

# *Carica papaya* leaves: One of dynamic plant parts having multiple therapeutic activities

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## REVIEW ARTICLE

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### ABSTRACT

**Introduction:** Papaya (*Carica papaya* Linn.) belongs to the Caricaceae family. Papaya is well known around the world for its medicinal and nutritional properties. Various parts of the plant like, fruits, roots, bark, peel, seeds and pulp are known to have medicinal properties and scientifically established for the various properties. Since the ancient times, part of plants has been utilized for their medicinal values. The plant contains high amount of vitamins A, B and C as well as proteolytic enzyme such as papain and chymopapain. Due to such type of versatile phytoconstituents, the plants show lots of pharmacological application. In this review article we summarized the information regarding the various pharmacological activities of papaya leaf such as anticancer, anti-inflammatory, antidiabetic, antispasmodic, antifungal, antisickling, antioxidant, antimicrobial, antimalarial, as well as helps in proper digestion, hair growth, skin related problems and relief in menstrual pain.

**Methods:** All information presented in this review article regarding the beneficial application of *Carica papaya* leaf extract has been acquired by imminent various electronic databases including Scopus, Google scholar, Science Direct, Web of science, and PubMed.

**Result:** The papaya plant, including fruit, leaves, seed, bark, latex and its ingredients, plays an important part in the management of progressive illness. The papaya leaf contains active ingredients such as alkaloids, glycosides, phenols, tannins, saponins and the flavonoids responsible for the basketful therapeutic function.

**Conclusion:** The main findings showed that papaya leaf extract has strong medicinal properties. The leaves of papaya may also useful in cosmetic applications..

**Keywords:** *Carica papaya* leaves, phytochemical constituents, therapeutic application

## 1. Introduction

*Carica papaya* Linn, of the Caricaceae family, is commonly referred to as papaya in English, Papita in Hindi and Erandakarkati in Sanskrit. The plant originated in the America and in 16<sup>th</sup> century it was introduced to India. Papaya is a well-known plant and it's also called powerhouse of nutrients. The papaya tree is an Indian tree which is essentially short lived. Because of its buttery flavor and beauty, it was considered an exotic fruit in the historical period. Papaya was the first human-eaten genetically modified fruit for its nutritional and medicinal properties. (1) Traditionally leaves have been used for treatment of a wide range of ailments, like in

treatment of malaria, dengue, jaundice, immunomodulatory and antiviral activity. 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. Both leaf and fruit of the *Carica papaya* Linn. Possess carotenoids namely  $\beta$ -carotene, lycopene, anthraquinones 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. Leaves

being an important part of several traditional formulations were undertaken for standardization for various parameters like moisture content, extractive values, ash values, swelling index, etc. (2)

### 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: *Carica papaya* Linn (Ayurvedic pharmacopoeia of India, Govt of India, I.)

#### Synonyms of *Carica papaya* Linn

Indian and International synonyms of *Carica papaya* Linn. are described (Table 1, and 2)

**Table 1.** Indian Synonyms of *Carica papaya* Linn (1)

Language	Region	Names
<b>Hindi</b>	Haryana, Delhi	Papaya, Papita
<b>Bengali</b>	West Bengal	Papaya, Pepe, Papita
<b>Malyalam</b>	Kerala	Om kai
<b>Punjabi</b>	Punjab	Papita
<b>Marathi</b>	Maharashtra	Papai
<b>Tamil</b>	Tamil Nadu	Pappali
<b>Gujrati</b>	Gujrat	Papaya

**Table 2.** International Synonym of *Carica papaya* Linn (1)

Country	Names
<b>India</b>	Papita
<b>Holland</b>	Tree Melon
<b>France</b>	Papay
<b>Australia</b>	Paw Paw
<b>UK</b>	Papaya, Paw Paw

### Geographical Distribution

Though the exact area of origin is unknown, the papaya is believed native to Tropical America, perhaps in Southern Mexico and neighboring 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 the states of Maharashtra, Bengal, Bihar, Haryana, Punjab, Delhi, Andhra Pradesh and Uttar Pradesh. (3)

