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[CARICA PAPAYA:A NUTRITIONAL FRUIT AND PHYTOMEDICINE]

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ABSTRACT:-

Papaya (*Carica papaya* L.) is a popular and important fruit tree in tropical and subtropical parts of the world. The fruit is consumed worldwide as fresh fruit and vegetable or used as processed product. The fruit is healthy and delicious and the whole plant parts including fruit, root, bark, peel, seeds and pulp are also known to have medicinal properties. The many benefits of papaya are owed due to high content of vitamin A, B and C, proteolytic enzymes like papain and chymopapain which have antiviral, antifungal and antibacterial properties. During the last few years, major insight has been achieved regarding the biological activity and medicinal application of papaya and now it is considered a valuable nutraceutical fruit plant. In the present review, nutritional value of the fruit and medicinal properties of its various parts have been discussed to provide collective information on this multipurpose commercial fruit crop.

INTRODUCTION:-

The papaya tree belongs to a small family — Caricaceae having four generation in the world. The genus *Carica* Linn. is represented by four species in India, of which *Carica papaya* Linn. is the most widely cultivated and best-known species. Among the other species, *C. cauliflora* Jacq., *C. pubescens* Lenne & K.Koch and *C. quercifolia* Benth. & Hook.f.ex Hieron. are possible sources of breeding material for inducing frost and virus resistance in cultivated papaya. The fruits, leaves and latex obtained from papaya plant are used medicinally and for various other purposes. Papain, a major chemical compound extracted from fruit and stem latex is used in brewing and wine making and in the textile and tanning industries^{1,3}.

Papaya contains broad spectrum of phytochemicals including, polysaccharides, vitamins, minerals, enzymes, proteins, alkaloids, glycosides, fats and oils, lectins, saponins, flavonoids, sterols, etc. The present paper deals with origin and distribution, brief morphological characters, nutritional value and results of reported research findings on its medicinal properties.

KEY WORDS:-Introduction, Origine ,Distribution and morphology,Taxonomy, chemical constituents,Pharmacological activity..

ORIGINE,DUSTRIBUTION AND MORPHOLOGY

Papaya is probably originated insouthern Mexico and Costa Rica, subsequently it was introduced as a plantation crop in Australia, Hawaii, Philippines, Sri Lanka, South Africa, India and in all tropical and subtropical regions.It is grown both commercially and in home gardens. Papaya is a polygamous species and it is difficult to identify a plant whether it is male, female or hermaphrodite. It is a tree reaching 3-10m in height, with the habit of a palm; the fleshy stem marked by scars where leaves have fallen off, is surmounted by a terminal panache of leaves on long petioles and with 5-7 lobes. Flowers fragrant,trimorphous, usually unisexual-dioecious,male flowers in lax many-flowered,densely pubescent cymes at the tips of the pendulous, fistular rachis; female flowers large, solitary or in few flowered racemewith a short thick rachis, fruit a large berry, varying widely in size, elongate to globose with a large central cavity, seeds black, tuberculous and enclosed in a transparent aril. The fruit bearing trees are less than 18 month old. The leaves and unripe fruit contain milky juice in which the protein ferment papain is present¹⁻³.



Fig:-Whole plant and fruits of C.Papaya

TAXONOMICAL CLASSIFICATION:-⁵

Kingdome	Plantae
Subkingdome	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Violales
Family	Caricaceae
Genus	Carica
Species	Carica papaya

CHEMICAL CONSTITUENTS OF CARICA PAPAYA:-⁶ -⁷

The different parts of papaya such as fruit, fruit juice, seed, root, leaves, bark, latex contain various chemical constituents, which are shown as follows:-

S.N.	Parts	Chemical Constituents
1..	Fruits	Protein, fat, fibre, carbohydrates, minerals: calcium, phosphorous, iron, vitamin C, thiamine, riboflavin, niacin, and carotene, amino acids, citric and malic acids (green fruits), volatile compounds: linalool, benzylisothiocyanate, cis and trans 2,6-dimethyl-3,6 epoxy-7 octen-2-ol, Alkaloid, α ; carpaine, benzyl- β -D glucoside, 2-phenylethyl - β -D-glucoside, 4 hydroxy phenyl-2 ethyl- β -D-glucoside and four isomeric malonated benzyl- β -D-glucosides
2..	Juice	N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic and cis-vaccenic and oleic acids
3..	Seed	Fatty acids, crude protein, crude fibre, papaya oil, Carpaine, benzylisothiocyanate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane, β -sitosterol, caricin and an enzyme myrosin
4..	Roots	Carposide and an enzyme myrosin.
5..	Leaves	Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E
6..	Bark	β -Sitosterol, glucose, fructose, sucrose, galactose and xylitol.
7..	Latex	Proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapains A, B and C, peptidase A and B and lysozymes.

