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To Study Antibacterial Activity of *Allium Sativum*, *Zingiber Officinale* and *Allium Cepa* by Kirby-Bauer Method

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Abstract: *Allium sativum, Zingiber officinale and Allium cepa are often used in different systems of medicines like ayurveda and Unani. All these three plants contain chemicals which can inhibit the growth of microbes. These chemicals actually bear properties which make them suitable to be utilized in different medicines. In the present investigation, the effectiveness of chloroform, ethanol and aqueous extracts of A. sativum, Z. officinale and A. cepa was detected against Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Proteus mirabilis and Salmonella spp. along with a comparison with an antibiotic, streptomycin. The method adopted in the present study was the Kirby-Bauer method. The maximum antimicrobial activity was exhibited by chloroform extract of A. sativum i.e.24mm against E.coli whereas the minimum antimicrobial activity was exhibited by aqueous extract of A. cepa 05mm against Enterococcus faecalis.*

Keywords*: Allium sativum, Zingiber officinale, Allium cepa, Antibacterial activity, Kirby- Bauer.*

I. Introduction

Garlic (Hindi-Lahsun)**,** botanical name "*Allium sativum*" is an economically important plant. It belongs to the family Liliaceae. The bulbs of Garlic are used as condiments. The juice extracted from garlic bulbs is also medicinally very useful has been described by Agarwal [1], 1999. Ginger (Hindi- Adrak), botanical name "*Zingiber officinale*" belongs to the family Zingiberaceae. Ginger is native of South East Asia, which has been used for long in India and China. Ginger cultivation is done mainly in the states of Kerala, Bengal, Maharashtra, Himachal pradesh, Madhya Pradesh and Uttar Pradesh of India. Ginger is perennial herb which grown in moist places by rhizome. Rhizome is of economic importance in which starch, gum, oleoresin and essential oil is found, was stated by Agarwal[1], 1999. Ginger is also a stimulant. Ginger is crushed to yield a juice which when mixed with honey is used for the treatment of colic pain or diarrhea, as medicine. Onion (Hindi-Piyaz) botanical name : "*Allium cepa*" belongs to the family liliaceae or Alliaceae. Oil can be extracted from onion bulbs was reported by Agarwal[1]), 1999. The Onion bulb paste and oil are mixed and applied on injured body parts which provide relief from inflammation. Onion has stimulant, diuretic and expectorant properties. Hence it is also used as medicine. The above information gives a clear view of medicinal values of *A. sativum, Z. officinale* and *A. cepa*. Kartal[10] *et al*., 2003 studied *In vitro* antibacterial, antifungal and antioxidant activity of the essential oil and methanol extract of herbal part and callus culture of *Satureja hortensis.* Antimicrobial activity of essential oil and other plant extracts was investigated by Hammer[8] *et al*. 1999. Antimicrobial activity of some important medicinal plant against plant and human pathogen was determined by Malesh[12] and Satish,2008. In 1985, Ramesh[17] *et al*., established that in modern age most of the medicinal therapies involve use of plant extracts. However, it has been studied by Elsamma Thomas[7] *et al*., 1999 that majority of angiospermic plants, are rich in chemicals which can be used in treating diseases like diarrhea, dysentery, skin infections, colic disorders, rheumatoid, arthritis etc. In addition to this Muraganandam[14] *et al*., 2000 isolated an oil from the leaves of *Wrightia tinctoria*, which with coconut oil base are used for the treatment of psoriasis. Bibita[5] *et al*.,2002 investigated on antibacterial activity of different plant extracts. Antimicrobial Activity of some medicinal plants against *Candida albicans* was studied by Hassawi[9] and Kharma, 2006. Kelmanson[11] and Staden, 2000 detected certain medicinal plants with antimicrobial activity. Mohan[13] *et al*., 2009 determined antimicrobial activity of selected Indian medicinal plants. *In vitro* antifungal activity of methanol extracts of some Indian medicinal against pathogenic yeasts and molds was investigated by Parekh[16] and Chanda 2008. Antibacterial and anticandidal efficacy of aqueous and alcoholic extracts of Neem (*Azadirachta indica*) was described by Nayak[15] *et al*., 2011. Antimicrobial activity and phytochemical analysis of selected Indian folk medicinal plants was studied by Shihabudeen[18] *et.al.*, 2010.

