Evaluation of inhibitory activity of extracts of *Apium gravelens, Coriandrum sativum* and *Cuminum cyminum* against number of pathogenic bacteria

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Abstract:

Natural resources especially plants are useful bactericides for the control of bacterial infection .To evaluate the antibacterial potential of three types of plants, essential oils were extracted from the seeds of *Apium gravelens, Coriandrum sativum* and *Cuminum cyminum* and assayed in vitro for antibacterial activity aganist most prevalent pathogens *Staphylococcus aureus, Salmonella spp.,Escherishia coli* and *Pseudomonas aeruginosa* at 37 º C and 25 ºC.The antimicrobial effect was assessed using agar diffusion method by applying ethanolic solutions of extracts using it in two different temperatures 37 ºC and 25 ºC. The result shows that the extract of *Apium gravelens, Coriandrum sativum* and *Cuminum cyminum* alcoholic extract at 25 ºC exhibited an inhibition zone on *S. aureus* in the concentration 200 mg/ml and had a exhibited significantly ($p < 0.05$) greater than that produced by gentamicine,also the extract of *Apium gravelens* at 25 ºC in the concentration 100 mg/ml had a significant antibacterial activity on *S. aureus,* and the extract of *Apium gravelens* alcoholic extract at 25 ºC and 37 ºC pronounced antibacterial activity against *Pseudomonas aeruginosa* in the concentration 100 and 200 mg/ml respectively moreover the inhibition produced by gentamicine. While the antibacterial effect *Apium gravelens* and *Coriandrum sativum* at 37 ºC on *S. aureus* in the concentration 200 mg/ml show very similar effect with gentamicine. The antibacterial activity against *Salmonella spp*.and *E. coli* were moderate in action

It was found that the investigated extracts of *Apium gravelens , Coriandrum sativum* and *Cuminum cyminum* were exhibited a considerable inhibitory effect against *S. aureus* and extracts of *Apium gravelens* and *Coriandrum sativum* against *P. aerogene.* The significant antibacterial activity appears promising.

تقييم الفاعلية التثبيطية لخلاصات الكرفس والكزبرة والكمون ضد نمو عدد من الجراثيم المرضية

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الخلاصة:

المواد الطبيعية وبالأخص خلاصات النباتات تعتبر مصدر مهم لانتاج مواد مضادة للجراثيم للسيطرة على الإصابات الجرثومية.

صممت الدراسة الحالية لتحديد الفاعلية المضادة للجراثيم من المستخلصات الكحولية الايثانولية لبذور ثلاثة أنواع من النباتات وهي الكرفس والكزبرة والكمون في المختبر ضد أكثر أنواع الجراثيم شيوعا التي تصيب الإنسان والحيوانات الحقلية وهي المكورات العنقودية الذهبية وجرثومة السالمونيلا والاشريشيا القولونية والزائفة الزنجارية بدرجتي حرارة 25 ºم و 37 ºم بطريقة الانتشار بحفر الاكار،وضحت النتائج إن الخلاصات الكحولية لمستخلصات الكرفس والكزبرة والكمون عند درجة حرارة 25°م لها فاعلية تثبيطية لجرثومة المكورات العنقودية الذهبية بتركيز 200ملغم\مل وبفرق معنوي أعلى من المضاد الحيوي الجنامايسين عند مستوى احتمال 0.05 وكذلك بين مستخلص الكرفس عند حرارة 25º م تأثيراً مضادا لجرثومة المكورات العنقودية الذهبية عند تركيز 100 ملغم \مل وبفرق معنوي أعلى من المضاد الحيوي الجنتامايسين عند مستوى احتمال 0.05 ،كان لمستخلص الكحولي للكرفس عند درجة 25º م و37 ºم تأثيرا مثبطا ضد جرثومة الزائفة الزنجارية عند تراكيز 100 و200 ملغم\مل بزيادة عن التأثير التثبيطي للجنتمايسين ،بينما بينت النتائج ان تاثير مستخلص الكرفس والكزبرة عند حرارة 37 ºم على جرثومة المكورات العنقودية الذهبية عند تركيز 200 ملغم\مل كان مطابقا للتأثير التثبيطي للجنتامايسين.

