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In- Vitro Study of Antibacterial Properties and Phytochemical Contents of Coriander Seeds Against Five Bacteria.

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Abstract

In an effort to highlight the role of digestion and maceration methods to determine the strength of antibacterial effect and phytochemical elements of coriander seeds aqueous and methanolic extracts. Five concentrations (20, 40, 80, 160 and 320 mg/ml) of four extracts (aqueous by maceration, aqueous by digestion, methanolic by maceration and methanolic by digestion) were utilized against five clinically isolated bacteria (*Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aerogenosa* and *Acenitobacter baumani*), and compared with ciprofloxacin and cefotaxime discs as control. Agar well diffusion technique was employed to clarify the antibacterial activity of the extracts' concentrations relaying on quantifying the diameter of inhibition zone (IZ) in millimeter. The bioactive chemical compounds of four extracts were specified by means of conventional systems. In the main, all extracts inhibited the growth of every bacterial species starting from (80) mg/ml concentration, forming IZs' with various measurements that their expansion was drawing upon the rising of extracts' concentrations. The IZs that proceeded from (160, 320) mg/ml concentrations were larger than that come out from cefotaxime. The maceration extracts declared their embracement of alkaloids, and their impact were vigorous compared with the extracts of digestion which marked by comprising the tannins and flavonoids in aqueous and methanolic extracts one by one. The most susceptible bacterium to ethanolic extracts was *S. aureus*. It could be benefiting from coriander seeds for treatment of bacterial infections through extraction the

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best active phytoconstituents by using both of suitable extraction technique and solvents together.

Keywords: Coriander seeds, Antibacterial, Phytohemical.

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في الزجاج دراسة خصائص مضاد الجراثيم و المحتويات الكيميائية النباتية لبذور الكزبرة تجاه خمسة جراثيم

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الملخص

بهدف القاء الضوء على دور طريقتي التنقيع و الهضم نحو تحديد قوة مفعول مضاد الجراثيم و العناصر الكيميائية النباتية للمستخلص المائي و الميثانولي لبذور الكزبرة. استخدمت خمسة تراكيز mg/ ml (20, 40, 80, 160, 320) للمستخلصات الاربعة (المائي بالتنقيع، المائي بالهضم، الميثانولي بالتنقيع، الميثانولي بالهضم) تجاه خمسة جراثيم معزولة سريريا (*Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aerogenosa* و *Acenitobacter baumanii*) و تمت المقارنة مع اقراص ciprofloxacin و cefotaxime كسيطرة. استعملت تقنية انتشار حفر الاغرة (الهلام) لتوضيح الفاعلية المضادة للجراثيم لتراكيز المستخلصات من خلال قياس احزمة التثبيط بالملمتر. وقد عينت المركبات الكيميائية الفعالة حيويا للمستخلصات الاربعة من خلال الطرق المألوفة. على العموم، جميع المستخلصات ثبطت نمو كل انواع الجراثيم ابتداء من تركيز mg/ml (80)، مشكلة احزمة تثبيط ذات قياسات مختلفة و التي كانت اتساعها مستندة الى ارتفاع تراكيز المستخلصات. ان احزمة التثبيط اللتي نشات من التركيزين mg/ ml (160, 320) كانت اكبر من تلك التي برزت من cefotaxime. اظهرت مستخلصات التنقيع تضمنها القلويدات، و كانت تأثيرهن قوية مقارنة مع مستخلصات الهضم التي تميزت باشتمالها على التنينات و الفلافينودات في مستخلصي المائي و الميثانولي على التوالي. اكثر الجراثيم حساسية لمستخلصات الميثانول كانت *S. aureus*. من الممكن الانتفاع من بذور الكزبرة في علاج الاصابات

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الجرثومية من خلال استخلاص المكونات الكيميائية النباتية الافضل تأثيرا باستخدام كلا من تقنية الاستخلاص و المذيبات المناسبتين معا.

الكلمات الدالة: بذور الكزبرة، مضاد الجراثيم، كيميائية نباتية.

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1. Introduction:

Multidrug resistant bacteria can distribute in human society, has significant risk on popular hygiene and must be controlled immediately and firmly [1]. It is essential urgently to develop very unique treatment plans and seek for new antibacterial medications that are further efficacious and has capacity to stand up seriously and persistently opposing to strategies of bacterial resistance [2]. In the present time, the real benefits such as plentiful experimental practices and existence of distinctive variety of chemical elements that possess biological properties are recorded from employing of natural products and indigenous medicine to frame modern remedies [3], especially detection of antibacterial remedies throughout persistent investigations which is considered the main basis of antibacterial work field [4].

