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RESEARCH ARTICLE

CARICA PAPAYA, A MAGIC HERBAL REMEDY.

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Key words:-

Carica papaya, nutraceutical, medicinal plant, multi faceted plant.

Abstract

Carica papaya Linn belonging to family Caricaceae. The properties of papaya fruit and other parts of the plant are also well known in traditional system of medicine. Papaya possess excellent medicinal properties for treatment of different ailments. The different parts of the *Carica papaya* plant including leaves, seeds, latex and fruit exhibited to have medicinal value. The stem, leaf and fruit of papaya contain plenty of latex. The latex from unripe papaya fruit contain enzymes papain and chymopapain.

Background;- there is no background

Method;- there is no method because its focused on review on *Carica papaya* plant.

Result;- There is no result because it is a review article on *Carica papaya*

Conculsion;- this review focuses on different properties of papaya as a multi-faceted plant. Papaya is commonly known for its food and nutritional values throughout the world.

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Introduction:-

Carica papaya Linn belonging to family Caricaceae is commonly known as papaya in English, Papita in Hindi and Erandakarkati in Sanskrit. Papaya is a powerhouse of nutrients and is available throughout the year. It is a rich source of three powerful antioxidant vitamin (C, A & E); the minerals (magnesium and potassium); the B vitamin pantothenic acid and folate and fiber.¹ The plant is native to tropical America and was introduced to India in 16th century. Papaya tree is basically a short lived Indian tree. In the historic times, it was considered as an exotic fruit because of its buttery taste and appearance.² The plant is recognised by its weak and usually unbranched soft stem and yielding copious white latex and crowded by a terminal cluster of large and long stalked leaves, is rapidly growing and can grow up to 20m tall. Traditionally leaves have been used for treatment of a wide range of ailments, like in treatment of malaria, dengue, jaundice, immunomodulatory and antiviral activity.³ Young leaves are rich in flavonoids (kaempferol and myricetin), alkaloids (carpaine, pseudocarpaine, dehydrocarpaine I and II), phenolic compounds (ferulic acid, caffeic acid, chlorogenic acid), the cynogenetic compounds (benzylglucosinolate) found in leaves.⁴

Both leaf and fruit of the *Carica papaya* Linn. possess carotenoids namely β -carotene, lycopene, anthraquinone glycoside, as compared to matured leaves and hence possess medicinal properties like anti-inflammatory, hypoglycaemic, anti-fertility, abortifacient, hepatoprotective, wound healing, recently its antihypertensive and antitumor activities have also been established.^{3,4} Leaves being an important part of several traditional formulations

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are undertaken for standardization for various parameters like moisture content, extractive values, ash values, swelling index, etc.⁵

Morphology:-

- **Botanical Name:** *Carica Papaya*
- **Family Name :** Caricaceae
- **Common Name :** Papaya, Paw Paw, Kates, Papaw
- **Flower:** Showy,fragrant
- **Fruit:** Showy,Edible
- **Leaf:** Evergreen
- **Part Used :** Leaves, Fruits, Roots
- **Habitat :** Throughout India ,Bangladesh

Different species of *Carica papaya* Linn:-

- | | |
|-----------------------------------|-------------------------------|
| 1. <i>Carica candamarcensis</i> | |
| 2. <i>Carica Mexicana</i> | 16 <i>Carica weberbaueri</i> |
| 3. <i>Carica caudate</i> | 17 <i>Carica omnilingua</i> |
| 4. <i>Carica cauliflora</i> | 18 <i>Carica palandensis</i> |
| 5. <i>Carica chilensis</i> | 19 <i>Carica parviflora</i> |
| 6. <i>Carica horovitziana</i> | 20 <i>Carica spruce</i> |
| 7. <i>Carica cundinamarcensis</i> | 21 <i>Carica pubescens</i> |
| 8. <i>Carica dodecaphylla</i> | 22 <i>Carica pulchra</i> |
| 9. <i>Carica glandulosa</i> | 23 <i>Carica quercifolia</i> |
| 10. <i>Carica goudotiana</i> | 24 <i>Carica sphaerocarpa</i> |
| 11. <i>Carica heterophylla</i> | 25 <i>Carica spinosa</i> |
| 12. <i>Carica candicans</i> | 26 <i>Carica nana</i> |
| 13. <i>Carica longiflora</i> | 27 <i>Carica stipulate</i> |
| 14. <i>Carica crassipetala</i> | 28 <i>Carica pentagona</i> |