أما تأثير المستخلصات على جراثيم السالمونيلا والاشريشيا القولونية فكان متوسط الفعالية .بينت نتائج الدراسة أن مستخلصات الكرفس والكزبرة والكمون ذات تأثير مثبط ضد جراثيم المكورات العنقودية الذهبية ولمستخلصي الكرفس والكزبرة فاعلية تثبيطية ضد جرثومة الزائفة الزنجارية.

Introduction:

In the past 60 years, antibiotics have been critical in the fight against infectious disease caused by bacteria and other microbes. Antimicrobial resistance is a worldwide growing-problem , isolation of microbial agents less susceptible to regular antibiotics and recovery of resistance regulate during antimicrobial therapy is increase throughout the world, part of the problem is due to increasing use, and misuse, of existing antibiotics in human and veterinary medicine(1,2).

natural resources especially plants are potent candidate for antimicrobial uses(3).

In order to determined the inhibitory effects of the *Apium gravelens,* *Coriandrum sativum* and *Cuminum cyminum* against the most prevalent pathogens this study performed ,using it in two different temperatures 37 ºC and 25 ºC .The microorganisms used in this study includes: *Staphylococcus aureus*, *Salmonella spp*.,*Escherishia coli* and *Pseudomonas aeruginosa.*

These are the most common causes of infections in human and animals *Staphylococcus* is that can cause a multitude of diseases, Skin infections, mastitis, pneumonia, Infection of the heart valves (endocarditis),(4) Staphylococcal food poisoning and many other diseases . The antibiotic-resistant infections are more common in such cases because of our overuse of antibiotics(5).

Escherichia coli bacteria, commonly called *E. coli* can cause food borne illness ,urinary-genital tract infections. Cattle are the main sources of *E. coli.* Recent reports have proposed that the use of tetracycline, sulfa drugs, cephalosporins and pencillin to be a major factor in the emergence and dissemination of antimicrobial-resistant *E. coli* (6).

Salmonella are gram-negative facultative intracellular anaerobes that cause a wide spectrum of disease. This spectrum can range from a gastroenteritis, enteric fever (caused by typhoid and paratyphoid serotypes), Eggs and poultry are the most common sources of infection.Ingestion of contaminated milk, milk products, beef, and dairy products are also common sources(7). *Salmonella* has a widespread distribution in the environment and certain host factors make humans particularly susceptible to infection. Its increasing antimicrobial resistance, prevalence, virulence, and adaptability are a challenge worldwide. Reservoirs of the bacteria include humans, poultry, swine, cattle, rodents, and pets(8). .Diseases such as otitis externa, urinary tract infections (UTIs), dermatitis, cellulitis, and osteomyelitis, are caused by *Pseudomonas aeruginosa* in human and animals(9). The pathogenesis of this organism is multifactorial and involves various toxins and proteases (eg, exotoxin A, lecithinase) and the glycocalyx "slime." *P aeruginosa* is both invasive and toxigenic,it has a wide range of antimicrobial resistance (10).

Apium is a strong-smelling, slender, erect biennial herb, up to 60cm tall, indigenous to Europe, the US, Asia and Africa. The volatile oil in Apium has been shown to have antifungal and antibacterial activity, and it is active against many bacteria including Staphylococcus aureus, Staphylococcus albus, Shigella dysenteriae, Salmonella typhi, Streptococcus faecalis, Streptococcus pyogenes and Pseudomonas(11).

The methanolic extract of *Apium graveolens* seeds was investigated for bioactive compounds and resulted of mosquitocidal, nematicidal, and antifungal compounds , it inhibited the growth of Candida albicans and Candida parapsilasis (12).

The cumin seed is widely used in cooking.Traditional uses of cumin include anti-inflammatory, diuretic, carminative, and antispasmodic. It has also been used as an aid for dyspepsia, jaundice, diarrhea, flatulence(13).

Coriandrum sativum (coriander) is considered both as an herb and a spice. Both its leaves and seeds are used as seasoning condiment. Coriander seeds have health supporting reputation that is high on the list of healing spices. It has traditionally been referred to as anti-inflammatory and antibacterial (14).

The present study was therefore conducted to evaluate the antibacterial potential of the *Apium gravelens, Coriandrum sativum* and *Cuminum cyminum* against four different isolates that includes *Staphylococcus aureus, Salmonella spp., Escherishia coli* and *Pseudomonas aeruginosa* These are the most common causes of infections in human and animals.