Different plant extracts done by numerous solvents brought into view the hopeful antibacterial impact of such extracts contrary to human's pathogenic bacteria; this idea proved through number of researches [5]. The herbs contain variety phytochemicals exemplified by secondary metabolites which considered the origin of medications and can be attended as fresh antibacterial factor [6], owing to if compared with artificial antibiotics, they are harmless without side effects, efficient clinically, do not develop resistance and cheaper [7]. Coriander is a yearly herb which is belonging to carrot family (Umbelliferae) and *Coriandrum* genus. It consists of two species; the first is *C. sativum*, a broadly crop which is available primarily in the tropics, though the other species is *C. tordylium* which is recognized as uncultivated plant [8]. *C. sativum* is exactly named as “herb of happiness”, on the strength of it looked at as one of the wonderful herbs because it consumed as spice along with herbal prescription together [9], including different employing it for different intentions for instance: in nutrition foodstuffs as flavoring material, covered commodities, brews, cosmetics, tobacco yields, perfumes, and as principal factor for curry powder [10].

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There are surveys that elucidated biological action of all segments of *Coriandrum sativum* for example fruit, flower, seeds and leaves; these action are antidiabetic, antioxidant, diuretic, antimutagenic, hypnotic, sedative, anti-convulsing, anthelmintic and antimicrobial [11], attributable to existence of different chemical constituents such as alkaloids, glycosides, reducing sugars, tannins, phenolics, flavonoids, essential oil, terpenoids, sterols and fatty acids [12].

On other hand the antibacterial potent of *C. sativum* has been established by several reports; the colonies of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aerogenosa* and *Salmonella typhi* was affected at numerous marks by stems and leaves of coriandrum extracted by four solvents (acetone, ethyl acetate, methanol and petroleum ether) as a general rule [13]. Fazeel verified the antibacterial activity of *C. sativum* essential oil against *P. aerogenosa*, *S. typhi*, *E. coli*, *Klebsiella pneumoniae* and *S. aureus*, the oil suppressed the culture of all prior bacteria preferable off than or nearby the antibiotics [14].

The existing research was directed to recognize whether there are variations between maceration and digestion extracts approaches employed to prepare aqueous and methanolic extracts of *C. sativum* seed as antibacteria against five selected bacteria *in vitro* depending on exploring the selected phytochemical ingredients of each extract.

2. Materials and methods:

2.1 Practiced plant:

2.1.1 Plant sample:

Coriander (*C. sativum*) seeds were bought from herbal merchant in Kirkuk city during august 2017, and then were delivered to laboratory technique department of Kirkuk Technical College. Taxonomic approving of the plant sample was authenticated according to conservative means. The choosing of the plant relying on its consuming as ethnic herbal medication.

2.1.2 Plant treating:

The seeds were eliminated from dirt by rinsing with distilled water. After aeration of seeds at room temperature, they were milled with electric grinder. The powdered seeds were stocked in nylon pouch at 4 °C.

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2.1.3 Plant extraction:

Both of the aqueous and methanolic extracts of coriander seeds were prepared by maceration and digestion methods in conformity with [15]; as two bottles every one of them containing 500 ml of distilled water were readied for aqueous extracts and in other hand methanolic extracts were equipped with two bottles each one of them comprising 500 ml of 99 % methanol (Scharlab S. L., Spain), at that time 400 (g) of seed powder was balanced via the digital balance (Denver instrument, Germany) and thawed in four bottles (100 g in every single bottle). Two bottles (one of aqueous, the other of methanolic) were macerated for one weak at room temperature with regular jerking until the resolvable material has softened. The digestion technique was executed on the other two bottles (one of aqueous, the other of methanolic) the same as maceration procedure plus heating at 50° C in water bath for 24 hours, there filtration using muslin cloth was achieved on the extract and the superfluous solvent was eradicated from consequential filtrate by oven (Memmert, Germany) at 70 °C for 48 hours that lead to the foundation of a sticky substance which deposited in airtight sterile containers that left in refrigerator up to afterward screening.

2.1.4 Readying of extracts' concentration:

The following concentrations (20, 40, 80, 160 and 320 milligram (mg)/ml) of each aqueous and methanolic extracts (produced from maceration and digestion methods) were organized through following style: 200, 400, 800, 1600 and 3200 mg of aqueous and methanolic sticky substances were dissolved separately in 10 ml of distilled water. All concentrations were preserved in airtight cups at 4 °C awaiting of exploration them for antibacterial potential. The antibacterial impact of the concentrations was compared with distilled water as negative control, on the other hand positive control signified as ciprofloxacin and cefotaxime.

2.2 Primary phytochemical composition tests:

The overall extracts were exposed to primary phytochemical investigations for revealing many plant phytochemical components employing standard tests as reviewed underneath:

1- Showing alkaloids by Wagner's Test: Extracts were admixed separately in 1% dilute Hydrochloric acid and filtered, and then 2 ml of filtrates solution were supplemented with 6 drops of Wagner's reagent (Iodine in Potassium Iodide in 100 ml water). Observation of brown/reddish precipitate establishes positive test and the existence of alkaloids [16].

