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Research Article

Comparative Study of *Allium Cepa, Zingiber Officinale And Allium Sativum* for Its Antimicrobial Property

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ABSTRACT

Antibiotic resistant bacteria are one of the major problems challenging the health care system in general. The antibacterial activity of fresh red and white *Allium cepa* (Onion) and *Zingiber officinale* (Ginger), garlic (*Allium Sativum)* juices against multidrug resistant bacteria viz: *Pseudomonas aeruginosa, Staphylococcus aureus, Salmonella typhi, Aerobacter aerogenes, Proteus vulgaricus* pure cultures were investigated using agar well diffusion and agar dilution methods. All the bacteria were susceptible to the fresh garlic and white onion juice with the diameter of zones of inhibition ranging from 1.3cm-5.5cm while the test bacteria were not sensitive to the fresh ginger juice. The Minimum Inhibitory Concentration (M. I. C.) of garlic were low in ranging from 1.125 – 25 %v/v and that of white onion was 2.125- 50%v/v. This study indicates that the fresh juices of white onion (*Allium cepa)* and garlic possess significant antibacterial potency against multidrug resistant bacteria.

Key-words: susceptibility , antibiotic, *allium cepa* , *zingiber officinale*.

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INTRODUCTION

It is believed that the history of herbal medicine began with the earliest man. The first written herbal record was in 2800BC and herbal medicine is practised today in countries
around the world . Some of the advantages of herbs over the formulated drugs are that they typically have fewer side effects and may be less safe to use over time; they are
inexpensive compared to formulated drugs and they are readily available[3]. The expanding bacterial resistance to antibiotics has become a growing concern worldwide. Intensive care physicians consider antibiotic-resistant bacteria a significant or major problem in the treatment of patients. Increasing bacterial resistance is prompting resurgence in research of the antimicrobial role of herbs against resistant strains. A vast number of medicinal plants have been recognized as valuable resources of natural antimicrobial compounds

Garlic (Allium sativum) and onion (Allium cepa) are two food ingredients widely used in our gastronomy. Moreover, garlic and onion extracts have been recently reported to be effective in cardiovascular disease, because of their hypocholesterolemic, hypolipidemic, anti-hypertensive, anti-diabetic, antithrombotic and anti-hyperhomocysteinemia effects, and to possess many other biological activities including antimicrobial, antioxidant, anticarcinogenic, antimutagenic, antiasthmatic, immunomodulatory and prebiotic activities[10].

Ginger is the rhizome of the plant *Zingiber officinale* which belongs to the family Zingiberaceae. Ginger is cultivated in India, China, Japan, Indonesia, Australia (Queensland); Sierra Leone, Nigeria; Jamaica and other West Indies islands[3]. Ginger contains a number of coactive constituents, which per se might be potentially useful in the treatment of various diseases including hypercholesterolemia, gastric ulcer, irritable bowel syndrome, pain, cancer, microbial infections or cardiovascular diseases[6].

At the present time, the Allium family has over 500 members, each differing in appearance, color and taste, but close in biochemical, phytochemical and neutraceutical content. Alliums were revered to possess antibacterial and antifungal activities, and contain the powerful sulfur and other numerous phenolic compounds which arouse great interest. Onions and garlic are composed mainly of water (85–90 g/100 g and 60–70 g/100 g fresh weight, respectively) and the most significant components, medicinally, are the organo sulfur-containing compounds. However, garlic contains nearly three times as much sulfur-containing compound as onions (11–35 mg/100 g fresh weight) [11].

The antibacterial properties of crushed garlic have been known for a long time. Various garlic preparations have been shown to exhibit a wide spectrum of antibacterial activity against Gram-negative and Gram-positive bacteria [15]. Therapeutic effect of garlic is possible because of its oil- and water-soluble organo sulfur compounds, which are responsible for the typical odor and flavor of garlic. Thiosulfinates play an important role in the antibiotic activity of garlic [17].

The present investigation aimed for comparative studies of in vitro antibacterial activity of garlic, onion and ginger on various pathogens which are responsible for harmful diseases, with a view of finding alternative means of treating infections caused by them.

MATERIALS:

Plant material collection (Ginger,Garlic ,onion)

The Allium cepa (red and white onion), Zingiber officinale (ginger), Allium sativum (garlic) were collected from local market Aurangabad, Maharashtra India in the month of Dec 2012.

Procurement of chemicals

All the chemicals used for experimental purpose were of laboratory grade obtained from
Hi- media laboratories Ltd, Mumbai, India.

Procurement of the organism.

The pure culture of *Pseudomonas aeruginosa, Staphylococcus aureus, Salmonella typhi , Aerobacter aerogenus, Proteus vulgaris* were procured from National chemical laboratories, Pune, India.

Extraction of plant materials

a) Extraction of Allium cepa(onion)

The onion bulbs were washed with sterile distilled water repeatedly. The outer covering of the bulbs was manually peeled off and fleshy part was re-washed with sterile distilled water .Exactly red and white onion bulb were blended separately and 25 gm of paste of each type was pressed using muslin cloth. The fresh onion juice was immediately analyzed for its antibacterial activity.

b) Extraction of Zingiber officinale (Ginger)

Fresh ginger rhizomes were thoroughly washed sterile distilled water .They were cut into pieces to allow easy blending. Exactly 25 gm of the blended ginger was pressed to form juice. The fresh juice was immediately analyzed for its antibacterial activity.

c) Extraction of Allium sativum (garlic)

Fresh garlic were thoroughly washed with sterile distilled water .They were cut into piece to allow easy blending .Exactly 25 gm of the blended garlic was pressed using muslin cloth to form juice. The fresh garlic juice was immediately analyzed for its antibacterial activity .

