the concentrated extract while the lowest effect was observed at the highest dilution of the extract.

Table 1. Antibacterial activity alcoholic extracts of grape (*V. vinifera*) seeds the inhibition zone measured by mm of diameter of inhibition zone.

No	Sample dilution and control	*E. coli*	*Proteus*	*Bacillus*	*S. aureus*
1	Concentrated	21	15	0	17
2	1/2	15	15	0	12
3	1/3	15	0	0	0
4	1/4	14	0	0	0
4	Control (Normal saline)	0	0	0	0

Table 2 shows the antibacterial effect of aqueous extracts of grape (*V. vinifera*) seeds against different

bacterial isolates. The results shows no antibacterial effect of aqueous extracts of grape (*V. vinifera*) seeds against all isolates of bacteria that used in current study.

Table 2. Antibacterial activity **aqueous extracts of** grape (*V. vinifera*) seeds the inhibition zone measured by mm of diameter of inhibition zone.

	Sample dilution and control	*E. coli*	*Proteus*	*Bacillus*	*Staphylococcus aureus*
1	Concentrated	0	0	0	0
2	1/2	0	0	0	0
3	1/3	0	0	0	0
4	1/4	0	0	0	0
4	Control (Normal saline)	0	0	0	0

Grape seed extract obtained from grapes grown in Hasandede, Emir and Kalecik Karasi in Turkey showed concentrations of 2.5%- 5% exhibited the most inhibitory effect against a wide variety of microorganisms including *E. coli*, *Klebsiella pneumoniae*, and *S. aureus*. A similar grape seed extract product IH636 was tested against 21 strains of Gram positive and Gram negative cocci which showed Gram positive cocci to be more susceptible, especially *S. aureus* [13]. In current study, the highest effect of extracts of grape (*V. vinifera*) seeds was against Gram negative bacteria.

FTIR analysis

In present study the antibacterial effect was found only in case of alcoholic extracts of grape (*V. vinifera*) seeds that is why; this extracted was analysis in the FTIR.

The results of FTIR analysis (**Fig 1**) showed that there is a clear and high intensive bond (3450 /cm) which represent NH2 groups of alcoholic extract. The sharp bond (3008 /cm) that represents frequency asymmetrical patterns of aromatic group C-H. Another bond (2925/cm) represented frequency patterns of alphatic bond of CH group. The bond of 1745/cm which is the patterns match the frequency of the ester anhydrate group (C=O). The bonds at 1649/cm and 1618 /cm represent the frequency of pattern of group C=C [12]. The present study proved strongly that the chemicals composition of extracts of grape (*V. vinifera*) seeds especially alcoholic extract plays an important role in inhibition of bacterial activity and growth. For these results it can be concluded that the aliphatic and ester anhydrate group have antibacterial activity and interfere of bacterial growth thus this extract v=can be used as safe preservative material.