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2- Showing of carbohydrates: Extracts distinctly were mixed distinctly in 5 ml of distilled water and filtered. The filtrates were utilized to test for the existence of carbohydrates by:

a- Molisch's Test: 2 ml of filtrates were treated with 2 drops of alcoholic α-naphthol solution in a test tube. Foundation of the violet ring at the interchange demonstrates positive test and the existence of carbohydrates [16].

b- Benedict's Test: 0.5 ml of filtrates were supplemented with 0.5 ml of Benedict's reagent and heated lightly for 2 minutes. A distinctive orange red result proves positive test and the existence of cabohydrates [16].

3- Showing flavonoids by sodium hydroxide test: Extracts separately were treated with few drops of sodium hydroxide solution. Occurrence of extreme yellow color, which diminishes after supplying of dilute hydrochloric acid, designates the existence of flavonoids [17].

4- Showing saponins by froth test: One g of each extract was supplemented independently with distilled water to 20 ml, appearance of 1 centimeter foam coat after surprising in a graduated cylinder for 15 minutes point out to saponin existence [18].

5- Showing phenolic compounds by Lead acetate test: Fifty mg from each extract individually is thawed in 100 ml of distilled water and supplemented with 3 ml of 10% lead acetate solution. Phenolic compounds are manifested through establishment of a massive white precipitate [18].

6- Showing tannin by ferric chloride test: About 0.1 g of each extract alone was milted with 10 ml of distilled water and then filtered. Two ml of each filtrate were completed with few drops of 1% ferric chloride solution. Remarking blue or greenish color exhibit the positive test and the existence of tannins [17].

2.3 Experienced bacteria:

2.3.1 Bacterial isolates:

The experiment of current study involved five clinical multidrug-resistant bacterial isolates which were diagnosed from specimen collected in pediatric hospital in Kirkuk city. One Gram positive bacteria: *S. aureus* and four Gram negative bacteria: *E. coli*, *K. pneumoniae*, *P. aerogenosa* and *Acenitobacter baumani*).

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2.3.2 Description of bacterial isolates:

The following typical microbiology procedures mentioned by [19] were resorted the specifications of every bacterial species; colony morphology after culturing in enriched media then sub culturing in differential and selective media to detect the fine colonies, Gram's staining inspection, documentation the biochemical features of each species by way of initial biochemical tests.

2.3.3 Continuation of bacterial isolates:

Few pure colonies of every single bacterial species were sub cultured on nutrient agar which incubated overnight, later on repetition of sub culturing on nutrient slants were performed monthly as stock culture and conserved at 4 °C until analyzing the antibacterial activity of the extracts.

2.3.4 Making and normalization of bacterial inoculum suspension:

A loop filled with bacterial growth was picked up from stock cultures and immersed into nutrient broth with a view to prepare suspension for each bacterial isolates, the broths were incubated at 37 °C till the bacterial count attain 10^{8}-10^{9} colony forming unit (CFU) that has been affirmed when bacterial suspension turbidity was analogous to McFarland number 0.5 tube optically.

2.3.5 Antibacterial effect checking:

Under excessive aseptic conditions, the antibacterial specialties of coriander extracts toward examined bacteria were observed on the authority of agar well diffusion technique *In vitro* [20]. The bacterial suspension of each bacterium was spread out on surface and margin of nutrient agar plates by means of sterile cotton swab. After about 20 minutes the plates were hardened, thereupon the surface of every plate was punctured identically in six sites in order to create six mm diameter holes with cork borer. One hundred microliter (µl) from each extract concentrations was put in every hole, together 100 µl from distilled water was placed in one hole by utilizing micropipette [21]. Agar disc diffusion technique [22] was also carried out with a view to assess antibacterial susceptibility of ciprofloxacin and cefotaxime discs against isolated bacteria when the discs were resided at plates' surfaces with sterile forceps. Later on the antibacterial action was identified by way of noticeable inhibition zone (IZ) surrounded the holes

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and discs after incubation the plates overnight at 37 °C. The results were listed as soon as calculating the IZ diameters around each hole and disc in mm via ruler. The experiments were realized in triplicate.

2.4 Statistical valuation:

Excel program of Microsoft office 2010 was utilized for appraising the results. Altogether the antibacterial effect of every one extract's concentration was represented by way of mean IZ diameter of three evaluations by millilmeter (mm) ± standard deviation (SD).