NUTRITIONAL VALUE OF 100gm CARICA PAPAYA:-

The constituents of ripe papaya contain: energy (163kj), protein (0.6 g), fat (0.1 g), minerals (0.5 g), fibre (0.8 g), carbohydrates (7.2), beta-carotene (888 μ m), total carotene (2740 μ m), sodium (3 mg), iron (0.10 g), vitamin A (1094IU), vitamin E (0.73 mg), niacin (3 mg) and water (89%). These nutritional values of papaya help to prevent the oxidation of cholesterol. Papaya is rich in iron and calcium; a good source of vitamin A, B and G and an excellent

source of vitamin C (ascorbic acid). The extract and fruit juice of *C. papaya* contain alkaloids, glycosides, flavonoids, carbohydrates, saponins, terpenoids, steroids and tannins.

PARTS AND MEDICINAL USES OF CARICA PAPAYA:-

C. papaya is a pack of enzymes. Different parts contain different enzymes: unripe fruit (papain, chymopapain), fruits (B carotene, carotenoids, cryptoxanthin, monoterpenoids, linalool), roots (carposides), seeds (papaya oil, glucosinolates, benzyl isothiocynate), leaves (Zn, Mn, Fe, K, minerals), shoots (flavanoids, kaemferol, myricetin, minerals, Ca, Mg, Fe) and leaves (vitamin C and E, alkaloids, carpaine).

MEDICINAL AND PHARMACOLOGICAL PROPERTIES:- Many biologically active phytochemical(s) have been isolated from papaya and studied for their action, recently an antifungal chitinase has been gene cloned and characterized from papaya fruit. The chitinase is classified as

class IV chitinase based on its amino acid sequence homology with other plant chitinases. The recombinant papaya chitinase also has antibacterial activity⁸. The purified chemopapain from commercially available spray dried latex of the fruits has shown immunological properties⁹. The anthelmintic activity of papaya seed has been variously ascribed to carpaine (an alkaloid) and carpasemine (later identified as benzyl thiourea) and benzylisothiocyanate¹⁰ cysteine proteinases from papaya fruit have also been reported¹¹. Carpaine, an alkaloid with an intensively bitter taste and a strong depressant action on the heart, has been obtained from the fruit and seed, but especially from the leaves¹². Various pharmacological action(s) and medicinal uses of different parts of papaya are well reported in the ancient literature^{3, 12, 13}. Some of them especially Ayurvedic have been summarized. Biological activities of papaya are reported with the crude extracts and different fractions from latex, seed, leaf, root, stem bark and fruit. However, crude extracts of different parts of papaya have been used as traditional medicine for the treatment of various diseases. However, apart from these, there are several reports on the therapeutic properties and pharmacological actions of papaya based on modern scientific investigations. Some have been discussed below.

ANTIOXIDANT ACTIVITY:-

The methanolic extract of unripe fruits of *C. papaya* was evaluated in vivo for its effect on activities of some antioxidant enzymes which includes glutathione peroxidase (GPx), glutathione transferase (GST), glutathione reductase, catalase and glucose-6-phosphate dehydrogenase in mice treated with a orally dose of 100 mg/kg. There is significant increase in the activities glutathione reductase, GST, GPx, glucose-6-phosphate dehydrogenase due

to the ethyl acetate fraction. Significant decrease in GPx was observed in kidney following administration of ethyl acetate fraction. It was suggested that quercetin and β -sitosterol may be responsible for the antioxidant activity.¹⁴

ANTIHYPERTENSIVE ACTIVITY:-

The ethanolic extract of ripe fruit of *C. papaya* was used for the anti-hypertensive activity. The basal mean arterial blood pressure (MAP) were (93.8 \pm 4.5), (175.2 \pm 5.1), (181.3 \pm 6.2) mmHg in the normotensive, renal and DOCA-salt hypertensive animals. Both hydralazine (200 μ L/100 g, i.v.) and ethanolic extract of unripe fruit of *C. papaya* (20 mg/kg, i.v) produced a significant depression of MAP in normotensive, renal and DOCA-salt hypertensive animals groups as compared to control. But the extract produced about 28% more depression of MAP than hydralazine in the hypertensive group. The study suggested that the unripe fruit of *C. papaya* had a potent anti-hypertensive activity¹⁵