### Nutritional value of 100 g of papaya fruit

The papaya is a large, tree-like plant, with a single stem rising from 5 to 10 m (16 to 33 ft) tall, with the leaves restricted to the trunk in spiral. The leaves are wide, 50-70 cm in diameter, with seven lobes deeply lobed in the palm. Uncommonly, the tree is unbranched, unless lopped. The flowers emerge on the leaves on the axils, ripening into large berries. The fruit is ripe when it feels tender, and has achieved amber to orange hue in its skin. Ripe papaya and green papaya vary in nutritional content. (3-5)

**Table 3.** Nutritional Constituents of *Carica papaya* Linn

Constituents	Ripe Papaya	Green Papaya
Protein	0.6 g	0.7 g
Fat	0.1 g	0.2 g
Ash	4.59 g	6.76 g
Fibers	0.8 g	0.9 g
Carbohydrates	7.2 g	5.7 g
Energy	32kcal	27kcal
Total Carotene	2740µm	0
Beta Carotene	888 µm	0
<b>Mineral</b>		
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
<b>Micro nutrients</b>		
Iron	12.84 mg	8.11 mg
Copper	0.8 mg	0.14 mg
Zinc	0.92 mg	0
Manganese	NR	NR
Selenium	NR	NR
<b>Vitamins</b>		
Vit C	568.8 mg	391.9 mg
Thiamin	0.28 mg	0.54 mg
Riboflavin	0.28 mg	26 mg
Niacin	2.80 mg	4.05 mg
Panthenic acid	NR	NR







## 2. Chemical Constituents of *Carica papaya* Linn.


*Carica papaya* Linn. is one of the precious plants used for different medicinal uses. Leaves, seeds and fruits of *Carica papaya* is

**Table 4.** Chemical Constituents and uses of *Carica papaya* Linn with different geographical locations (4, 6)

used as an ethno-medicine. This work describes biochemical constituents of leaves of *Carica papaya*. Chemical composition of various part of *Carica papaya* plant are described in table 4.

Sr. No.	Parts of Plant	Chemical Constituents	Uses	Images
1	Fruit	Protein, fat, fiber, carbohydrates, minerals, calcium, phosphorus, iron, vitamin C, thiamine, riboflavin, niacin, and carotene, amino acid, citric acids and malic acid (green fruits), volatile	Sinusitis, chronic forms of skin indurations in Caribe, Philippines; Chronic skin ulcers in Jamaica Stomachic, digestive, diuretic,	

		compounds: linalol, benzylisothiocynate, cis and trans 2, 6-dimethyl-3,6 epoxy-7 octen-2-ol. Alkaloid, $\alpha$ ; carpaine, benzyl- $\beta$ -d glucoside, 2-phenylethyl- $\beta$ -D-glucoside, 4-hydroxyl -phenyl-2 ethyl-B-D glucoside and four isomeric malonated benzyl- $\beta$ -D glucosides	expectorant, sedative and tonic, bleeding Piles and dyspepsia in India, Malaria, hypertension, diabetes mellitus, hypercholesterolemia, jaundice Intestinal helminthiasis in Nigeria	
2	<b>Juice</b>	N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic acids-vaccenic acid and oleic acids	Treats Dengue fever, Anti-Malarial properties, Good for liver, Supports digestion, Lowers blood sugar levels, Cure to Your menstrual pain, Helps treat skin problem, Promotes hair growth.	
3	<b>Seed</b>	Fatty acids, crude proteins, crude fibre, papaya oil, carpaine, benzylisothiocynate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane, $\beta$ -sistosterol, caricin and an enzyme nyrosin	Anti-fertility. Antimicrobial, fungicidal, carminative, counter irritant	
4	<b>Root</b>	Arposide and an enzyme myrosin	Digestive, tonic, abortifacient in Australia, sore teeth in India, syphilis in Africa	
5	<b>Leaves</b>	Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E	Heart tonic, febrifuge, vermifuge, colic, dengue fever, beriberi, abortion, asthma India, Stomach troubles, cancer in Australia	
6	<b>Bark</b>	$\beta$ -sitosterol, glucose, fructose, sucrose, galactose and xylitol	Digestive, tonic, abortifacient in Australia, sore teeth in India, syphilis in Africa	
7	<b>Latex</b>	proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapain A,	Dermatitis and psoriasis in Africa, Asia, Europe	

	B and C, peptidase A and B and lysozymes	
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Papaya contains several unique protein-digesting proteolytic enzymes including papain and chymopapain. All having different therapeutic application (3)