3. Results:

In this study as designated in Table 1, extracts of digestion method used in 20 and 40 mg/ml concentration showed no antibacterial activity. Regarding with aqueous digestion extract when used in 80 mg/ ml concentration displayed IZs of (2 mm) ± 3.46, (1.67 mm) ± 2.89, (5.33 mm)±4.62 and (3.33 mm)±5.77 against *S. aureus, E. coli, P. aerogenosa* and *A. baumani* respectively, while the activity of the extract in 160 mg/ml produced IZs as (4.33 mm)±4.04, (5.33 mm) ±4.62, (5 mm) ±4.36, (5.33 mm) ±4.62 and (8 mm) ±2 when tested for *S. aureus, K. pneumoniae, E. coli, P. aerogenosa* and *A. baumani* consecutively, whereas the extract showed growth IZs of (11 mm) ±1, (12 mm) ±2.65, (10.33 mm) ±2.52, (11 mm) ±1 and (11 mm) ±2.64 in 320 mg/ml when tested for *S. aureus, K. pneumoniae, E. coli, P. aerogenosa* and *A. baumani* one after the other.

On the subject of with methanolic digestion extract, *S. aureus, K. pneumoniae, E. coli* and *P. aerogenosa* revealed IZs of (2.67 mm) ±4.62, (5.33 mm) ±4.62, (2 mm) ±3.46 and (2.67 mm) ±4.62 IZs at 80 mg/ ml concentration by turns, whereas the effect of 160 mg/ml were clarified as (10.67 mm) ±0.58, (6 mm) ±5.20, (9 mm) ±1.73, (6 mm) ±5.29, and (5.67 mm) ±4.93 IZs to the *S. aureus, K. pneumoniae, E. coli, P. aerogenosa* and *A. baumani* continually, while in contrary the IZs of (12.33 mm) ±0.58, (8.33 mm) ±7.23, (11 mm) ±1, (9.67 mm) ±2.08 and (6.67 mm) ±5.77 were evident against *S. aureus, K. pneumoniae, E. coli, P. aerogenosa* and *A. baumani* respectively at 320 mg/ml concentration.

Table 2 shows that extracts of maceration method at concentrations of 20 and 40 mg/ml did not inhibit growth of all bacterial isolates. Concerning with aqueous maceration extract, the *S. aureus, K. pneumoniae, E. coli, P. aerogenosa* and *A. baumani* demonstrated (8.67 mm)±1.15, (3

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mm)±5.20, (5 mm)±4.36, (5.33 mm)±4.73 and (8.33 mm)±0.58 IZs at 80 mg/ ml concentration one at a time, whereas the IZs of (11.33 mm)±0.58, (10 mm)±2, (9.33 mm)±0.58, (8.33 mm)±0.58 and (10.67 mm)±1.53 were observed against *S. aureus*, *K. pneumoniae*, *E. coli*, *P. aerogenosa* and *A. baumani* continuously at concentration 160 mg/ml, While the extract in 320 mg/ml inhibited the growth of *S. aureus*, *K. pneumoniae*, *E. coli*, *P. aerogenosa* and *A. baumani* with the IZs of (12.67 mm)±0.58, (12 mm)±1, (10.67 mm)±0.58, (9.33 mm)±0.58 and (11.67 mm)±1.53 in turn. In respect of methanolic maceration extract, 80 mg/ml concentration exhibited activity as (10.33 mm)±2.08, (6 mm)±5.29, (8 mm)±1 and (5.33 mm)±4.73 IZs toward *S. aureus*, *K. pneumoniae*, *E. coli* and *A. baumani* one by one, while in the contrary the IZs of (11.67 mm)±1.53, (10 mm)±1, (9.33 mm)±0.58, (6.67 mm)±0.58 and (9.33 mm)±1.15 were noticed at 160 mg/ml toward *S. aureus*, *K. pneumoniae*, *E. coli*, *P. aerogenosa* and *A. baumani* respectively, while the extract at 320 mg/ml concentration presented IZs of (13.33 mm)±0.58, (12 mm)±1, (11 mm)±0, (9 mm)±1.73 and (11.67 mm)±2.31 to the *S. aureus*, *K. pneumoniae*, *E. coli*, *P. aerogenosa* and *A. baumani* continually.

Table 1: Sensitivity of studied bacteria in the face of digestion method extracts.

Test Extracts	Concentration	Inhibition zone diameters (mm)±SD				
		S. aureus	***K. pneum***	***E. coli***	***P. aerogeno.***	***A. baumani***
Aqueous	20 mg/ml	-	-	-	-	-
	40 mg/ml	-	-	-	-	-
	80 mg/ml	(2)±3.46	-	(1.67)±2.89	(5.33)±4.62	(3.33)±5.77
	160 mg/ml	(4.33)±4.04	(5.33)±4.62	(5)±4.36	(5.33)±4.62	(8)±2
	320 mg/ml	(11)±1	(12)±2.65	(10.33)±2.52	(11)±1	(11)±2.64
Methanolic	20 mg/ml	-	-	-	-	-
	40 mg/ml	-	-	-	-	-
	80 mg/ml	(2.67)±4.62	(5.33)±4.62	(2)±3.46	(2.67)±4.62	-
	160 mg/ml	(10.67)±0.58	(6)±5.20	(9)±1.73	(6)±5.29	(5.67)±4.93
	320 mg/ml	(12.33)±0.58	(8.33)±7.23	(11)±1	(9.67)±2.08	(6.67)±5.77

