

Antibacterial Activity of *Carica papaya* Leaves and *Allium sativum* Cloves Alone and in Combination against Multiple Strains

Srividya Lonkala *, A. Rama Narsimha Reddy

ABSTRACT

Aim: Screening of natural extracts is a focused intensive study that aims to find active principles sorted from plant resources both safe and environmental friendly. The present study was aimed to evaluate the antibacterial activity of direct crude extracts of *Carica papaya* leaves and *Allium sativum* cloves alone and in combination against multiple drug resistant strains.

Methods: Two Gram positive (*Staphylococcus aureus* and *Bacillus cereus*) and three strains of Gram negative (*Escherichia coli*, *Salmonella typhi* and *Pseudomonas aeruginosa*) bacteria were used to evaluate the antibacterial activity of *Carica papaya* leaves and *Allium sativum* using Agar Disk Diffusion Method. **Results:** The results of this study showed that both extracts showed moderate antibacterial activity against the test bacterial strains and the potency of the extracts was increased when these two extracts were combined. **Conclusion:** These extracts directly can be used as natural alternative preventives to control various food poisoning diseases and preserve food stuff avoiding healthy hazards of chemically antimicrobial agent applications.

Key words: *Carica papaya* leaves, *Allium sativum* cloves, crude extract, Antibacterial activity, *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa*.

INTRODUCTION

Medicinal plants have become the focus of intense study for potential pharmacological effects. Indeed, the search for new pharmacologically active agents, through the screening of natural sources and plant extracts, has led to the discovery of many clinically useful therapeutic agents that play vital role in the treatment of human diseases.^{1,2} Present day 80 % of individuals from developed countries use traditional medicine, which has compound derived from medicinal plants. Natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for new drug lead molecules due to diverse availability of chemical constituents.³ Garlic (*Allium sativum*, Liliaceae)⁴ and Papaya (*Carica papaya*, Caricaceae)⁵ has been known for their traditional dietary and medicinal applications as an anti infective agents.

Carica papaya has been used as remedy against a variety of diseases. *Carica papaya* is a nutraceutical plant having a wide range of pharmacological activities. The whole plant has its own medicinal value. Papaya is a powerhouse of nutrients and is available throughout the year. It is a rich source of three powerful antioxidant vitamin C, vitamin A and vitamin E; the minerals, magnesium and potassium; the B vitamin pantothenic acid and folate and fiber.⁶ Leaves have been poulticed

into nervous pains, elephantoid growths.⁷ Papaya leaves are made into tea as a treatment for malaria. Antimalarial and antiplasmodial activity has been noted in some preparations of the plant, the leaves of the papaya plants contain chemical compounds of karpain, Substance which kills microorganisms that often interfere with the digestive function.⁸ Papaya leaf extracts have phenolic compounds, such as protocatechuic acid, p-coumaric acid, 5, 7-dimethoxycoumarin, caffeic acid, kaempferol, quercetin, chlorogenic acid.⁹ Antifertility, Antihelminthic and anti-inflammatory activity have also been reported.¹⁰ Papaya leaf has a numberless of benefits and has potential of increasing levels of thrombocytes, leucocytes useful in treating dengue fever. It is found to contain hepatoprotective, gastroprotective activity and boosts up the production of key signaling molecules called Th1-type cytokines for immune protective activity.¹¹

Garlic (*Allium sativum*) is a popular vegetable with a variety of medicinal properties. Garlic bulbs are edible, inexpensive and are readily available traditional dietary and medicinal agent¹² possesses anti-infective activity.¹³ The fresh and freeze-dried garlic extracts were tested against many bacteria,¹⁴⁻¹⁵ fungi,¹⁶ candida¹⁷ and viruses.¹⁸ The Garlic Porridge is a kind of herbal diet which lowering blood pres-

Srividya Lonkala *, A. Rama Narsimha Reddy

Department of Pharmaceutical Sciences, Beside LMD Police Station, Thimmapur, Karimnagar-505481, Telangana, INDIA.