**Table 5.** List of enzymes in Papaya plant with therapeutic applications

Enzyme	Therapeutic Application
<b>Papain</b>	This enzyme is similar to pepsin, a digestive enzyme in our body
<b>Chymopapain</b>	A drug made from chymopapain used to be very popular in treating slipped disk. Both papain and chymopapain can help lower inflammation and improve healing from burns
<b>Carpaine</b>	The alkaloid, Carpaine, slows the heart rate in humans and thus reduces blood pressure. Its action is similar to the drug prescribed for heart patients, digitalis. The alkaloid is reported to be able to kill worms and amoebas
<b>Lycopene</b>	Papaya has an abundance of cancer fighting lycopene. It is a key intermediate in the biosynthesis of many important carotenoids, such as beta-carotene and xanthophylls
<b>Fibrin</b>	Another useful compound not readily found in the plant kingdom is Fibrin. It reduces the risk of blood clots and improves the quality of blood cells, optimizing the ability of blood to flow through the circulatory system. Fibrin is also important in preventing stroke

Akhila S. et al., figure out other papaya leaves constituents by LCMS strategy. They detect 21 active pharmacological constituents of leaf extract of papaya. All detected compounds are listed in table 6.

**Table 6.** Phytochemical constituents of Leaves of *Carica papaya* Linn.(7)

Phytochemical constituents	Molecular mass
<b>Tocopherol</b>	430.72
<b>Ascorbic acid</b>	176.13
<b>Carpaine</b>	466.71
<b>Deoxykaempferol</b>	270.25
<b>Kaempferol</b>	286.24
<b>Deoxyquercetin</b>	286.25
<b>Quercetin</b>	302.24
<b>Dicoumarol</b>	336.31
<b>Coumaroylquinic acid</b>	338.32
<b>Coumarin</b>	146.15
<b>Folic acid</b>	441.41
<b>Cystine</b>	121.16
<b>Homocysteine</b>	135.19
<b>Cysteine sulphoxide</b>	177.22
<b>L glutamic acid</b>	147.13
<b>P- coumaroyl alcohol</b>	150.18
<b>Dimethoxy phenol</b>	154.17
<b>Umbelliferone</b>	162.19



Phenylalanine	165.19
Caffeoyl alcohol	166.18
Methyl nonyl ketone	170.30

### 3. Therapeutic application

#### Anti-tumor activity

Otsuki et al., studied the antitumor activity of leaf extract of papaya (0.625-20 mg/mL). The extract inhibited the proliferative response of solid tumor cell lines derived from cervical carcinoma (Hela), breast cancer (MCF-7), hepatocellular carcinoma (HepG2), Lung cancer (PC14), Pancreatic epithelial carcinoma (Panc-1) and mesothelioma (H2452) in a dose dependent manner. (8) Singh et al., discover the biosynthesis and characterization of silver nanoparticles (AgNPs) with papaya leaf extract (PLE) and its anti-cancer properties against different human cancer cells. Purified nanoparticles were characterized by standard techniques, such as TEM, STM, SEM, EDS, XRD, and FTIR. AgNPs-PLE when compared with AgNPs-citric acid or PLE showed better efficacy against cancer cells and was also relatively less toxic to normal cells. The developed Pa-AgNPs showed efficient antibacterial activity (ZOI) against gram negative (*E. coli*) and gram positive (*S. aureus*) bacteria. (9, 10)

Habiba et al., synthesize iron oxide nanoparticles by the recently developed green approach. It is extremely promising because of its non-toxicity and environmentally friendly behavior. In which nano scaled iron oxide particles ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>) were synthesized from hexahydrate ferric chloride (FeCl<sub>3</sub>.6H<sub>2</sub>O) with the addition of papaya (*Carica papaya*) leaf extract under atmospheric conditions. The synthesis of iron oxide nanoparticles was confirmed by systematic characterization using FTIR, XRD, FESEM, EDX and TGA studies. The synthesized nanoparticles showed moderate antibacterial activity against *Klebsiella spp.*, *E. Coli*, *Pseudomonas spp.*, *S. aureus* bacterial strains. While the cytotoxic effect of nanoparticles was shown to be toxic at full doses against Hela, BHK-21 and Vero cell lines, it can be considered for tumor cell damage as it displayed excellent action against the Hela and BHK-21 cell lines. (11)