Results in Table 3 indicate that negative control which showed no growth IZs against microorganisms tested. The IZs of ciprofloxacin were (27 mm)±2, (11.5 mm)±14.46, (30.25

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mm)±3.69 and (20.25 mm)±15.71 against the *S. aureus*, *K. pneumoniae*, *E. coli* and *A. baumani* microorganisms one by one, while the IZs of (9.75 mm)±7.41, (2.75 mm)±5.5, (5.75 mm)±7.22, (2 mm)±4 and (7.5 mm)±10.38 were formed by cefotaxime toward *S. aureus*, *K. pneumoniae*, *E. coli*, *P. aerogenosa* and *A. baumani* consecutively.

Table 2: Sensitivity of studied bacteria in the face of maceration method extracts.

Test Extracts	Concentration	Inhibition zone diameters (mm)±SD				
		S. aureus	***K. pneum.***	***E. coli***	***P. aerogeno.***	***A. baumani***
Aqueous	20 mg/ml	-	-	-	-	-
	40 mg/ml	-	-	-	-	-
	80 mg/ml	(8.67)±1.15	(3)±5.20	(5)±4.36	(5.33)±4.73	(8.33)±0.58
	160 mg/ml	(11.33)±0.58	(10)±2	(9.33)±0.58	(8.33)±0.58	(10.67)±1.53
	320 mg/ml	(12.67)±0.58	(12)±1	(10.67)±0.58	(9.33)±0.58	(11.67)±1.53
Methanolic	20 mg/ml	-	-	-	-	-
	40 mg/ml	-	-	-	-	-
	80 mg/ml	(10.33)±2.08	(6)±5.29	(8)±1	-	(5.33)±4.73
	160 mg/ml	(11.67)±1.53	(10)±1	(9.33)±0.58	(6.67)±0.58	(9.33)±1.15
	320 mg/ml	(13.33)±0.58	(12)±1	(11)±0	(9)±1.73	(11.67)±2.31

Table 3: Sensitivity of studied bacteria in the face of positive and negative controls.

Test Extracts	Concentration	Inhibition zone diameters (mm)±SD				
		S. aureus	***K. pneumo***	***E. coli***	***P. aerogeno***	***A. baumani***
Ciprofloxacin	10 µg	(27)±2	(11.5)±14.46	(30.25)±3.69	-	(20.25)±15.71
Cefotaxime	10 µg	(9.75)±7.41	(2.75)±5.5	(5.75)±7.22	(2)±4	(7.5)±10.38
Distilled water	-	-	-	-	-	-

In terms of phytochemical searching, digestion aqueous extract displayed positive result towards the presence of phenolic and tannin. Alkaloides were found in methanolic and aqueous

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extracts prepared by maceration method. In the other hand, flavonoides was only present in digestion methanolic extract as seen in Table 4.

Table 4: Phytochemical searching of digestion and maceration methods extracts.

	Maceration Methanolic	Maceration aqueous	Digestion methanolic	Digestion aqueous
Carbohydrates	-	-	-	-
Saponin	-	-	-	-
Phenolic	-	-	-	+
Tannin	-	-	-	+
Alkaloides	+	+	-	-
Flavonoides	-	-	+	-

4. Discussion:

Observations achieved from current study revealed that coriandrum seeds aqueous and methanolic extracts from 80 to 320 mg/ml concentrations prepared from maceration and digestion methods have spectrum antibacterial action alongside all tested bacteria as whole Tables 1, 2 this is supported by a former report [23] when the colonies growth of *E. coli*, *S. aureus*, *P. aerogenosa* and *K. pneumoniae* were influenced by *C. sativum* seeds extracts with IZs extended from 7-20 mm regarding with methanol extract and 10-13 mm concerning with aqueous extract about all mentioned bacteria. In contrast to the results of Keskin and Toroglu research work at the time when methanol extract of coriander did not have antibacterial property toward *K. pneumoniae*, *S. aureus*, *P. aerogenosa* and *E. coli* [24]. The various findings of antibacterial impact of same extracts against the similar bacteria from one country to another are correlated to herb gathering place that lead to unlike subspecies of the herb, diverse climates, in addition to different bacterial strains of each species.