The above evidences prove that plants are rich in various useful chemicals which can be utilized for treatment of different human diseases. Keeping the above evidences into consideration the present investigation was undertaken to assess the effectiveness of *A. sativum, Z. officinale* and *A. cepa* extracts on *Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Proteus mirabilis* and *Salmonella spp.* Anbuganapathi[3] *et al*., 2000 used the Kirby-Bauer method to show the

antibacterial and antifungal effect of the leaves of *Wrightia tinctoria*. The Kirby-Bauer [4] method used in the present study involves the principle of diffusion; hence it is also referred to as disc diffusion method (Ananthanarayana[2]), 1997. Kirby-Bauer method has also been described by Dubey[6] and Maheswari, 2002.

II. Materials And Methods

2.1 Extract preparation:

The fresh plant parts of *A. sativum, Z. officinale* and *A. cepa* were subjected to prepare chloroform, ethanol and aqueous extracts. For this purpose, the plant parts were washed and chopped into small pieces. Then 10g of the material was crushed thoroughly in a blender with 100 ml of extraction solvent (i.e. chloroform, ethanol or distilled water). Chloroform, ethanol and aqueous extracts of *A. sativum, Z. officinale* and *A. cepa* were extracted in a similar manner as described above. In the above prepared extracts filter paper discs were immersed, which were removed after 10 minutes and dried.

2.2 Procedure:

Nutrient agar medium was prepared and autoclaved at standard temperature of 121^0 C, pressure of 15 psi (pounds per square inch) for a time period of 15 minutes. The autoclaved medium was aseptically transferred into pre sterilized Petri plates which are allowed to cool for solidification of medium. Now in aseptic conditions, on the solid agar surface, culture of *Escherichia coli, Klebsiella pneumoniae., Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Proteus mirabilis* and *Salmonella spp.* was inoculated by spread plate method in different Petri plates respectively. Thereafter, under aseptic conditions, saturated filter paper discs were placed on the inoculated solid agar surface. Similarly, commercially available streptomycin (10mcg) antibiotic discs were placed aseptically on the inoculated solid agar surface. The Petri plates were finally marked accordingly and incubated at 37^0 C for 48 hours.

III. Results And Discussion

The results obtained after incubation clearly exhibit that chloroform extracts of *A. sativum, Z. officinale* and *A. cepa* developed a maximum zone of inhibition i.e. 24mm for *E.coli*, 22mm for *Staphylococcus aureus* and 16 mm for *Klebsiella pneumoniae* (TABLE 1.), whereas the ethanol extracts of *A. sativum, Z. officinale* and *A. cepa* developed maximum zone of inhibition i.e. 23mm for *Klebsiella pneumoniae*, 18mm for *S. aureus* and 16mm for *E.coli* (TABLE 2.) and aqueous extracts of *A. sativum, Z. officinale* and *A. cepa* developed maximum zone of inhibition i.e. 20mm for *Enterococcus faecalis.*, 19mm *Pseudomonas aeruginosa* and 13mm for *E. coli* (TABLE 3.). The zone of inhibition with Streptomycin antibiotic discs was obtained to be 25mm ±2.

Table-1. Showing inhibition zone diameter in mm. with Chloroform extract.

Name of culture	Inhibition zone diameter in mm		
	Chloroform extract		
	A. sativum	*Z. officinale*	*A. cepa*
Escherichia coli	24	13	14
Klebsiella pneumoniae	21	16	16
Pseudomonas aeruginosa	12	10	09
Staphylococcus aureus	15	22	14
Enterococcus faecalis.	10	08	07
Proteus mirabilis.	11	15	13
Salmonella spp.	12	10	11

Table-2. Showing inhibition zone diameter in mm. with Ethanol extract.

Name of culture	Inhibition zone diameter in mm		
	Ethanol extract		
	A. sativum	*Z. officinale*	*A. cepa*
Escherichia coli	22	17	16
Klebsiella pneumoniae	23	16	15
Pseudomonas aeruginosa	12	10	09
Staphylococcus aureus	15	18	14
Enterococcus faecalis	10	08	07
Proteus mirabilis	11	15	13
Salmonella spp.	13	14	10

Table-3. Showing inhibition zone diameter in mm. with Aqueous extract.

Name of culture	Inhibition zone diameter in mm		
	Aqueous extract		
	A. sativum	*Z. officinale*	*A. cepa*
Escherichia coli	17	14	13
Klebsiella pneumoniae	18	16	11
Pseudomonas aeruginosa	15	19	10
Staphylococcus aureus	19	10	08
Enterococcus faecalis	20	06	05
Proteus mirabilis	12	13	10
Salmonella spp.	10	13	09

IV. Conclusion

The present investigation depicts that the chloroform extract of *A. sativum* is more effective compared to ethanol and aqueous extracts of plants parts used in the present study. The antimicrobial activity of these plant parts indicates there suitability for being used as important composition of certain medicines.

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