Botanical Description:-

Plant:-

Papaya plant is a large, single-stemmed herbaceous perennial tree having 20–30 feet height . The leaves are very large (upto 2½ feet wide), palmately lobed or deeply incised with entire margins and petioles of 1-3 feet in length. Stems are hollow, light green to tan brown in color with diameter of 8 inches and bear prominent of scars.⁴

Fruit:-

The fruits are big oval in shape and sometimes called pepo-like berries, since they resemble melon by having a central seed cavity . Fruits are borne axillary on the main stem, usually singly but sometimes in small clusters. Fruits weigh from 0.5 up to 20 lbs, and are green unlike ripe, turning yellow or red orange. Flesh is yellow-orange to salmon (pinkish orange) at maturity. The edible portion surrounds the large central seed cavity. Individual fruits mature in 5-9 months, depending on cultivator and temperature. Plants begin bearing fruits in 6-12 months.^{6,7}

Flowers:-

Papaya plants are dioecious or hermaphroditic, producing only male, female or bisexual (hermaphroditic) flowers. Papaya as are sometimes said to be “trioecious” meaning that separate plants bear either male, female, or bisexual flowers .Female and bisexual flowers are waxy, ivory white, and borne on short peduncles in leaf axils, along the main stem. Flowers are solitary or small cymes of 3 individuals. Ovary position is superior. Prior to opening, bisexual flowers are tubular, while female flowers are pear shaped. Since, bisexual plants produce the most desirable fruit and are self-pollinating, they are preferred over female or male plants. A male papaya is distinguished by the smaller flowers borne on long stalks. Female flowers of papaya was pear shaped, when unopened whereas, bisexual flowers are cylindrical .⁸

Geographical Distribution:-

Though the exact area of origin is unknown, the papaya is believed native to Tropical America, perhaps in Southern Mexico and neighbouring Central America. Successful commercial production today is primarily in Hawaii,

Tropical Africa, the Philippines, India, Ceylon, Malaysia and Australia, apart from the widespread but smaller scale production in South Africa, and Latin America. In India, papaya is cultivated in Maharashtra, Bengal, Bihar, Haryana, Punjab, Delhi, Andhra Pradesh and Uttar Pradesh.⁹

Nutritional Value of Papaya:-

The papaya is a large, tree-like plant, with a single stem growing from 5 to 10 m (16 to 33 ft) tall, with spirally arranged leaves confined to the trunk. The leaves are large, 50-70 cm in diameter, deeply palmately lobed, with seven lobes. The tree is unusually un-branched, unless lopped. The flowers appear on the axils on the leaves, maturing into large fruit. The fruit is ripe when it feels soft and its skin has attained amber to orange hue. Ripe and green papaya has difference in nutritional value.^{6,9}

Chemical composition of various part of *Carica papaya* plant are described:-

Part Constituents:-

Fruit:- protein, fat, fibre, carbohydrates, minerals, calcium, phosphorus, iron, vitamin C, thiamine, riboflavin, niacin, and carotene, amino acid, citric acids and malic acid (green fruits), volatile compounds: linalol, 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-hydroxyl -phenyl-2ethyl-B-D glucoside and four isomeric malonated benzyl- β -D glucosides.⁶

Juice:- N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic acids-vaccenic acid and oleic acids.