Materials and methods:

1.Plant samples and extraction procedure:

The plants used in the study were obtained from the local market in Al Diwaniya City ,and identified by the National Herbarium in Baghdad. These plants were cleand and ground to a powder,specimens of all the seeds of the plants were preserved and kept.

The fine powder of air dried specimens were extracted with Ethanol (95 %) for each plant specimen by taking (50 gm)of the powder, kept in a class container ,adding 500 ml of Ethanol (95 %) and mixed by hot plate magnetic stirror for 48 hours at room temperature , Further extraction of the residue was repeated until a clear supernatant liquid was obtained.The mixture concentrated by using the centrifuge 3000 cycle \minute for 15 minute. The extracts were sterilized by 0.22 µm Millipore filter. The solvent was dried and concentrated using vacuum rotary evaporator at 40°C, The evaporation was done until a solid state of extracted liquid was obtained. Extract from this method was then weighed and stored in closed container at 4 C until further use.

Different concentrations (25,50,100, 200 mg/ml) were prepared from these extracts by dissolving the dry extract in sterile distal water (W/V).

2.Microorganism

The study used four types of Bacteria includes: *Staphylococcus aureus*, *Salmonella spp.*,*Escherishia coli* and *Pseudomonas aeruginosa* obtained from department of Microbiology and the unit of zoonotic diseases in Vet. Med College , Al Qadysia University. This strain was checked for purity and identity(15), then kept in slant agar stock.

3.Antibacterial assay:

The antibacterial activity of the extracts was determined using the agar well diffusion method (16).By using Muller Hinton agar. The prepared culture media were inoculated with strain of bacteria, Multiple plates were done for each of the extract (three replications). Equidistant wells on the surface of the agar were done in the seeded plates. The wells were filled with 0.1mL of each the different extract concentration (25, 50, 100,200 mg/ml) as well as Ethanol in the central well.

The plates were then maintained at room temperature for 1h allowing for diffusion of the solution. All plates were then incubated at 37°c and at 25°**C** for 24 hours and the zones of inhibition were calculated by measuring the diameter of the inhibition zone around the well (in

mm) including the well diameter. The readings were taken in three different fixed directions and the average values were tabulated.

Results:

The inhibitory effects of the *Apium gravelens* alcoholic extract at 25 ºC on *Staphylococcus aureus* was 12.66±0.16 , 15.66±0.16 , 19.33±0.16,25.22±0.27(mm) concentration value in which it was (25,50,100,200 mg/ml) , The gentamicine diameters of inhibition zone was 17 ± 0 , ,fallowed by using the same extract on *Pseudomonas aeruginosa* at 25 ºC was 10 ±0.28, 12.66±0.16, 15.88±0.11, 20±0.33 (mm) .The gentamycine diameters of inhibition zone was 14±0 (mm).fallowed by the inhibitory effects of the same extract on *Escherishia coli* at 25 ºC was12 ±0, 13.88±0.11, 15.55±0.17, 18.55±0.17 (mm). The gentamicine diameters of inhibition zone was 19.88±0.11. the less effect was on *Salmonella* at 25 ºC it was 0 ±0, 8.55±0.17, 11.66±0.16, 15±0 (mm) .The gentamicine diameters of inhibition zone was17.3±0.17 on *Salmonella.*

The inhibitory effects of the *Apium gravelens* alcoholic extract at 37 ºC exhibited maximum activity on *P. aeruginosa* was12±0.28, 14.11 ±0.35, 15.44±0.29, 21±0 (mm) concentration value in which it was (25,50,100,200 mg/ml) respectively .The gentamycine diameters of inhibition zone was14±0, inhibitory effects of same extract on both *S. aureus* and *Escherishia coli* were close at 37 °**C** ,for *S. aureus* it was 9±0, 10.66±0.16, 13.77±0.22, 17.33±0.33(mm) for the gentamicine was17 ± 0 , and for *E. coli* was 9±0, 11.22±0.14, 14.55±0.17, 17.55±0.17 (mm) .for the gentamicine was 19.88±0.11(mm),and the less effect was on *Salmonella* 0±0, 9 ±0, 14.33±0.86, 11.33 ± 0 .86 (mm) concentration value in which it was (25,50,100,200 mg/ml) respectively, and the gentamicine zone of inhibition was17.3±0.17

The results of the inhibitory effects of the extract of *Coriandrum sativum* were measured at 25 ºC for all the four types of bacteria the most active inhibition was on *S. aureus* it was 10.33±0.16, 13.44±0.17, 17±0, 20±0(mm) concentration value in which it was (25,50,100,200 mg/ml) the gentamicine zone of inhibition was17±0.

