

## Antibacterial Activities of Ethanolic Leaf Extract of *Carica papaya* on *Escherichia coli* and *Staphylococcus aureus*

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The ethanolic leaf extract of *Carica papaya* was screened for antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*. The satisfactory MIC of the plant extract against *E. coli* is 500 µg/ml while that of *S. aureus* is 800µg/ml. This study also revealed that the combination of the crude plant extract and the protein synthesis inhibitors had the highest inhibitor activity.

**Key words:** Leaf extract, *Carica papaya* on *Escherichia coli* and *Staphylococcus aureus*.

The model of drugs selected as possible antibacterial also comes from a mimic of structure of natural products isolated from plants whose medicinal efficacy have been proven and from design of drugs molecules via computational chemistry. Over the years, plant extract as reported by Knadil *et al* (1994) and Jagessar *et al* (2009) and isolated pure natural products.

The papaya (from Carib via Spanish), papaw, or pawpaw is the fruit of the plant *Carica papaya*, the sole species in the genus *Carica* of the plant family Caricaceae. It is native to the tropics of the Americas, and was first cultivated in Mexico (2001) several centuries before the emergence of the Mesoamerican classical civilizations.

The papaya is a large tree-like plant, with a single stem growing from 5 to 10 metres (16 to 33

ft) tall, with spirally arranged leaves confined to the top of the trunk. The lower trunk is conspicuously scarred where leaves and fruit were borne. The leaves are large, 50–70 centimetres (20–28 in) diameter, deeply palmately lobed with 7 lobes. The tree is usually unbranched, unless lopped. The flowers are similar in shape to the flowers of the *Plumeria*, but are much smaller and wax-like. They appear on the axils of the leaves, maturing into the large 15–45 centimetres (5.9–18 in) long, 10–30 centimetres (3.9–12 in) diameter fruit. The fruit is ripe when it feels soft (as soft as a ripe avocado or a bit softer) and its skin has attained amber to orange hue. *Carica papaya* was the first transgenic fruit tree to have its genome deciphered (Delbridge. 1988).

*Carica papaya* plants, and their fruits, are generally known as papayas. The papaya is also commonly called *pawpaw* or *papaw* (Lohiya, *et al*, 2002 and Oderinde *et al*, 2002) although in North America the term *pawpaw* usually refers to plants in the unrelated North American genus *Asimina*, especially *A. triloba*, which produces large, edible fruits. The papaya is also sometimes called *mugua*, a name used in traditional Chinese medicine for *Chaenomeles speciosa* (flowering

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quince) or *Pseudocarya sinensis* (Chinese quince) (Berrin *et al.*, 1997). In Venezuela and the Dominican Republic, the papaya is usually called "lechosa", a name associated with the plant's milky sap. In Cuba, the papaya is called "fruta bomba" and the word papaya is a reference to female genitalia. Papaya is marketed in tablet form to remedy digestive problems.

Papain is also applied topically (in countries where it grows) for the treatment of cuts, rashes, stings and burns. Papain ointment is commonly made from fermented papaya flesh, and is applied as a gel-like paste. Harrison Ford was treated for a ruptured disc incurred during filming of *Indiana Jones and the Temple of Doom* by papain injections (Asmah *et al.* 2009).

Women in India, Bangladesh, Pakistan, Sri Lanka, and other countries have long used green papaya as a folk remedy for contraception and abortion. Enslaved women in the West Indies were noted for consuming papaya to prevent pregnancies and thus preventing their children from being born into slavery.

Preliminary medical research in animals has confirmed the potential contraceptive and abortifacient capability of papaya, and also found that papaya seeds have contraceptive effects in adult male langur monkeys, and possibly in adult male humans. Unripe papaya is especially effective in large amounts or high doses. Ripe papaya is not teratogenic and will not cause miscarriage in small amounts. Phytochemicals in papaya may suppress the effects of progesterone. Papaya Moche Culture. Larco Museum Collection. The Moche often depicted papayas in their ceramics.

Other preliminary research indicates alternate possible effects which remain to be further studied. Papaya juice has an *in vitro* antiproliferative effect on liver cancer cells, possibly due to lycopene or immune system stimulation. Papaya seeds might contain antibacterial properties against *Escherichia coli*, *Staphylococcus aureus* or *Salmonella typhi*. Papaya seed extract may have effects in toxicity-induced kidney failure.

This paper investigates the antibacterial activity of *C. papaya* leaf extracts against *E. coli* and *S. aureus* using agar well diffusion plate and pour plate methods.

## MATERIALS AND METHODS

### Extraction of plant material

Leaves of *Carica papaya* were collected from Faculty of Agriculture and Forestry research station, University of Guyana Berbice Campus, John's Science Centre, Johns. Collected leaves were air dried at room temperature. Soxhlet apparatus was used for extraction. 1 liter of ethanol was used to extract 250g of leaves at 78°C. The extract was stored in a refrigerator until required.

