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Research Article

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Comparison of antibacterial activities of Coriander (*Coriandrum sativum*) and Mint spp. (*Mentha arvensis*) extracts against *Staphylococcus aureus*, *Escherichia coli* and *Salmonella enteritidis*

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Abstract Mint spp. (*Mentha arvensis)* and Coriander (*Coriandrum sativum*) leaves extracts comparison against *Staphylococcus aureus*, *Escherichia coli* and *Salmonella enteritidis*. Paper Disk Diffusion and Agar Well Diffusion were followed to compare zone of inhibition (mm) for coriander and mint leaves extracts against selected bacterial strains. Mint leaves extracts showed greater inhibition zone as compared to coriander leaves extracts. As average showed that mint extracts has excellent zone of inhibition 19.8mm and 18.9 mm against *Staphylococcus aureus* and *Salmonella enteritidis* respectively. While coriander leaves extracts is most inhibitory against *Escherichia coli*. It is concluded that Mint spp. (*Mentha arvensis)* extracts showed greater antibacterial activities having an average of 18.3 mm zone of inhibition and can be used as the best food preservatives, while Coriander (*Coriandrum sativum*) is a good aromatic plant with limited antibacterial activity with average of 17.5mm zone of inhibition.

Keywords Mint spp. and coriander leaves extracts; antibacterial activity .

Introduction

Microbial activities are the basic causes of foods spoilage that leads to loss of food quality and safety [1-2]. Food borne pathogens are widely present in nature having a major concern with increasing number of food borne outbreaks [2-4]. People from an ancient time preserved foods in different ways such as using high salt, high molasses system, acid, alcohol, smoking, underground storage and drying etc. In modern world food processing industries adopted different chemical preservatives against microorganisms, that increased the risk of toxic residues in food products that have adverse side effects (carcinogenic and teratogenic) on human and animals health. The effects of these chemically synthesized preservatives on human health have opened the eyes of authorities to search for alternative natural preservatives that are urgently needed to control food pathogens [2-3, 5].

Consumers and food industries avoid the consumption of such products having chemically synthetic preservatives, therefore it is needed to find out such preservatives which possess antimicrobial activities and could be used alternative to synthetic preservatives [6-7]. In the modern food industries more priority is given to natural preservatives over chemically synthetic preservatives [1] Coriander (*Coriandrum sativum*) is an annual herbaceous plant belongs to the family *Apiaceae.* It is cultivated all over the world, but its origin is the countries which are located at the shores of the Mediterranean and Central Asia [3]. It is an economically important annual plant and their functional properties and uses cannot be under estimated [8]. Coriander is widely used in a spice, folk medicine, drugs, perfumes, cosmetics, pharmacy and in food industries [9-10]. Due to these findings coriander (*Coriandrum sativum*) got researchers attention to explore new aspects of this important plant. The leaves stem and

fruits have very pleasant aromatic odour [11]. *Mentha* (mint) is a genus of about 25 species of flowering plants and belongs to *Lamiaceae* family. This commercially important aromatic plant has many uses such as in herbal teas, as additives in spices mixture, medicine and food products etc [5, 12-13]. Two important methods ager well diffusion and paper disk diffusion have been followed to determine the antibacterial activities by measuring inhibition zones [14-15].

Materials and Methods

Plant Samples Collections

In present study healthy, fresh and disease free Mint spp. (*Mentha arvensis*) and Coriander (*Coriander sativum*) were purchased in the month of November 2014, from local market of the Gulistan-e-Johar, Karachi, Pakistan. Plants sample were deposited and identified by Herbarium Department of Karachi University, Pakistan.

Plant Processing

Plant samples were washed with tap water for four times and removed all dust and soil particles, and finally washed with distilled water. Then leaves of both plants (Coriander and Mint) were plug off and made their small pieces with clean sterilized knife and kept them in tray dryer in open environment for drying. After seven days then homogenized fine powder were obtained (60-80 mesh by Meinzer II Sieve shaker), by using a commercial electric grinder (Model Number: WK-802). The powdered material was stored in air tight sterilized bottles in refrigerator at 4°C for further use.