Fallowed by the effect of the extract on *E. coli* 7.44±0.17, 8.77±0.14, 11.77±0.14, 13.44±0.17 (mm),the inhibition of gentamicine was 19.88±0.11(mm).fallowed by it is inhibitory effects on *Salmonella* 0±0, 0±0, 9.4±0.5, 13.11±0.33, the inhibition of gentamicine was 17.3±0.17(mm), and the minimum activity against *P. aeruginosa* 0±0, 0±0, 0±0, 8.77±0.14 and the inhibition of gentamicine was14±0.

The antibacterial activity of the extract of *Coriandrum sativum* was measured at 37 °**C** for all bacterial isolates,the result was similar of it is effect at 25 ºC in which it had a maximum effect on *S. aureus* 7.7±0.14, 8±0, 11.66±0.16,

17.33±0.33(mm) concentration value in which it was (25,50,100,200 mg/ml) the gentamicine zone of inhibition was17±0.while the antibacterial activity of the extract on *E. coli* was 7.22±0.14, 8.77±0.14, 11.66±0.16, 14.66±0.16(mm), the inhibition of gentamicine was 19.88±0.11,fallowed by it is effect on *Salmonella* 0±0, 0±0,7.88±0.33, 9.77±1.09, the inhibition of gentamicine was 17.3±0.17(mm) and the minimum activity against *P. aeruginosa* 0±0, 0±0,7.11±0.11, 8.22±0.14 and the inhibition of gentamicine was14±0. concentration value in which it was (25,50,100,200 mg/ml) for all the extracts .

The last extract of the *Cuminum cyminum* also measured at 25 ºC and 37 ºC.It antibacterial effect at 25 ºC most active inhibition was on *S. aureus* it was 9.4±0.17, 10±0, 16.55±0.29, 19.66±0.16 (mm) the gentamicine zone of inhibition was17±0.while the antibacterial activity of the extract on *E. coli* was 0±0, 0±0, 16.55±0.29 , 19.66±0.16 (mm), the inhibition of gentamicine was 19.88±0.11,the antibacterial activity against *P. aeruginosa* was 0±0, 0±0, 8.88±0.33 , 11.66±0.5 ,and the inhibition of gentamicine was14±0 . The minimum activity against *Salmonella* 0±0, 0±0, 7.66±0.5, 10.77±0.44 ,the inhibition of gentamicine was 17.3±0.17(mm). Concentration value in which it was (25,50,100,200 mg/ml) for all the extracts.

Finally the *Cuminum cyminum* extract antibacterial effect at 37 ºC most active inhibition was on *S. aureus* it was, 0±0, 8±0.28 , 10.33±0.16 , 12.66±0.33 (mm) the gentamicine zone of inhibition was17±0. the antibacterial activity of the extract on *E. coli* was 0±0, 0±0, 8.66±0.16, 12 ±0 (mm), the inhibition of gentamicine was 19.88±0.11,while the antibacterial activity of the extract on *Salmonella* 0±0, 0±0, 8.33±0.5 , 10 ±0 ,the inhibition of gentamicine was 17.3±0.17(mm). The minimum activity against *P. aeruginosa* was 0±0, 0±0, 7±0, 9.8 ±0.42 ,and the inhibition of gentamicine was14±0). Concentration value in which it was (25,50,100,200 mg/ml) for all the extracts.

The result shows that the extract of *Apium gravelens* alcoholic extract at 25 ºC on *S. aureus* it exhibited an inhibition zone in the concentration 100 and 200 mg/ml respectively moreover the inhibition than this produced by antibiotics,and there was a statistically significant difference between the effect of extracts and antibiotic ($P < 0.05$).