Seed:- Fatty acids, crude proteins, crude fibre, papaya oil, carpaine, benzylisothiocyanate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane, β -sitosterol, carcin and an enzyme myrosin⁸

Root:- Arposide and an enzyme myrosin.

Leaves:- Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E.

Bark:- β -sitosterol, glucose, fructose, sucrose, galactose and xylitol.

Latex:- proteolytic enzymes, papain glutamine cyclotransferase, chymopapain A, B and C, peptidase A and B and lysozymes.^{10,11}

Medicinal and Pharmacological properties of various parts of *Carica papaya* leaves.

Biological activities of papaya are reported with the crude extracts and different fraction from latex, seed, leaf, root, stem bark and fruits.

Leaves:-

Papaya leaf has a numberless of benefits. In some parts of Asia, the young leaves of the papaya are steamed and eaten like spinach.

- a. Dengue fever :- Dr. Sanath Hettige, who conducted the research on 70 dengue fever patients, said papaya leaf juice helps increase white blood cells and platelets, normalizes clotting, and repairs the liver.²
- b. Cancer cell growth inhibition :- Recent research on papaya leaf tea extract has demonstrated cancer cell growth inhibition. It appears to boost the production of key signaling molecules called Th1 -type cytokines, which help regulate the immune system.
- c. Antimalarial and antiplasmodial activity;- Papaya leaves are made into tea as a treatment for malaria. Antimalarial and antiplasmodial activity has been noted in some preparations of the plant.⁸
- d. Facilitate digestion. The leaves of the papaya plants contain chemical compounds of carpain, Substance which kills microorganisms that often interfere with the digestive function.
- e. Antibacterial activity. It contains huge number of enzyme to kill the microorganism.¹²

Fruit:-

Papaya fruit is a rich source of nutrients such as provitamin A, carotenoids, vitamin C, vitamin B, lycopene, dietary minerals and dietary fibre. Danielone is a phytoalexin found in the papaya fruit.

- a. Laxative;- Ripe papaya fruit is laxative which assures of regular bowel movement
- b. Indigestion;- The milky juice which is tapped from the green, mature fruit while still in the tree contains an enzyme known as "papain". People use this in the preparation of different remedies for indigestion.
- c. Void the heart attack or stroke;- The folic acid found in papayas is needed for the conversion of homocysteine into amino acids such as cysteine or methionine. If unconverted, homocysteine can directly damage blood vessel walls, is considered a significant risk factor for a heart attack or stroke.
- d. Skin diseases;- it contains the vitamins which is used for skin disease.⁷

Seeds:-

The black seeds of the papaya are edible and have a sharp, spicy taste. They are sometimes ground and used as a substitute for black pepper.

- a. Nephro - protective activity;- In wistar rats nephro-protective activity was observed in dose related manner. Concentration of urine and creatinine were evaluated.
- b. More potent- The papaya seeds are very pungent and peppery, making them almost unpalatable. However the seeds seem to have more potent medicinal values than the flesh.
- c. Papaya seeds may protect the kidneys from toxin – induced kidney failure. Seeds can eliminate intestinal parasites, and help detoxify the liver. Used as a skin irritant to lower fever. Cure for piles and typhoid and anti-helminthic and antiamoebic properties.¹⁴

Peel:-

Papaya peel is often used in cosmetics. The papaya peel can also be used in many home remedies.

- a) Sunscreen and soothing slave- The presence of vitamin A helps to restore and rebuild damaged skin. Applied papaya peel used as skin lightening agent. When peel mixed with honey and applied it can act as soothe and moisturizers the skin.
- b) Fight dandruff- The papaya vinegar with lemon juice can be applied to the scalp for 20 minutes prior to shampooing to fight dandruff.
- c) Muscle Relaxant- Adding papaya oil and vinegar to bath water, along with essential oils like lavender, orange and rosemary can be nourishing, refreshing and relaxing, and can work as a pain reliever and muscle relaxant .^{15,3}