Saleem et al., evaluate the comparative antimicrobial and antitumor capacity of endophytic papaya plant bacteria with antimicrobial and antitumor function of its plant extracts. Further scale up production of the bioactive compounds from these endophytic bacteria and identification of compounds by the spectroscopic techniques including NMR and mass spectrometry might yield commercially useful drugs. The extracts also exhibited notable *in vitro* cytotoxicity against colorectal carcinoma cell lines (HTC 116, ATTC CCL-247) by MTT assay. (12) Arif et al., researched the growth of tumor tissue in rats due to the combination of ethanol extract of *Moringa oleifera* L.) and ethanol extract of papaya leaves (*Carica papaya* L.) as an alternative to improved nutrition in slowing tumor tissue to be used as an alternative medicine for cancer for further studies in Phyto-therapy. This research was performed experimentally using a Complete Random Design (CRD) laboratory approach and findings indicate by different changes in body weight between groups during 12 weeks and that the combination of *Moringa oleifera* L.) ethanol extract and papaya leaves ethanol extract (*Carica papaya* L.) at a dosage of 150 mg / kg BW has efficacy in slowing cancer development. (13) Fauziya et al., studied the *Carica papaya* extracts may alter the growth of several types of cancer cell lines. Aqueous extract of papaya leaves (1.25 – 27 mg/ml or 0.625 -20 mg/ml) dose calculated according to *in vivo* and *in vitro* studies on many types of cell lines. The dose is effective against the stomach cancer line, lymphoma cell line, breast cancer cell line, colon cancer cell line, T-cell leukemia cell line and chronic myelogenous leukemia cell line, cervical carcinoma cell line respectively. (5)

#### Anti-oxidant activity

Farida et al., isolate and identify the active antioxidant compound in ethanol extract of papaya leaves (*Carica papaya* L.). Isolated compound evaluates through fractionation using vacuum liquid chromatography (VLC),

and the active fraction was purified using column chromatography (CC). The pure isolate was obtained with preparative thin-layer chromatographic (TLC) identified by spectroscopy. Its antioxidant activity was evaluated using 2,2-diphenyl-picryl-hydrazyl. The presence of phenols was analyzed using ultraviolet (UV)-visible, Fourier-transform infrared (FTIR), and gas chromatography (GC)-mass spectrometry (MS). The results showed that ethanol extract of papaya leaf has a strong antioxidant activity with IC<sub>50</sub> value of 100.0±0.07 ppm. (14)

### Anti-microbial activity

Rani et al., find out the natural mordanting followed by treatment with *Carica papaya* leaf-extracted dye using environmentally friendly solvents can significantly enhance UPF, antimicrobial property, color strength and fastness of dyed substrates offering directions for manufacturing textiles with good appearance and health benefits but without environmental hazards. (15)

### Dengue fever and thrombocytopenia activity

Kala et al., researched on to papaya leaves juice is an important herbal remedy to treat dengue fever. Kala & co-workers studied the behavior of the leaves and the increase in platelet counts ranged from patients to patients ranging from 8000 to 11000. Here showing that mostly aged group of person platelet formation is less compared to adult ones. (16) Tahir et al., studied the Papaya leaf juice prevents reversible thrombocytopenia induced by carboplatin in a dose dependent manner. There is no difference between male and female plants in this respect. In which explained that the effect of different doses of male and female papaya leaf juice on prevention of carboplatin induced thrombocytopenia in mice. A total of 55 Swiss albino mice were randomly divided into five groups (C, M10, M5, F10 and F5). Thrombocytopenia was induced in all groups by a single intraperitoneal injection of carboplatin. Male papaya leaf juice was given to prevent of thrombocytopenia to groups M10 and M5 and female papaya leaf juice was given to F10 and F5. On days 0, 7, 14 and 21 blood samples were collected by cardiac

puncture for platelet count. Significance of difference was calculated by one way ANOVA. (17) Pandita et al., studied the papaya leaf extract can be a safe and efficient treatment of chronic neonatal refractory thrombocytopenia. They find the potential mechanism of action involves allowing papaya extract has a membrane-stabilizing property and maybe could prevents lysis of platelets. Such samples were determined to be ALOX 12 rise (Arachidonate 12-Lipoxygenase, 12S Type) 15-fold activity and PTFAR (Platelet-Activity) Activating factor receptor) from 13-fold to 14-fold, and Raises the development of platelets, In fact, It's been mentioned that *Carica papaya* leaf flavonoids extract can inhibit protease associated with viral assembly. The other possible mechanism proof that leaf extract further useful in preventing the hemolysis and bleeding. (18)