The extract of *Coriandrum sativum* and the *Cuminum cyminum* at 25 ºC on *S .aureus.* in the concentration 200 mg/ml show larger inhibition zone than this produced by antibiotic(gentamicine) and had a significant differences ($P < 0.05$) .

The extract of *Coriandrum sativum* and the *Cuminum cyminum* at 25 ºC on *S.pyogenes* in the concentration 100 mg/ml show close inhibition zone with this produced by

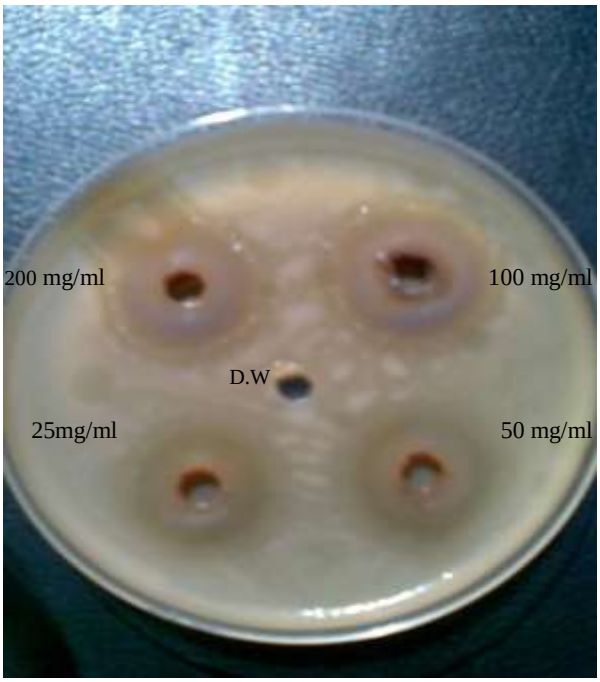
antibiotic(gentamycine) with a statistically no significant difference.

The extract of *Apium gravelens* and the *Coriandrum sativum* at 37 ºC on *S. aureus* in the concentration 200 mg/ml show close inhibition zone with this produced by gentamicine and the statistical analysis showed there's no significant differences between extract and antibiotic.

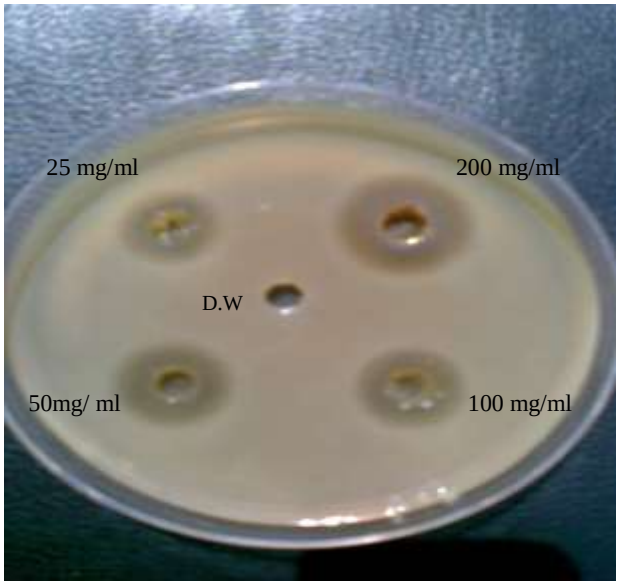
The antibacterial activity of the extracts on *E. coli* and *Salmonella* were moderate in action with a statistically no significant difference with this produced by gentamicine.

The antibacterial activity of the *Apium gravelens* alcoholic extract at 25 ºC and 37 ºC on *P. aeruginosa* exhibited an inhibition zone in the concentration 100 and 200 mg/ml respectively moreover the inhibition than this produced by gentamicine.

As illustrated in table 1,2,3 and 4 the effect of each extract was increased with high concentrations. The capital letters revel to the vertical statistical reading ,while the small letters revel to the horizontal statistical reading ,the similar letters indicate that no significant difference under ($P < 0.05$).



Picture (1). The antibacterial activity of alcoholic extracts of *Apium gravelens* , against the growth of *P. aeruginosa* at 37 ºC.