ANTIBACTERIAL ACTIVITY:-

The seed of papaya has antimicrobial activity against *Trichomonas vaginalis* trophozoites. The report suggests the use of papaya seed in urinogenital disorder like trichomoniasis with care to avoid toxicity¹⁶. The seed and pulp of papaya was shown to be bacteriostatic against several enteropathogens such as *Bacillus subtilis*, *Enterobacter cloacae*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* by the agar cup plate method¹⁷. Purified extracts from ripe and unripe fruits also produces very significant antibacterial activity on *S. aureus*, *Bacillus cereus*, *E. coli*, *P. aeruginosa* and *Shigella flexneri*¹⁸. The aqueous extract of fruit exhibited antimicrobial activity and promoted significant wound healing in diabetic rats. The seeds of irrespective stage of fruit maturity have bacteriostatic activity on Gram positive and Gram negative organisms, which could be useful in treating chronic skin ulcers. The papaya seed macerate has a clinical potential on conjugal R plasmid transfer from *Salmonella typhimurium* to *Escherichia coli*, on in vitro and in the digestive tract of genotoxic mice. Herbal formulations containing papaya leaves and root or leaves alone as one of the constituent has antibacterial activity against *Salmonella typhi*, *S. paratyphi* and *S. typhimurium*; however, water, acetone and ethanolic extract of papaya leaves showed no microbicidal activity¹⁹⁻²⁰

WOUND HEALING ACTIVITY:- The aqueous extract of *C. papaya* fruit [100 mg/(kg.d) for 10 d] for wound healing property in streptozotocin-induced diabetic rats using excision and dead space wound models. The aqueous extract shows 77% reduction in the wound area when compared to 59% contraction to wound of the controls. Thus the result suggested that the aqueous extract of *C. papaya* had a potent wound healing property²¹

HYPOGLYCEMIC ACTIVITY:-

Hypoglycemic activityThe ethanolic leaf extract of *C. papaya* at the dose 5.0 mg/kg produced significant blood sugar level reduction with no significant effects at the higher dose of 10 mg/kg. The extract delayed the onset of hypoglycemic activity of glimepiride and increased the hypoglycemic effect of metformin with the variables interacting differently for each drug-extractcombinations²²

ANTI ULCER ACTIVITY:-

Anti-ulcer activityAqueous seed extract of *C. papaya* at the dose of 50 mg/kg and 100 mg/kg p.o against alcohol induced acute gastric damage and blood oxidative stress in rats. The gastric acidity was significantly reduced in rats treated with 100 mg/kg of the extract²³

ANTIMICROBIAL ACTIVITY:-

The seed of papaya hasantimicrobial activity against *Trichomonas vaginalis* trophozoites. The report suggests the use of papaya seed in urinogenital disorder like trichomoniasis with care to avoid toxicity²⁴. The seed and pulp of papaya was shown to be bacteriostatic against several enteropathogens such as *Bacillus subtilis*, *Enterobacter cloacae*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* by the agar cup plate method²⁴. Purified extracts from ripe and unripe fruits also produces very significant antibacterial activity on *S. aureus*, *Bacillus cereus*, *E. coli*, *P. aeruginosa* and *Shigella flexneri*²⁵.

ANTIMALARIAL ACTIVITY:-

The petroleum ether extract of the rind of raw papaya fruit exhibits significantantimalarial activity. There may be significant commercial potential in extracting the active element from this plant, which grows abundantly throughout the tropics and the rind of which is discarded as waste, can be exploited for antimalarial activity²⁶

HEPATOPROTECTIVE ACTIVITY:-

The ethanol and aqueous extracts of the fruit possess remarkable hepatoprotective activity against CCl₄ induced hepatotoxicity. But hepatoprotective mechanism as well as active principles responsible for hepatoprotective activity of this plant is not yet known²⁷.

HISTAMINERGIC ACTIVITY:-

The crude extract of *C. papaya* (0.5-512 µg/mL) caused concentration-dependent contraction of ileal strips suspended in tyrode solution which was mediated via H₁-receptor and is dependent on extracellular Ca²⁺ influx²⁸.

C.PAPAYA IN CASE OF PREGANANCY:- The main constituents of papaya are papain and chymopapain present in latex showing teratogenic and abortifcent (can induce an abortion) effects. This can cause increase in the chances of uterine contraction as the papain acts like prostaglandin and oxytocin which are known to put a mother's body into labour and hence can cause the adverse effect on babies and mothers health. The latex can also cause the oedema and haemorrhage placentas, resulting in severe complications in pregnancy and normally early delivery.

CONCLUSION:-

Papaya, popularly known as foodarticle is the unique source of various types of compounds having diverse structure. Quite a significant amount of work has been done on the biological activity and possible application of these compounds and hence extensive investigation on its pharmacodynamics, kinetics and proper standardization and clinical trials is needed to exploit their therapeutic utility to combat various diseases.

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