Results of present study is also not in agreement with investigations of Oudah and Ali, when they published that the growth of *K. pneumoniae* and *E. coli* was not suppressed by warm aqueous extracts of coriander seed prepared through heating at 50 °C for one hour [25]. Chaudhry and Tariq ascertained that all studied bacterial colonies were not have been inhibited

by aqueous extract of coriander drew out by decoction technique [26]. Various extraction techniques looked to be extremely affecting the antibacterial potent of the same coriander extract. Extraction procedures play a critical role for determination the strength of herb's antibacterial effectiveness, Just as obvious in this work, the antibacterial action of aqueous extracts toward the same bacteria is changeable rendering to the extraction method represented by maceration and digestion, which is also, be applicable to the IZs that made through methanolic extracts prepared by referred methods around identical bacteria as was elucidated in Tables 1, 2, commonly the extracts accomplished by maceration method were more effective than that obtained by digestion method which involves application of 50 °C temperature; which is coordinate the findings of former paper once the efficacy that arose due to ethanolic extract of coriander seeds prepared at 25 °C was superior than that efficacy when 37 °C was directed for obtaining the similar extract prepared at 37 °C upon several pathogenic bacteria [27]; this might be due to the fact that during the preparation procedure of extracts, the application of heating or raising of temperature may alter chemical or physical situations of the extracts, by that means lead to diminish the antibacterial action of extracts [28]. Therefore, it is necessary to select suitable extraction technique which their temperatures degrees do not impact upon antibacterial properties of medicinal plant because such plants may be involve antibacterial phytochemical elements that are thermostable and breakdown by heat conduct throughout dealing with the plant extract [29].

It was pointed out that the increasing the concentration of the extracts progress the antibacterial activity of them; hence expand the diameter of IZ of tested bacteria signifying that the growth of the bacteria were suppressed further when the level of chemical constituents increased in coriander seeds. Similar records were proposed by Mahdi [27] and Shahid *et al.* [30]. The susceptibility of every tested bacteria to the seed extracts was be unlike to another bacteria considering that everyone concentration of the extracts create diverse degree of IZs based on bacterial kinds. This is compatible with conclusions revealed by Thangavel *et al.* [23] and Keskin and Toroglu [24] when the antibacterial effect of the herbal extracts is subjected to bacterial species. Ratha bai and Kanimozhi clarified that the suppression of the *S. aureus* progress in the culture was more intense than other tested bacteria by methanolic extract [31], which is in accordance with existing research; Tables 1, 2 displayed that *S. aureus* amongst all used bacteria put on show maximum IZ against the methanolic extracts.

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It is evident from Table 2 that IZ of *E. coli* was 11 mm toward 320 mg/ml of methanolic extract by maceration method; the finding was in harmony with observation of Seema *et al*. to some extent whilst 11 mm IZ created on *E. coli* culture by coriander seeds at what time macerated by methanol [21]. The activity of aqueous extract obtained by maceration method at 320 mg/ml toward *P. aerogenosa* was apparent by 9.33 mm IZ; this is seemed to be in line with the obtaining of 9 mm IZ by aqueous extract of coriander seed at 100% concentration upon the said bacteria [32].

Pursuant to results appeared in Tables 1, 2, 3 the suppressing action of altogether extracts at 160 and 230 mg/ml concentrations were superior to that caused by cefotaxime on all cultured bacteria in most cases. It was noted that the alcoholic extract of coriander at the higher concentration (200 mg/ml) employed was exceeded gentamicine as for ability of prevention the growth of *S. aureus* colonies [27]. Thereby, it should be dependence on advanced concentration of the extract if necessary to utilize it as antibacterial agent. Phytochemical investigation of the extracts in present work confirmed the appearance of tannins in digestion aqueous extract, the digestion methanolic extract and maceration extracts were positive for presence of flavonoids and alkaloids separately Table 4, this result in the same way with another research at what time alkaloids, tannins and flavonoids were documented from aqueous and methanolic extracts of *C. sativum* seeds after carrying out of phytochemical analysis [23]. Gayathri *et al*. examined the phytochemical properties of essential oils extracted from coriander seeds through several solvents; they stated that methanolic extract was contain flavonoids, in other hand the tannins was prominent symbol of aqueous extract only [33]. Results of a work showed that the growth of many bacterial isolates was effected powerfully by all of tannins got out from some farming harvests with a number of solvents [34]. Various size of IZs were obtainable when the flavonoids drew out from two chosen algaes were applied upon different tested pathogenic bacteria [35]. In the manner of directly above, the findings of a study revealed that full alkaloids took out from five folk herbs have antibacterial characteristic that was in variable appearance according to the type of herbs [36]. The antimicrobial effect of the four extracts in our search might be associated with their contented of above-mentioned phytochemicals. Plants most likely keep themselves away from microorganisms through secretion of phytoconstituents which they are protective compounds, have diverse mechanisms of action such as destroying of bacterial virulence factors comprising toxins and enzymes, destruction of cell membrane and prevention of biofilm

creation. It is clear that the active, secure, little adverse effects and low-cost antibacterial agents is attained probability by phytochemicals [37].