Picture (2). The antibacterial activity of alcoholic extracts of *Apium* against the growth of *S. aureus* at 37 ºC

Table 1: The antibacterial activity of alcoholic extracts of *Apium gravelens* ,*Coriandrum sativum* and *Cuminum cyminum* against the growth of *S. aureus* **.**Mean zone of inhibition ± Standard deviation

	Temp.	Con.25mg\ml	Con.50mg\ml	Con.100mg\ml	Con.200mg\ml	gentamicine
Apium gravelens	25ºC	12.66±0.16 Aa	15.66±0.16 Ab	19.33±0.16 Ac	25.22±0.27 Ad	17±0 Ae
	37ºC	9±0 Ba	10.66±0.16 Bb	13.77±0.22 Bc	17.33±0.33 Bd	17±0 Ad
Coriandrum sativum	25ºC	10.33±0.16 Ca	13.44±0.17 Cb	17±0 Cc	20±0 Cd	17±0 Ac
	37ºC	7.7±0.14 Da	8±0 Da	11.66±0.16 Db	17.33±0.33 Bc	17±0 Ac
Cuminum cyminum	25ºC	9.4±0.17 Ba	10±0 Ba	16.55±0.29 Cb	19.66±0.16 Cc	17±0 Ab
	37ºC	0±0 Ea	8±0.28 Db	10.33±0.16 Ec	12.66±0.33 Dd	17±0 AE

Table 2: The antibacterial activity of alcoholic extracts of *Apium gravelens* ,*Coriandrum sativum* and *Cuminum cyminum* against the growth of *E.coli* **.**Mean zone of inhibition ± Standard deviation

	Temp.	Con.25mg\ml	Con.50mg\ml	Con.100mg\ml	Con.200mg\ml	gentamicine
Apium gravelens	25ºC	12 ±0 Aa	13.88±0.11 Ab	15.55±0.17 Ac	18.55±0.17 Ad	19.88±0.11 Ad
	37ºC	9±0 Ba	11.22±0.14 Bb	14.55±0.17 Ac	17.55±0.17 Ad	19.88±0.11 Ae
Coriandrum sativum	25ºC	7.44±0.17 Ca	8.77±0.14 Ca	11.77±0.14 Bb	13.44±0.17 Cc	19.88±0.11 Ad
	37ºC	7.22±0.14 Ca	8.77±0.14 Ca	11.66±0.16 Bb	14.66±0.16 Cc	19.88±0.11 Ad
Cuminum cyminum	25ºC	0±0 Da	0±0 Da	8.33±0.16 Cb	12.33±0.16 Dc	19.88±0.11 Ad
	37ºC	0±0 Da	0±0 Da	8.66±0.16 Cb	12 ±0 Dc	19.88±0.11 Ad

Table 3: The antibacterial activity of alcoholic extracts of *Apium gravelens* ,*Coriandrum sativum* and *Cuminum cyminum* against the growth of *salmonella.* Mean zone of inhibition ± Standard deviation

	Temp.	Con.25mg\ml	Con.50mg\ml	Con.100mg\ml	Con.200mg\ml	gentamicine
Apium gravelens	25ºC	0 ±0 Aa	8.55±0.17 Ab	11.66±0.16 Ac	15±0 Ad	17.3±0.17 Ae
	37ºC	0±0 Aa	9 ±0 Ab	11.33±0.86 Ac	14.33±0.5 Ad	17.3±0.17 Ae
Coriandrum sativum	25ºC	0±0 Aa	0±0 Ba	9.4±0.5 Bb	13.11±0.33 Bc	17.3±0.17 Ad
	37ºC	0±0 Aa	0±0 Ba	7.88±0.33 Cb	9.77±1.09 Cc	17.3±0.17 Ad
Cuminum cyminum	25ºC	0±0 Aa	0±0 Ba	7.66±0.5 Cb	10.77±0.44 Cc	17.3±0.17 Ad
	37ºC	0±0 Aa	0±0 Ba	8.33±0.5 Cb	10 ±0 Cc	17.3±0.17 Ad

Table 4: The antibacterial activity of alcoholic extracts of *Apium gravelens* ,*Coriandrum sativum* and *Cuminum cyminum* against the growth of *P. aeruginosa.* Mean zone of inhibition ± Standard deviation