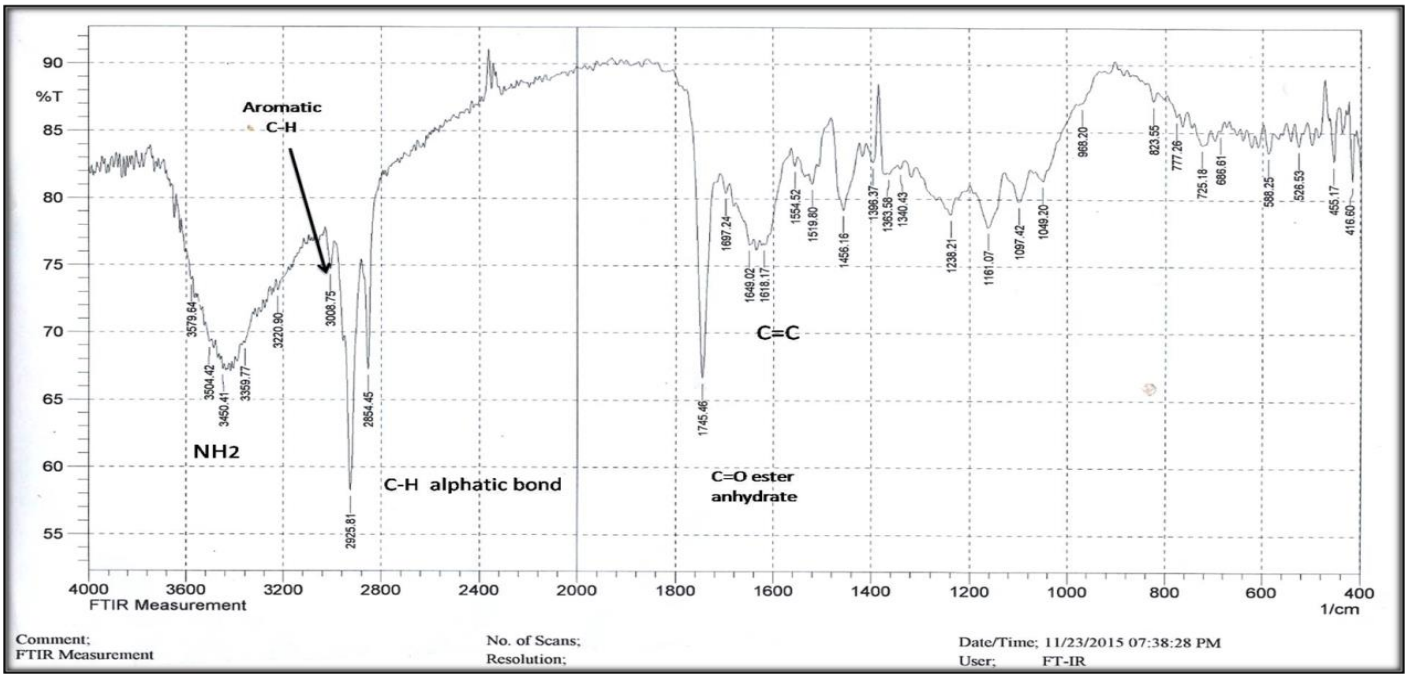

Fig 1. FTIR analysis of **alcoholic extracts of** grape (*V. vinifera*) seeds. FTIR analysis of the extract showed several peaks of bonds.

Conflict of interest

The authors declare that they have no conflict of interests.

REFERENCE

1. **Xia E-Q, Deng G-F, Guo Y-J, Li H-B.** (2010) Biological Activities of Polyphenols from Grapes. *Int J Mol Sci* **11**: 622-646.
2. **Spacil Z, Novakova L, Solich P.** (2008) Analysis of phenolic compounds by high performance liquidchromatography and ultra performance liquid chromatography. *Talanta* **76**: 189–199.

3. **Robinson AL, Boss PK, Solomon PS, Trengove RD, Heymann H, Ebeler SE.** (2014) Origins of Grape and Wine Aroma. Part 2. Chemical and Sensory Analysis. *Am J Enol Vitic* **65**: 25-42.
4. **Sanhueza L, Tello M, Vivanco M, Mendoza L, Wilkens M.** (2014) Relation between Antibacterial Activity against Food Transmitted Pathogens and Total Phenolic Compounds in Grape Pomace Extracts from Cabernet Sauvignon and Syrah Varieties. *Adv Microbiol* **4**: 225-232.
5. **Thimothe J, Bonsi IA, Padilla-Zakour OI, Koo H.** (2007) Chemical Characterization of Red Wine Grape (*Vitis vinifera* and Vitis Interspecific Hybrids) and Pomace Phenolic Extracts and Their Biological Activity against Streptococcus mutans. *J Agr Food Chem* **55:** 10200-10207.
6. **Kao TT, Tu HC, Chang WN, Chen BH, Shi YY, et al.** (2010) Grape Seed Extract Inhibits the Growth and Pathogenicity of Staphylococcus aureus by Interfering with Dihydrofolate Reductase Activity and Folate-Mediated One-Carbon Metabolism. *Int J Food Microbiol* **141**: 17-27.
7. **Özkan G, Sagdiç O, Baydar NG, Kurumahmutoglu Z.** (2004) Antibacterial Activities and Total Phenolic Contents of Grape Pomace Extracts. *J Sci Food Agr* **84**: 1807-1811.
8. **Jayaprakasha GK, Singh RP, Sakariah KK.** (2001) Antioxidant activity of grape seed (*Vitis vinefera*) extracts on peroxidation models *in vitro*. *Food Chemistry* **73**: 285–290.
9. **Jayaprakasha GK, Selvi T, Sakariah KK.** (2003) Antibacterial and antioxidant activities of grape (*Vitis vinifera*) seed extracts**.** *Food Res Int* **36**: 117–122.
10. **Mohammed KA, Al-Maliki, ADM** (2014) Moderate effect of phenolic and alkaloid compounds extracted from Brassica oleracea var. capitata leaf on blood glucose level in alloxan-induced diabetic rabbits. *World J Exp Biosci* **2**: 30-35.
11. **Mohammed KA, Al-Maliki, ADM** (2014) Effect of phenolic and alkaloid compounds extracted from Brassica oleracea var. capitata seed on glucose level in blood of alloxan-induced diabetes rabbits. *World J Exp Biosci* **2**: 24-29.
12. **Hepworth JD, Waring DR, Waring MJ, Berry M, Drayton C.** (2002) Aromatic Chemistry, The Royal Society of Chemistry, Cambridge: 176.
13. **Shrestha B, Theerathavaj S, Thaweboon S, Thaweboon B.** (2012) In vitro antimicrobial effects of grape seed extract on peri-implantitis microflora in craniofacial implants. *Asian Pac J Trop Biomed* **2**: 822–825.
14. **Whittaker D.** (2000) Interpreting Organic Spectra. *The Royal Society of Chemistry*.

Author affiliation

1. *Department of Chemistry, College of Science, University of Baghdad, Baghdad, Iraq.*