Correspondence

Dr. Srividya Lonkala, M. Pharm., Ph.D

Associate Professor and HOD, Department of Pharma Analysis & Quality Assurance, Jyothishmathi Institute of Pharmaceutical Sciences, Beside LMD Police Station, Thimmapur, Karimnagar, Telangana, INDIA.

Phone no : +91 9493472098

E-mail: svps11288@gmail.com

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Table 1: Yield of extracts.

Plant	Part used	Quantity used	extract (ml)
<i>Carica papaya</i>	leaf	250 gm	12.5
<i>Allium sativum</i>	Cloves	250 gm	30.5

Table 2: Antibacterial activity of *Carica papaya* and *Allium sativum* alone and in combination.

Plant extract	Inhibition zones (mm)				
	Gram(+ve) bacteria		Gram (-ve) bacteria		
	<i>B. cereus</i>	<i>S. aureus</i>	<i>E. coli</i>	<i>S. typhi</i>	<i>P. aeruginosa</i>
<i>Carica papaya</i>	10.2 ± 0.27	11.8 ± 0.21	8.5 ± 0.5	0.0 ± 0.0	7.5 ± 0.62
<i>Allium sativum</i>	11.3 ± 0.57	8.5 ± 0.18	14.7 ± 0.16	8.5 ± 0.21	10.5 ± 0.64
Combined extract	16.2 ± 0.47	18.6 ± 0.23	16.2 ± 0.71	9.2 ± 0.36	12.8 ± 0.22
Gentamycin (5µg)	18.2 ± 0.37	21.5 ± 0.21	18.8 ± 0.42	17.7 ± 0.12	15.4 ± 0.53

Data are means of three replicates ($n = 3$) Mean ± SD.

sure and blood lipid, soften blood vessel. The tonic diet for nourishing and moistening the lung, nourish blood and soothing the liver, lower the blood pressure. Taking or eating garlic can benefit cardiovascular health, physical and sexual vitality, cognition and resistance to infection. It also has anti-aging properties. Raw or aged garlic reliably reduces total cholesterol and Low-density Lipoprotein (LDL-C), while increasing High-density Lipoprotein (HDL-C). Known traditionally as suitable for those who suffered with health problems of hypertension. Garlic also finds use as Antiprotozoal activity against *Entamoeba histolytica*, anticandidal effects. Cloves are known to possess antimicrobial, anticancer, antioxidant, antidiabetic, antiemetic, antihypertensive, hypoglycemic, hypolipidemic and immunomodulatory.¹⁹ In the present study, we evaluated the antibacterial activity of direct crude extracts of *Carica papaya* leaves and *Allium sativum* cloves alone and in combination against various strains.

MATERIALS AND METHODS

Plant Extraction

Fresh, middle stage age, *Carica papaya* leaves were picked. Leaves were washed and the stems were removed before use. After weighing, leaves were directly blended without adding water or other liquids. Then the mixture was filtered to obtain a crude extract of *Carica papaya* leaves. Finally, the volume of the extract was measured and used directly for the evaluation. Fresh garlic bulbs were purchased from a retail food store. The outer skin of the garlic cloves was peeled and crushed in a garlic press. The pressed garlic was then collected in a beaker and mixed thoroughly. The pressed mash was filtered to obtain a crude extract of *Allium sativum* and the volume of the extract was measured and used directly for the evaluation.

Bacterial strains

The antibacterial potency of each plant extract individually and in combination was evaluated using five bacterial strains causing infections. Two strains of Gram positive (*Staphylococcus aureus* and *Bacillus cereus*) and three strains of Gram negative (*Escherichia coli*, *Salmonella typhi* and *Pseudomonas aeruginosa*) bacteria were used.