### Biological assay bacterial inoculation and incubation with extracts

Pure cultures *E. coli* and *S. aureus* were collected from Guyana Government Hospital in Georgetown, Guyana. They were kept in McCartney bottles, with slant preparation in nutrient agar, to maintain their growth. Nutrient agar and nutrient broth were prepared according to the manufactures recommendations. The agar well diffusion method (Magaldi *et al.* 2004) was used for the inoculation of the bacteria. The extracts were allowed to diffuse into the medium for 1 h at room temperature Petri plates containing 20ml Muller Hinton medium were seeded with 24 hr culture of bacterial strains. Wells were cut and from 100 µl to 1000 µl of the plant extracts (namely methanol) were added. The plates were then incubated at 37°C for 24 hours. The antibacterial activity was assayed by measuring the diameter of the inhibition zone formed around the well (NCCLS, 1993). Chloramphenicol disc was used as a positive control.

## RESULTS AND DISCUSSION

The antibacterial properties of ethanolic leaf extract *C. papaya* at different concentration ranging from 100- 1000µl against *E. coli* and *S. aureus* is presented in Table.1. The satisfactory MIC of the plant extract against *E. coli* is 300µl while that of *S. aureus* 500µl. Table 2 is the effect of seven antibiotic drugs on *E. coli* and *S. aureus*. The protein synthesis inhibitors presented the strongest inhibitory activity followed by the folic acid inhibitor while the cell wall inhibitors had the least inhibitory activity (Odunbaku *et al.*, 2008). Table 3 is the result of synergism between the

antibiotic drugs and the crude plant extract on the organisms. The combination of the crude plant extract and the protein synthesis inhibitors had the highest inhibitory activity followed by the folic acid inhibitor. While the cell wall inhibitors produced the least inhibitory activity.

The MIC of plant extract against *S. aureus* (900µl) is rather too high and indicates that *C. papaya* crude extract would not be good enough to treat any infection caused by *S. aureus* the result also revealed that *C. papaya* had same activity at the concentration tested against *E. coli* as the

protein synthesis inhibitors and the folic acid inhibitors.

The antibiotic drugs had higher inhibitory activities against *E. coli* when compared with *S. aureus*. This is so because *E. coli* is a gram-negative bacteria with a single layers of cell wall which is not complicated while *S. aureus* is gram-positive with about cell wall if various polypeptide polymers and this could be the more reason for the drugs to have had reduced effect (Odunbaku *et al.*,2008). However, *E. coli* was resistant to ampicillin (Ajaiyeob, 2000) but *S. aureus* was partially

**Table 1.** Antibacterial activity on test organism using 100 to 1000ul of ethanolic leaf extract

Organisms	Average inhibitory zones(mm)									
	100	200	300	400	500	600	700	800	900	1000
<i>Escherichia coli</i>	-	-	6*	10	14	18	20	23	25	28
<i>Staphylococcus arures</i>	-	-	+	+	++	++	+++	+++	+++	+++
	-	-	-	5	8	12	16	20	22	24
	-	-	-	+	+	+	++	+++	+++	+++

No inhibitory reaction observed in the negative control (ethanol)

- = No inhibition; + = low level of inhibition; ++ = moderate level of inhibition; +++ = high level of inhibition

\*Values are zone of inhibition (mm)

**Table 2.** Effect of antibiotics on *E.coli* and *S. arueus*

Organisms	Conc.(mg/ml)	Gent. 0.4	Amp. 0.4	Chlora. 0.4	Samt. 0.4	Tetra. 0.4	Thro. 0.4	Pro.Pen 0.4
<i>E. coli</i>	Zone of inhibition (mm)	22+++	--	24+++	20+++	18++	10++	--
<i>S. arures</i>	Zone of inhibition (mm)	20++	19++	25+++	23+++	26+++	-	-

-- No inhibition; + = low level of inhibition; ++ = moderate level of inhibition; +++ = high level of inhibition

**Table 3.** Result of synergism between drugs and plant extract on the organisms

Drug target	Antibiotic	<i>E. coli</i>			<i>S. arueus</i>		
		Conc. of extract +antibiotic (mg/ml)	Zone of inhibition (mm)		Conc. of extract+ antibiotic (mg/ml)	Zone of inhibition (mm)	
Protein synthesis	Gentomycin	700+0.4	28	+++	900+0.4	30	+++
	Tetracycline	700+0.4	26	+++	900+0.4	32	+++
	Chloramphenicol	700+0.4	30	+++	900+0.4	28	+++
Folic acid	Samtrim	700+0.4	24	+++	900+0.4	29	+++
Nucleic acid	Ampicillin	700+0.4	14	++	900+0.4	24	+++
	Pro.Penicillin	700+0.4	11	++	900+0.4	19	++

--No inhibition; + = Lowe level of inhibition; ++ = Moderate level of inhibition; +++ = high level of inhibition

susceptible. The area of target of ampicillin is the cell wall. The cell wall of *S. aureus* is a target zone of pharmacokinetics of ampicillin, being semi-synthetic penicillin. *E. coli* has grown resistant to ampicillin and penicillin over the years. The synergism between and plant extract was higher than the extract activities and this is a good indication that drugs can be cabined (Joyce *et al.*, 2006).

### CONCLUSION

The plant extract has displays antimicrobial activity and therefore justifies its ethanobotanical uses for the treatment of ophthalmic, coughs, colic and haemorrhoids. *C. papaya* could be taking alongside some synthetic drugs, during the treatment of diseases caused by *E. coli* and *S. aureus*. For future study on this plant, the active ingredients of the plant should be investigated.

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