Antibiotic sensitivity testing of test organisms using disc diffusion method.

The test organisms were tested for their sensitivity against antibiotics (Penicillin, Streptomycin, Tetracycline, Gentamycin) using disc diffusion methods. The culture were enriched in sterile nutrient broth for 24hrs at 37^0c .Each culture was spread on the surface of the sterile nutrient agar plates .The antibiotic discs were aseptically placed over the seeded nutrient agar plates . The plates were incubated at 37^0c for 24 hrs. The diameter of the zone of inhibition was measured in cm. Interpretation of the isolates as sensitive or resistance was based on zone of inhibition.

Antibacterial analysis of extracts.

The molten sterile soft agar (10ml) was inoculated with 0.1ml of the inoculums and was poured on hard agar plates and allowed to set. Well of 1 cm diameter using a sterile gel plunger were prepared in the plate.0.1ml of sample extract (garlic, ginger, onion) was added to wells in each plate. The plates were incubated in an upright position at 37^0c for24 hrs. The diameter of inhibition zone was measured in cm and the results were recorded .The above method was carried out in triplicates and the mean of the triplicate results were taken.

Determination of M.I.C of extracts.

The M.I.C of the fresh onion, garlic and ginger juice against the test bacteria was determined using the broth dilution method. One (1.0) ml of the juice was added to 1 ml of nutrient broth and subsequently transferred. One (1.0) ml from the first test tube to the next, for up to the seventh test tube. Then 1 ml of standardized 18 h broth culture of test organism (1.0 x 106 cfu/ml) was inoculated into each test tube and thoroughly mixed on a vortex mixer. The test tubes were then incubated at 37°C for 24 h. The tube with the lowest dilution with no detectable growth was considered as the M.I.C.

RESULTS

Table I: Antibiotic sensitivity pattern of the test organisms

Sr.	Antibiotics	Ps.aerogenosa	A.aerogenus	P.vulgaricus	S.typhi	*Staph.aureus*
1	PEN (10 µg)	S	S	S	S	R
2	STR (200µg)	R	S	R	R	R
3	GTC (10 µg)	S	R	R	R	S
4	TET (30 µg)	R	R	S	R	R

Key: PEN – Penicillin, STR- Streptomycin, GTC- Gentamycin, TET- Tetracycline, R-resistant, S- sensitive.

Table II: Susceptibility of the test bacteria isolates to plants juices

Test bacteria	**Zone of Inhibition (cm)**			
	White onion	**Red onion**	**Ginger**	**Garlic**
Ps. aerogenosa	1.5	NI	NI	4.1
A.aerogenus	1.7	NI	NI	5.3
P.vulgaricus	1.5	NI	NI	3.3
S.typhi	1.7	NI	NI	4.5
Staph. Aureus	1.3	NI	NI	3.5

Key: NI- no inhibition

From the diameter of zone of inhibition of white onion and garlic extracts we can say that garlic shows maximum antimicrobial activity against the test organisms.

Table III: The Minimum Inhibitory Concentration (M.I.C.) of the plant juices.

Test bacteria	**White onion**	**Red onion**	**Garlic**	**Ginger**
	M.I.C %v/v			
Ps. aerogenosa	2.125	NA	1.125	NA
A.aerogenus	3.125	NA	2.25	NA
P.vulgaricus	6.25	NA	3.25	NA
S.typhi	3.125	NA	1.125	NA
Staph. aureus	50	NA	25	NA

DISCUSSION :

The antibacterial activity of onion juice can be attributed to the presence of flavonoids and polyphenols which has been reported to have broad spectrum of antibacterial activity (Hendrich AB).Polyphenols from plants have been reported to have antibacterial activity (Ani V *et.al.*) .The susceptibility of the test multidrug resistant bacteria especially *Pseudomonas aeruginosa* and *Salmonella typhi,A.aerogenosa, P.vulgaricus, S.typhi, Staph. aureus* to the white onion juice and garlic is encouraging because of the health crisis caused by these organisms all over the world. Some of the advantages that herbal preparations have over the synthetic ones are that they do not act directly on bacteria but create an adverse environment for them, thus threatening their survival and they have also been found to deter the development of resistant strains of microorganisms (Adeshina GO *et.al.)*. The reason for the ineffectiveness of raw ginger juice against the test bacteria is not known. The result obtained from the antibacterial activity of ginger against the test bacteria strains is contrary to those of Chrubasik *et al.,* and Chandarama *et al.,* who reported that ginger as an antibacterial activity and G.O. Adeshina *et.al* reported red onion showed antibacterial activity against these bacteria.

CONCLUSION

Allium cepa L. (white onion) and *Allium sativum* (garlic) showed antibacterial activity against multidrug resistant *Pseudomonas aeruginosa* and *Salmonella typhi, A.aerogenosa, P.vulgaricus, S.typhi, Staph. aureus* while *Zingiber officinale* (ginger) did not show antibacterial activity against the organisms. White onion showed more antibacterial activity than red onion against the organisms. This study indicates that *Allium sativum* (garlic) posses significant antibacterial potency against the test pathogenic organisms as compared to *allium cepa* and *zingiber officinale*. Therefore it has great potentials for the development of antimicrobial drugs especially for the treatment bacterial infections.

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