	Temp.	Con.25mg\ml	Con.50mg\ml	Con.100mg\ml	Con.200mg\ml	gentamicine
Apium gravelens	25ºC	10 ±0.28 Aa	12.66±0.16 Ab	15.88±0.11 Ac	20±0.33 Ad	14±0 Ae
	37ºC	12±0.28 Ba	14.11 ±0.35 Bb	15.44±0.29 Ac	21±0 Ad	14±0 Ab
Coriandrum sativum	25ºC	0±0 Ca	0±0 Ca	0±0 Ba	8.77±0.14 Bb	14±0 Ac
	37ºC	0±0 Ca	0±0 Ca	7.11±0.11 Cb	8.22±0.14 Bc	14±0 Ad
Cuminum cyminum	25ºC	0±0 Ca	0±0 Ca	8.88±0.33 Db	11.66±0.5 Cc	14±0 Ad
	37ºC	0±0 Ca	0±0 Ca	7±0 Cb	9.8 ±0.42 Bc	14±0 Ad

Discussion:

Apium graveolens is known as a mild diuretic and urinary antiseptic and has been used in the treatment of urinary calculi. also hypoglycemic, regulates blood pressure, reduces cholesterol and as such is helpful in diabetes; The volatile oil in Apium has been shown to have antifungal activity, and it is active against many bacteria(21).

The main constituents in the oil of *A. gravelens* were limonene, carvone and 3n-butylphthalide, Phthalides, Beta selinene, Giaveobisides and Fatty oil(22).

Furthermore the present study showed that *Apium graveolens* extracts were capable of inhibiting the growth microorganisms used in the study.

The results of the present study are similar to some workers have found that chemical composition of *A. gravelens* active against many bacteria including Staphylococcus aureus, taphylococcus albus, Shigella dysenteriae, Salmonella typhi, Streptococcus faecalis, Streptococcus pyogenes and Pseudomonas solanacearum(21).

The effect of the extract was increased with high concentrations indicating that increasing the active Chemical composition of Apium gravelens affecting the growth of the microorganisms.

Antimicrobial activity may be due to numerous free hydroxyls, limonene, Beta selinene and other compounds that have the capability to combine with the carbohydrates and proteins in the bacterial cell wall. They may get attached to enzyme sites rendering them inactive(23).

Chemical composition of seed essential oil of Coriandrum sativum contains 53 compounds where the major compounds are linalool (37.7%), geranyl acetate (17.6%)

and γ-terpinene (14.4%).(17).These compounds had an antibacterial activites (19).

The oil was dominated by aldehydes and alcohols which accounted for 56.1% and 46.3% of the oil, respectively.(18,20). These compounds are astringent that either bind and precipitate or shrink proteins and various other organic compounds including amino acids(24).

The results of the present study are similar to some workers have found that *C. sativum* has strong antibacterial activity against both G +ve and G –ve (19).Similarly, the compounds aliphatic 2E-alkenals and alkanals, isolated from *C. sativum* were found to possess bactericidal activity against *Salmonella choleraesuis* (20).

Essential oil of *Coriandrum sativum* was screened for antimicrobial activity against both Gram positive (*Staphylococcus aureus, Bacillus* spp.) and Gram negative (*Escherichia coli*, *Salmonella typhi*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Pseudomonas aeruginosae*) bacteria and a pathogenic fungus, *Candida albicans* (17).

Extracted oil of *Cuminum cyminum* contains a high percentage of triglycerides and a low percentage of free fatty acids. The fatty acid composition of oil showing higher contents of unsaturated acids (85%). Cumin oil and cuminaldehyde have been reported to exhibit strong larvicidal and antibacterial activity. At in vitro concentrations of 300 or 600 ppm, cumin oil inhibited the growth of Lactobacillus plantarum (27).

Seeds have cooling affect and therefore form an ingredient of most prescriptions for gonorhoea,(25). In the present study, the antibacterial activities of *Cuminum cyminum* were also evaluated. All tested isolates were found low antibacterial or resistant to *Cuminum cyminum* . These findings are in fair correlation with the study carried out by (26) who found that decoction of *C. sativum* does not have antibacterial potential against G +ve and G -ve bacteria.

Conclusions and Recommendations:

The present study has revealed the importance of natural products to control antibiotic resistant bacteria which are a threat to animal and human health and can serve as an important platform for the development of inexpensive, safe and effective medicines.

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