5. Conclusion:

In assumption to the existing results, the coriander seeds aqueous and methanolic extracts seemingly suppress the growth of all tested bacterial species owing to the attendance of forceful phytochemicals in these extracts. The extracts got from maceration method are better inhibitory antibacterial than digestion method. Extraction practice considered to be essential step for successful segregation of chemicals from herbal substance as well as the category of extraction solvent. In recommendation, it is mandatory to check the best extraction method for detection and standardization the more active extracts accountable for antibacterial activity on numerous antibiotic resistant bacteria through the phytochemical compounds that originate in such extracts.

References:

[1] D. Van Duin and D. Paterson, "***Multidrug Resistant Bacteria in the Community: Trends and Lessons Learned***", Infectious Disease Clinics of North America, 30(2), 377 (2016).

[2] K. M. G. O'Connell, J. T. Hodgkinson, H. F. Sore, M. Welch, G. P. C. Salmond and D. R. Spring, "***Combating Multidrug-Resistant Bacteria: Current Strategies for the Discovery of Novel Antibacterials***", Angewandte Chemie International Edition, 52 (41), 10706 (2013).

[3] H. Yuan, Q. Ma, L. Ye and G. Piao, "***The Traditional Medicine and Modern Medicine from Natural Products***", Molecules, 21(5), 559 (2016).

[4] D. G. Brown, T. Lister and T. L. May-Dracka, "***New Natural Products as New Leads for Antibacterial Drug Discovery***", Bioorganic and Medicinal Chemistry Letters, 24 (2), 413 (2014).

[5] P. Saranraj and S. Sivasakthi, "***Medicinal Plants and Its Antimicrobial Properties: A Review***", Global Journal of Pharmacology, 8(3), 316 (2014).

[6] A. K. Pandey and S. Kumar, "***Perspective on Plant Products as Antimicrobials Agents: A Review***", Pharmacologia, 4(7), 469 (2013).

[7] C. Modi, S. Mody, H. Patel, G. Dudhatra, A. Kumar and M. Awale, "***Herbal Antibacterials: A Review***", Journal of Intercultural Ethnopharmacology, 1(1), 52 (2012).

[8] K. V. Peter, "***Handbook of Herbs and Spices***", 2nd Ed., Woodhead Publishing Limited, UK, 1 (2012).

[9] S. Bhat, P. Kaushal, M. Kaur and H. K. Sharma, "***Coriander (Coriandrum sativum L.): Processing, Nutritional and Functional Aspects***", African Journal of Plant Science, 8(1), 25 (2014).

[10] P. Mahendra and S. Bisht, "***Coriandrum sativum: A Daily Use Spice with Great Medicinal Effect***", Pharmacognosy Journal, 3(21), 84 (2011).

[11] N. L. Pathak, S. B. Kasture, N. M. Bhatt and J. D. Rathod, "***Phytopharmacological Properties of Coriander sativum as a Potential Medicinal Tree: An Overview***", Journal of Applied Pharmaceutical Science, 1(4), 20 (2011).

[12] A. E. Al-Snafi, "***A Review on Chemical Constituents and Pharmacological Activities of Coriandrum sativum***", International Organization of Scientific Research Journal of Pharmacy, 6(7), 17 (2016).

[13] A. Pandey, S. Agrawal, A. K. Bhatia and A. Saxena, "***Invitro Assesment of Antibacterial Activity of Calotropis Procera and Coriandrum Sativum Against Various Pathogens***", International Journal of Pharmaceutical Research and Allied Sciences, 4(1), 33 (2015).

[14] Z. A. S. Fazeel, "***Evaluation of Antibacterial Activity of Coriandrum sativum (L.) Against Gram–Positive and Gram–Negative Bacteria***", International Journal of Basic Clinical Pharmacology, 5(6), 2653 (2016).

[15] S. O. Majekodunmi, "***Review of Extraction of Medicinal Plants for Pharmaceutical Research***", Merit Research Journal of Medicine and Medical Sciences, 3(11), 521 (2015).

[16] A. Pandey and S. Tripathi, "***Concept of Standardization, Extraction and Pre Phytochemical Screening Strategies for Herbal Drug***", Journal of Pharmacognosy and Phytochemistry, 2(5), 115 (2014).

[17] S. Sasidharan, Y. Chen, D. Saravanan, K. M. Sundram and L. Y. Latha, "***Extraction, Isolation and Characterization of Bioactive Compounds from Plants' Extracts***", African Journal of Traditional, Complementary and Alternative Medicines, 8(1), 1 (2011).

[18] K. S. Banu and L. Cathrine, "***General Techniques Involved in Phytochemical Analysis***", International Journal of Advanced Research in Chemical Science, 2(4), 25 (2015).

[19] M. D. Delost, "***Introduction to Diagnostic Microbiology for the Laboratory Sciences***", 18th Ed., Jones and Bartlett Learning, USA (2015).

[20] S. G. Jenkins and A. N. Schuetz, "***Current Concepts in Laboratory Testing to Guide Antimicrobial Therapy***", Mayo Clinic Proceedings, 87(3), 290 (2012).