### Anti-inflammatory activity

Owoyele et al., studied the anti-inflammatory activity of an ethanolic extract of *Carica papaya* leaves was investigated in rats using carrageenan induced paw oedema, cotton pellet granuloma and formaldehyde induced arthritis models. (19)

### Anti-sickling activity

Imega et al., examined methanolic leaf extracts of *Carica papaya* L. for possible *in vitro* antisickling and membrane-stabilizing activities involving the use of positive (p-hydroxybenzoic acid 5 mg/ml) and negative (normal saline) controls for the antisickling experiments and osmotic fragility test on Hbss red blood cells obtained from non-crisis state sickle cell patients. Fragiliograms indicated that the plant extract reduced hemolysis and protected erythrocyte membrane integrity under osmotic stress conditions. Pretreatment of SS cell suspensions with *C. papaya* leaf extract inhibited formation of sickle cells under severe hypoxia, with only 0 - 5% sickle cells at 40 min compared with untreated SS cell suspensions which had over 60% sickle cells. (20)

### Anti-fungal activity

Chavez-Quintal et al., describe the ethanolic extracts from *Carica papaya* L.

Leaves are a potential source of secondary metabolites with antifungal properties. (21)

### Antispasmodic activity

Julianti et al., find out the antiplasmodial activity of the leaf extracts and of the main alkaloid carpaine were recently confirmed. A quantitative assay for determination of carpaine in papaya leaves was developed and validated. The assay involved pressurize liquid extraction and quantification with the aid of ultrahigh-performance liquid chromatography-tandem mass spectroscopy. (22) Melariri et al., investigated the antiplasmodial properties of crude extracts from *Carica papaya* leaves to trace the activity through bioassay guided fractionation. The greatest antiplasmodial activity was observed in the ethyl acetate crude extract. *C. papaya* showed a high selectivity for *P. falciparum* against CHO cells with a selectivity index of 249.25 and 185.37 in the chloroquine-sensitive D10 and chloroquine-resistant DD2 strains, respectively. The study demonstrated greater antiplasmodial activity of the crude ethyl acetate extract of *Carica papaya* leaves with an IC<sub>50</sub> of  $2.96 \pm 0.14$   $\mu\text{g/ml}$  when compared to the activity of the fractions and isolated compounds. (23)

### Anti-fertility activity

Gadge et al., studied the anti-fertility effects of *Carica papaya* Linn on methanol leaf extracts in male wistar rats. The results obtained from the study that some level of caution in the use of these leaves in folkloric therapy of diseases. However, the drug could be a good source of birth control. Further it was shown that the papaya leaves were responsible for the changes seen in the semen as well as to identify actual fractions of the extract which possesses the anti-fertility properties. (24)

### Neuroprotective activity

Savla et al., find out the neuroprotective effect of papaya leaves extract. Alzheimer's disease (AD) is one of the most common neurodegenerative diseases among elderly people around the world. The tertiary butyl methyl ether fraction from methanol extract of dried papaya leaves shows the neuroprotective effect. It is proved by performing the Thioflavin T (ThT) assay and decoking studies

to perceive the inhibition of A $\beta$ -42 aggregation, a hallmark of AD. The tertiary butyl methyl ether fraction is non-cytotoxic in nature and shows the neuroprotection against anti-nerve growth factor (anti-NGF) induced cytotoxicity in PC-12 derived neurons. (25) Bindhu et al., studied the protective role of alcoholic leaf extract of *Carica papaya* in aluminium induced cognitive dysfunction and oxidative damage in albino rats and to explore the neuroprotective effect *Carica papaya* by using acetylcholine. The present study indicates the cumulative protective effect of *Carica papaya* leaf with high level of antioxidant activity against AlCl<sub>3</sub> induced spatial memory deficit and further confirms the beneficial effects of antioxidant in neurodegenerative disorders. (26)