Microorganisms and Selective Media

For *Staphylococcus aureus* ATCC 25923 we used, Baird Parker. For *Escherichia coli* ATCC 25922, *Eosin methylene blue agar* (EMB) and for *Salmonella enteritidis* ATCC 14028 Xylose *lysine deoxycholate agar* (XLD) were used. Each strain was cultured and tested for inhibition zone. Bacterial strains were provided by the Food Microbiology laboratory of Karachi University and commercial food laboratory SGS, Karachi. Stock cultures were grown and preserved on specific media.

Plants extraction

Known amount of 30 gm powder of each plants sample was Soxhlet extracted with different solvents like, ethanol, methanol and ethyl acetate (300 ml) [16-17] each, provided by Microbiology Department University of Sindh Jamshoro, Hyderabad, Pakistan. Extraction was done with Soxhlet apparatus (PP 25-1287) Pt. Panairsan Pratama Brand. The final extracts were transferred to glass dishes and were left at 40°C for 24 hrs. Finally these extractions were left at 4°C for further usage.

Paper Disk Diffusion Method

Paper disk diffusion method was employed to determine antibacterial activity of Mint and Coriander extracts, in term of inhibition zone. 100 µl of known bacterial suspension (10^7-10^8 cfu/ml) was cultured in 90 mm Petri dishes surface having selective media. Subsequently all extracts were tested using (6 mm diameter) sterilized filter paper disks, impregnated in different concentration of 5 µl, 10 µl, 15 µl and 20 µl of extraction with ethanol, methanol and ethyl acetate [18].

Agar Well Diffusion Method

100 µl of known bacterial suspension (10^7-10^8 cfu/ml) was cultured in 90 mm Petri dishes having selective media. Five wells of 4 mm diameter at equal distance were punched using sterile cork borer and sealing was done with 50 µl molten agar [16] 5 µl, 10 µl, 15 µl and 20 µl plant extracts with ethanol, methanol and ethyl acetate were added to the wells respectively with the help of micropipette (Biotech) [19].

Incubation

Paper Disk plates and well plates were incubated aerobically at 37 °C for 24 hrs. As a positive references control, Gentamycin (10 µg per disk) was used in disk method, while Acetic acid was used in well method. As a negative control, 10 µl distilled water per well were used in well method, while 6 mm sterilized filter paper disk was used in disk method [3].

Results and Discussion

300 µl extracts of each coriander and mint have been tested against selected bacterial strains in 36 plates. Plates were examined for inhibition zone. Among 36 plates 18 were used in coriander and 18 were in mint experiment. Results were expressed on average bases in term of measuring inhibitory zone in millimeter. In a single plate 5µl, 10µl, 15µl, 20µl of each extract (Ethanol, Methanol and Ethyl Acetate) were tested. The average results of 18 plates of both plants extracts showed, that mint leaves extracts showed greater inhibition zone as compared to coriander leaves extract (Shan *et al*., 2007). As average results mentioned in table 1.C showed that mint extracts has excellent zone of inhibition 19.8 mm and 18.9 mm against *Staphylococcus aurous* [20-21] and *Salmonella enteritidis* respectively [14, 22]. While coriander leaves extracts is most inhibitory against *Escherichia coli*. For detail study table 1 A and B are given below.

This study appears to be the first one where disk diffusion and agar diffusion method were used side by side to study the antibacterial activities of two important traditionally used plants (Coriander and Mint) [15].

Microbial activities are the primary mode of deterioration of foods during its processing and storage and are associated with these affections after contributed for the loss of food quality and safety [1]. This research work comes at the time when plant based preservatives were the popular demand of consumers and food industries. Therefore different authorities like food processors, food safety researchers and other regulatory agencies have been strongly concerned in different ways with the increasing number of food borne diseases outbreaks day by bay which is caused by some harmful pathogenic bacteria. Our present study work showed that mint has excellent zone of inhibition as compared to coriander leaves extracts against *Staphylococcus aureus* [23] and *Salmonella enteritidis*. Furthermore coriander leaves extracts showed most inhibitory effects against *Escherichia coli* [24].