[21] M. Seema, S. Ankur, V. Manjari, K. Akanshi and A. Parish, "***Evaluation of Antibacterial Activity of Methanol and Acetone Extracts of Trigonella foenum, Coriandrum sativum and Brassica nigra***", International Journal of Drug Discovery and Research, 5(3), 316 (2013).

[22] A. W. Bauer, W. M. Kirby, J. C. Sherris and M. Turck, "***Antibiotic Susceptibility Testing by a Standardized Single Disk Method***", American Journal of Clinical Pathology, 45 (4), 493 (1966).

[23] A. Thangavel, S. Balakrishan, V. Lakshmi and S. Duraisamy, "***Phytochemical Screening, Gas Chromatography - Mass Spectrometry (gc-ms) Analysis of Phytochemical***

Constituents and Antibacterial Activity of Coriandrum sativum (l) Seeds", International Journal of Pharmacy and Pharmaceutical Sciences, 7(9), 153 (2015).

[24] D. Keskin and S. Toroglu, "***Studies on Antimicrobial Activities of Solvent Extracts of Different Spices***", Journal of Environmental Biology, 32(2), 251 (2011).

[25] I. M. Oudah and Y. H. Ali, "***Evaluation of Aqueous and Ethanolic Extraction for Coriander Seeds, Leaves and Stems and Studying their Antibacterial Activity***", Iraqi Scientific Journal of Nursing, 23(2), 1 (2010).

[26] N. M. Chaudhry and P. Tariq, "***Bactericidal Activity of Black Pepper, Bay Leaf, Aniseed and Coriander Against Oral Isolates***", Pakistan Journal of Pharmaceutical Sciences, 19(3), 214 (2006).

[27] O. S. Mahdi, "***Evaluation of Inhibitory Activity of Extracts of Apium gravelens, Coriandrum sativum and Cuminum cyminum Against Number of Pathogenic Bacteria***", Kufa Journal for Veterinary Medical Sciences, 2(2), 37 (2011).

[28] M. A. Ahmed, S. Ravi and P. Ghogare, "***Studies on Antimicrobial Activity of Spices and Effect of Temperature and Ph on Its Antimicrobial Properties***", Journal of Pharmacy and Biological Sciences, 10(1), 99 (2015).

[29] M. M. Ginovyan, "***Effect of Heat Treatment on Antimicrobial Activity of Crude Extracts of Some Armenian Herbs***", Chemistry and Biology, 51(2), 113 (2017).

[30] W. Shahid, R. Durrani, S. Iram, M. Durrani and F. A. Khan, "***Antibacterial Activity in Vitro of Medicinal Plants***", Sky Journal of Microbiology Research, 1(2), 5 (2013).

[31] V. Ratha bai and D. Kanimozhi, "***Evaluation of Anti-Microbial Activity of Coriandrum sativum***", International Journal of Scientific Research and Reviews, 1(3), 1 (2012).

[32] A. O. Bakhiet, S. D. Mohammed, S. M. A. El Badwi, W. S. Abdel Gadir, A-G. H. A. Alkhatim and S. E. I. Adam, "***Antimicrobial Activity of Petroselinum sativum and Coriandrum sativum Seeds***", Research Journal of Microbiology, 1(4), 346 (2006).

[33] P. K. Gayathri, J. Rithika and S. Dhanasree, "***Preliminary Phytochemical Analysis and Anti-microbial Evaluation of the Cilantro Extract***", Journal of Chemical and Pharmaceutical Sciences, 9(3), 1633 (2016).

[34] S. H. Sung, K. H. Kim, B. T. Jeon, S. H. Cheong, J. H. Park, D. H. Kim, H. J. Kweon and S. H. Moon, "***Antibacterial and Antioxidant Activities of Tannins Extracted from Agricultural by-Products***", Journal of Medicinal Plants Research, 6(15), 3072 (2012).

[35] R. Alghazeer, A. Elmansori, M. Sidati, F. Gammoudi, S. Azwai, H. Naas, A. Garbaj and I. Eldaghayes, "***In Vitro Antibacterial Activity of Flavonoid Extracts of Two Selected Libyan Algae Against Multi-Drug Resistant Bacteria Isolated from Food Products***", Journal of Biosciences and Medicines, 5(1), 26 (2017).

[36] S. Garba and S. O. Okeniyi, "***Antimicrobial Activities of Total Alkaloids Extracted from Some Nigerian Medicinal Plants***", Journal of Microbiology and Antimicrobials, 4(3), 60 (2012).

[37] R. Barbieri, E. Coppo, A. Marchese, M. Daglia, E. Sobarzo-Sánchez, S. F. Nabavi and S. M. Nabavi, "***Phytochemicals for Human Disease: An Update on Plant-Derived Compounds Antibacterial Activity***", Microbiological Research, 196, 44 (2017).