Roots:-

Juice from papaya roots is used in some countries of Asia to ease urinary troubles. Papaya leaf when dried and cured like a cigar, is smoked by asthmatic persons. An infusion of fresh papaya leaves is used by person to expel or destroy intestinal worms. Fresh young papaya are also used to remedy colic, a certain stomach disorder or cramp. A decoction formed by boiling the outer part of the roots of the papaya tree in the cure of dyspepsia .¹⁶

Latex:-

The milky sap of an unripe papaya contains Papain and chymopapain. chymopapain was approved for intradiscal injection in patients with documented herniated lumbar intervertebra discs and who had not responded to "conservative therapy". Papain is also used to treat commercial beer, to degum natural silk, as a meat tenderizer and in the production of chewing gums. Cosmetically it is used in Shampoos and in a number of face-lifting operations. In humans papain slows down the heart and thus reduces blood pressure. It is also used in Antihelminthic, relieves dyspepsia, cures diarrhea, pain of burns and topical use, bleeding haemorrhoids, stomachic, whooping cough .¹⁷

Other Uses:-

- a. Colon cancer- The fiber of papaya is able to bind cancercausing toxins in the colon and keep them away from the healthy colon cells. These nutrients provide synergistic protection for colon cells from free radical damage to their DNA.
- b. Anti-Inflammatory effects- Protein enzymes including papain and chymopapain and antioxidant nutrients found in papaya; including vitamin C, vitamins E, and betacarotene, reduce the severity of the conditions such as asthma, osteoarthritis, and rheumatoid arthritis.
- c. Rheumatoid arthritis- Vitamin C - rich foods, such as papaya, provide humans with protection against inflammatory polyarthritis, a form of rheumatoid arthritis involving two or morejoints
- d. Promote lung health- If you are smoker, or if you are frequently exposed to second hand smoke. Eating vitamin A rich foods, such as papaya, help your lung healthy and save your life.

- e. Anti-sickling activity- Current research proves that papaya is having an anti- sickling activity
- f. Prevent prostate cancer- Men consuming lycopene – rich fruits and vegetables such as papaya, tomatoes, apricots, pink grape fruit, watermelon, and guava were 82 % less likely to have prostate cancer compared to those consuming the least lycopene - rich .^{14,16}

Pharmacological activities of *Carica papaya* on laboratory animals:-

Antisickling activity:-

Sickle cell disease (SCD) results from a mutation in hemoglobin inside the red blood cells, where a glutamic acid at 6th position is replaced by valine. Recent studies showed that unripe papaya fruit extract has anti-sickling activity .[18]. Another study showed the potent antisickling property of *Carica papaya* leaf extract in a dose- dependent manner.¹⁹

Anthelmintic activity:-

A wide range of plants and plant extracts has been used traditionally for the treatment of helminthes infections including papaya, which is rich in proteolytic enzymes known to digest nematode cuticles, have low toxicity and have been used in traditional medicine against gastrointestinal nematodes for decades . In 1940, the worm digesting activity of a preparation of papain from *C.papaya* latex was described as they rapidly digest the ascaris.²⁰

Antifungal activity:-

The latex of papaya and fluconazole has synergistic action on the inhibition of *Candida albicans* growth . This synergistic effect results in partial cell wall degradation due to lack of polysaccharides constituents in the outermost layers of fungal cell wall and release of cell debris into the cell culture. Latex proteins appear to be responsible for antifungal action and minimum protein concentration for producing a complete inhibition was reported as about 138 mg/dl.²¹

Antibacterial activity:-

The seeds of *Carica papaya* were found to possess bacteriostatic activity against several enteropathogens such as *Bacillus subtilis*, *Enterobacter cloacae*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia*. Among the gram positive and gram-negative bacteria tested the gram negative bacteria were more susceptible to the extract.²²