Antibacterial activity of extracts

The disk diffusion method²⁰ was used to evaluate antibacterial activity of the each plant extract. The extracts were sterilized through Millipore filter of bore 0.22 µm and loaded (volume of 0.1ml/disc of crude extract) on sterile filter paper discs of 10 mm diameter. Ten ml of Mueller-Hilton agar

medium was poured into sterile Petri dishes as agar followed by addition of 15 ml of seeded medium previously inoculated with bacterial suspension to attain 10⁵ CFU/ml of medium indicating 100 ml of medium/1 ml of 10⁷ CFU. Sterile filter paper discs loaded with plant extract were placed on the top of Mueller-Hilton agar plates. Filter paper discs loaded with 5 µg of Gentamycin was used as positive control. The plates were kept in the fridge at 5°C for 2 h to permit plant extracts diffusion, then incubated at 37°C for 24 h. The presence of inhibition zones were measured by Vernier caliper recorded and noted for antibacterial activity.

RESULTS AND DISCUSSION

The yields of extracts of employed plants are illustrated in Table 1.

The plant extracts were investigated to evaluate their antibacterial activity against bacteria including two strains of Gram positive bacteria (*B. cereus* and *S. aureus*) and three strains of Gram negative bacteria (*E. coli*, *S. typhi* and *P. aeruginosa*) using disc diffusion method. Evaluation of antibacterial activity of these plant extracts was recorded in Table 2.

The results revealed that *Carica papaya* leaves extract and *Allium sativum* cloves extracts were potentially effective in suppressing microbial growth with variable potency. The combination of extracts of both plants was found to be most effective combination in retarding microbial growth of all tested pathogenic bacteria at concentration of 10 mg/disc than individual extracts. *Carica papaya* was found as inactive against the *S. typhi*.

CONCLUSION

Based on the results of the present study, it was found that fresh extracts of *Carica papaya* leaves and *Allium sativum* cloves showing good antibacterial activity and was found as synergistic activity when these two extracts were combined. These extracts directly can be used as natural alternative preventives to control various food poisoning diseases and preserve food stuff avoiding healthy hazards of chemically antimicrobial agent applications.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ABBREVIATIONS

B. cereus: *Bacillus cereus*; **S. aureus:** *Staphylococcus aureus*; **E. coli:** *Escherichia coli*; **S. typhi:** *Salmonella typhi*; **P. aeruginosa:** *Pseudomonas aeruginosa*; **°C:** Degrees Celsius; **+Ve:** Positive; **-Ve:** Negative; **hrs:** Hours of time; **ml:** Millilitre; **mm:** Millimetre; **µm:** Micrometre; **µg:** Microgram.

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ABOUT AUTHORS



Dr. Srividya Lonkala is an Associate Professor and Head, Department of Pharmaceutical Chemistry at Jyothishmathi Institute of Pharmaceutical Sciences, Karimnagar with over 7 years of professional experience in Pharma Teaching and research. She is Ph D in Pharmacy from Sunrise University, Alwar, Rajasthan, India. She has authored about 15 research papers covering Ethnopharmacognosy, antiulcer, antidiabetic and anticancer activities.



Dr. Anreddy Rama Narsimha Reddy is a Professor and HOD, Department of Pharmacology at Jyothishmathi Institute of Pharmaceutical Sciences, Karimnagar with over 12 years of professional experience in Pharma research. He holds an U.S Patent on Copper Nanoparticles for cancer treatment. He is Ph D in Pharmacology from Kakatiya University College of Pharmacy, Warangal, Telangana, India. He has authored several research papers, research reports covering several areas of Pharmacology, Toxicology, Nano Sciences. He continues to work on research studies in Pharmacology. He has contributed more than 80 papers and 13 books in the areas of Pharmacology and Toxicology.

SUMMARY

- Virtually plants are natural medicines with active principles serving as effective treatment regimens.
- Subsequently combination of these plant extracts provide additive and beneficiary uses in various aspects of nutrition, antioxidant, wound healing and so on.
- Carica graded as good vitamin supplement and Garlic being powerful immunomodulator their combination is expected to be a better antimicrobial agent.

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