Table 1. A Coriander (*Coriandrum sativum*) leaves extracts inhibition zone in mm

	Paper Disk Diffusion Method																							
	Ethanol				Methanol				Ethyl Acetate				Ethanol				Methanol				Ethyl Acetate			
Vol	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl
S*a*	6.0	8.2	10.7	13.6	6.2	7.3	9.2	10.5	6.1	7.3	8.2	9.8	19.6	25.7	31.3	37.4	18.7	24.4	32.6	36.9	16.6	19.2	23.6	26.4
E.c	6.8	9.8	13.3	18.3	7.0	8.1	11.6	19.7	6.9	10.8	11.4	15.1	18.8	24.1	30.1	35.5	19.3	24.8	29.6	35.4	16.7	20.3	25.1	26.8
S.e	6.3	7.3	8.5	10.3	6.0	7.2	8.4	10.2	6.2	8.4	9.7	10.8	19.3	24.5	29.8	36.2	17.2	23.2	29.8	35.1	16.2	19.0	23.9	26.0

Table 1. B Mint (*Mentha arvensis*) leaves extracts inhibition zone in mm

	Paper Disk Diffusion Method																							
	Ethanol				Methanol				Ethyl Acetate				Ethanol				Methanol				Ethyl Acetate			
Vol	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl	5 µl	10 µl	15 µl	20 µl
S*a*	7.9	11.2	16.2	22.7	8.5	16.4	22.3	28.3	6.7	8.6	9.2	12	12.3	18.2	26.1	35.3	18.6	27.7	35.5	43.2	11.6	18.7	25.9	31.3
E.c	7.2	12.5	17.8	20.3	6.6	13.3	19.2	21.6	6.4	6.8	7.4	8.5	9.6	13.1	17.3	26.6	17.4	23.2	30.6	36	9.1	12.7	19.2	27.4
S.e	8.9	13.7	21.4	27.4	8.8	14.5	24.6	29.7	6.2	7.4	8.8	9.8	10.4	16	23.4	32.4	18.8	25.5	32.6	39.3	9.9	15.3	21	28.1

Table: 1.C

	Leaves extracts Inhibition zone in mm	
	Coriandrum sativum	*Mentha arvensis*
S*a*	17.3	19.8
E.c	18.6	16.2
S.e	16.6	18.9
Total (zone of inhibitions) Average	17.5	18.3

Vol: Volume

Sa: *Staphylococcus aureus* (ATCC 25923), E.c: *Escherichia coli* (ATCC 25922), S.e: *Salmonella enteritidis* (ATCC 14028)

Each extract of volume, 5µl, 10µl, 15µl, 20µl /plate

Paper Disk size 6 mm

Well is of 4 mm size

Well Diffusion Method: Acetic acid: +ve control, Distilled water: -ve Control

Paper Disk Diffusion Method: Gentamycin: +ve control, Sterilizes Paper Disk: -ve Control

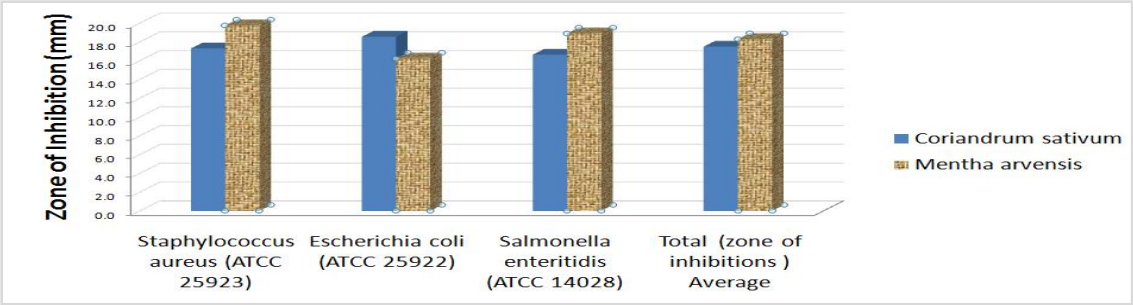

Figure 1: Anti bacterial activities comparison of Mint (Mentha arvensis) and Coriander (Coriandrum sativum) Leaves Extracts in term of Average Zone of Inhibition

Conclusion

It is concluded from the present study that Mint spp. (*Mentha arvensis)* extracts shows greater antibacterial activities having average of 18.3mm zone of inhibition and can be used as the best food preservatives, while Coriander (*Coriandrum sativum*) is a good aromatic plant with limited antibacterial activity with average of 17.5 mm zone of inhibition.

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