Antioxidant activity:-

reported a study on *Carica papaya* for its antioxidant activity, its phenolic content using the different parts of papaya. The total phenolic content of the extracts was determined by Folin-Ciocalteu method and antioxidant activity was assayed using DPPH method. The total phenolic contents and antioxidant activity of the extracts as Gallic acid equivalents were found to be highest in fresh extract .²³

Hypoglycemic and hypolipidemic activity:-

Study show that oral treatment with 0.1 mg/kg/day of glibenclamide and 100-400 mg/kg/day of aqueous seed extract of *Carica papaya* induced significant, steady and progressive hypo-glycemic and hypolipidemic effect.²⁴

Antipyretic activity:-

investigated the platelet increasing property of *Carica papaya* leaves juice (CPLJ) in patients with dengue fever (DF). An open labeled randomized controlled trial was carried out on 228 patients with DF and dengue hemorrhagic fever (DHF). Approximately half the patients received the juice, for 3 consecutive days while the others remained as controls and received the standard management. Their full blood count was monitored 8 hours for 48 hours. Gene expression studies were conducted on the ALOX 12 and PTAFR genes. The mean increase in platelet counts were compared in both groups using repeated measure ANCOVA. There was a significant increase in mean platelet count observed in the intervention group but not in the control group 40 hours since the first dose of CPLJ. Comparison of mean platelet count between intervention and control group showed that mean platelet count in intervention group was significantly higher than control group after 40 and 48 hours of admission. The ALOX 12 (FC=15.00) and PTAFR (FC=13.42) genes were highly expressed among those on the juice. It was concluded that CPLJ does significantly increase the platelet count in patients with DF and DHF.²⁵

Anti-inflammatory activity:-

The anti-inflammatory property of plant cysteine proteinases were already noted in literature. In a clinical study, the histological severity of inflammatory bowel disease was determined for treatment of chronic inflammatory and related diseases papain has found to be safe and efficacious. Anti-inflammatory activity of papaya seeds were also reported. The anti-inflammatory effect of the leaves extract including the reference drug was very poor when using the carrageenan method, the 100 mg/kg extract produced its highest effect at 3 hr (2.7%) after carrageenan injection while the 200mg/kg extract also produced its effects at 3 hr (6.7%) after injection. The reference drug indomethacin produced time dependant reduction as the effect was more pronounced at 3 hr (11.4%) of carrageenan administration. The results of this investigation revealed that the aqueous extract of the leaves was slightly less effective than that of indomethacin.²⁶

Anti-fertility activity:-

The anti-fertility effects of *Carica papaya* were investigated by feeding adult and pregnant rat with different components of the fruit. No attempt was made to force feed the animal and the result indicated that the unripe fruit interrupted the estrous cycle and induced abortion. This effect vanished as the fruit became stale or over riped. Chloroform extract of *Carica papaya* seeds induced long term azoospermia in languor monkey.²⁷ Papaya also showed the anti-implantation and abortifacient effect.²⁸

Anticancer activity :-

Initially pharmaceutical preparations containing various proteolytic enzymes (papain) have been used as adjuvant in the treatment of malignant diseases, despite lack of knowledge of their mode of action. Experiments indicate that the effects after oral administration of polyezymes preparations are related to the induction of cytokines production by human peripheral blood mononuclear cells. Papaya in vitro study shows that it will treat many cancer cell line and they have anticancer activity. Papain enzyme from papaya effective against cancer. Papain breaks down the fibrin cancer cell wall and protein into amino acid form. Other than papain it also contain lycopene which highly reactive towards oxygen and free radical. Isothiocyanate effective against breast, lung, colon, pancreas, prostate as well as leukemia. These enzymes capable of inhibiting both formation and development of cancer cell.²⁹

Anti-hypertensive activity:-

Papaya leaves decoction can be used as an anti-hypertensive agent. A study on villagers of Agboville located at 80 km of Abidjan (West Africa), showed the hypotensive activity of papaya plant when administered orally.³⁰

Immunomodulatory activity:-

Papain induces human eosinophils to degranulate and to produce superoxide anion. The E-64 inhibitors abolished the activation by papain suggesting that the protease activity is required to trigger eosinophil response. It is likely that this action in eosinophils is mediated by protein G linked receptor. As it stands it appears that bromelaine and papain depending on the target cell display opposite effects.³¹

Wound healing:-

The similarities between latex coagulation in papaya and the mammalian coagulation process led us to propose that some analogous factor may be present in both systems. If putative analogies do occur, it is possible that some plant metabolites intervening during plant healing may also act during the healing process ensuring clot formation in mammals. The proliferative effect of papain attained 15% above control, suggesting that this properly is specific for some proteolytic enzymes. Also one study showed that papain from *C. papaya* latex was effective in protecting histamine-induced ulcer in rat by blocking the acid secretion¹⁷. Papain major component of papaya latex is nonspecific cysteine proteinase that is capable of breaking down a wide variety of necrotic tissue substrates over a wide pH range from 3.0 to 12.0¹⁸. This factor may also have contributed to the faster wound healing and was facilitated by the action proteinases. Papain also known to be effective in disloughing necrotic tissue, prevention of infection and the antimicrobial and antioxidant properties related to hydroxyl scavenging and iron chelating properties. Moreover they decrease the risk of oxidative damage to tissue also they show burn healing properties as the increment in hydroxyproline content.³²

Anti- HIV agent:-

Evaluation of anti-HIV-1 effect of *Carica papaya* aerial parts polar extracts and also the investigation of the chemical content from the polar extracts of the plant. The methanol and aqueous extracts of *Carica papaya* were tested for their anti-HIV-1 activity using the syncytia formation assay. Methanol and aqueous extracts of *Carica*

papaya aerial parts showed activity as anti HIV-1 agents, both of the extracts therapeutic index (TI) of 5.51 and 7.13 compared with the standard drug. Phytochemical analysis of both the extracts proves the presence of phytochemicals as flavonoids, tannins, alkaloids, carbohydrates and triterpenes. The results have shown that Carica papaya methanol and aqueous extracts have drug ability as anti- HIV agent³³

Taxonomy, Morphology and Distribution Botanical Classification.

Domain:	Flowering plant
Kingdom	Plantae
Sub Kingdom	Tracheobionta
Class	Magnoliopsida
Subclass	Dilleniidae
Superdivision:	Spermatophyta
Phyllum:	Steptophyta
Order:	Brassicales
Family:	Caricaceae
Genus	Carica
Botanical Name	papaya Linn

Nutritional value:-

Constituents	Ripe Papaya	Green Papaya
Water	89.1 gm	92.6 gm
Proteins	8.26 gm	10.8 gm
Total lipid	0.93 gm	1.35 gm
Ash	4.59 gm	6.76 gm
Carbohydrates	86.2 gm	81.1 gm
Total DF	11.9 gm	27.0 gm
Sugar		

Mineral Macronutrients:-

Sodium	128.4 mg	283.8 mg
Potassium	1238 mg	2743 mg
Magnesium	229.4 mg	635.1 mg
Phosphorus	NR	NR
Calcium	146.8 mg	432.4 mg
Iron	12.84 mg	8.11 mg
Copper	0.18 mg	0.14 mg
Zinc	0.92 mg	0 mg
Manganese	NR	NR





Conculsion:-

Papaya (*Carica papaya* Linn.) is well known for its exceptional and medicinal properties throughout the world. The whole Papaya plant including its leaves, seeds, ripe and unripe fruits and their juices is used as traditional medicine. *Carica papaya* is a nutraceutical plant having a wide range of pharmacological activities. The whole plant has its own medicinal value. The wide range of enzymes, vitamins present in *Carica papaya* makes it a nutraceutical plant.

Declaration of interest ; - The authors report no declarations of interest. Funding herself

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