### Antidiabetic activity

Maniyar et al., conclude that AEPCL is effective controlling blood glucose level improving lipid profile in diabetic rats. He was studied the plant having antihyperglycemic and hypolipemic activities may give approach the treatments of diabetes mellitus. Maniyar found the uses of aqueous extract of *Carica papaya* Linn. in alloxan induced diabetic rates. AEPCL showed significant reduction ( $p < 0.01$ ) in blood glucose level. (27) Juárez-Rojop et al., find out the hypoglycemic effect of the aqueous extract of *Carica. Papaya* leaves helpful in diabetic rats. Result showing the aqueous extract of *Carica papaya* (0.75 g and 1.5 g/100 mL) significantly decreased blood glucose levels ( $p < 0.05$ ) in diabetic rats compared by the administration of 60 mg/kg of streptozotocin (STZ). (28)

### Wound healing activity

Mahmood et al., find out the wound healing properties of *Carica papaya* leaf extract with the help of Vaseline jelly and Solcoseryl jelly on apply to different rats. All animal were experimentally wounded on specific area. Different dose are given to all animal and find out good result. (29)

### Menstrual pain

Abidah et al., studied the papaya leaf extract (*Carica papaya* L.) can decrease the level of menstrual pain and prostaglandin levels in primary dysmenorrhea. In which abidah used



randomized pretest posttest control group design. There were 32 samples recruited using simple random sampling, with 16 each assigned to an experiment and control group. Numerical Rating Scale (NRS) was used to measure menstrual pain, and the level of prostaglandin was measured using the enzyme-linked immunosorbent assay (ELISA) method. Independent t-test and paired t-test were performed for data analysis. There was statistically significant difference of menstrual pain and prostaglandin level before and after intervention with p-value 0.000 (<0.005), which indicated that papaya leaf extract had a significant effect on reducing menstrual pain. (30) Imandiri et al., studied the acupuncture and herbs therapies can reduce menstrual pain. Acupuncture therapy at point Liangmen (ST 21), Zhaohai (KI 6), Xingjian (LR 2), and Guanyuan (CV 4) combined with papaya leaf herbs (*Carica Papaya* L.) not only can reduce menstrual pain but also menstrual symptoms classified kidney and liver deficiency syndrome. (31)

**Hair growth**

Sundaram et al., studied the nutrients in papaya leaves help in preventing balding. Applying the leaf extract minimum twice every week on hair can help promotes the hair growth and prevents baldness and thinning

hair. Papaya leaf extract is made by crushing the tender and young leaves of the *Carica papaya* plant. (32)

**Body weight**

Erwan et al., check out the effect of pellet rationing papaya leaf flour inclusion on broiler efficiency including feed intake, body weight gain and feed conversion ratio in which is used for 4 treatments and 4 replications. The treatments were T1: 0% Papaya leaf flour in ration formulation, T2: 3% Papaya leave meals in ration formulation, T3: 6% Papaya leave meals in ration formulation and T4: 9% Papaya leave meals in ration formulation. And showing the significant effect (P<0.05) of treatment on feed consumption, but not significant (P>0.05) on body weight gain and feed conversion ratio. The outcome recommends that the inclusion of papaya leave meals up to 9% into pellet ration may not alter broiler performance. (33) Uzoma et al., studied weight loss technique was used to investigate the use of *Carica papaya* leaves extract as a bio-corrosion inhibitor for mild steel applications in a marine environment. The result showed that the *Carica papaya* leaf extract is active for control of bio-corrosion of both untreated and treated mild steel in a marine environment. (34)

**Table 7. Marketed formulations of *Carica papaya* leaf extract**

Sr. No.	Name of the dosage forms available in market	Marketed formulations
1	<i>Carica papaya</i> leaf syrup	Plato plus
		Caripaya
		Platimax
		Denplat plus
		Pyrapap
		Caroid
		Platestra
		Riyoplat
		Platenza
		Tangee
		Minmin pb
		Plate - o -fast
		Pepmax efferevecent
		Plant save
		Platipump
		Platwin
		Platezesat

2	<i>Carica papaya</i> leaf tablet	Platigain
		Upcell
		Vita g9p
		Pepaero
		Pepfil
		Tthrombomax
		Xttraplate
		Carlet
		Pop e
		Cari plust
		Gotwel
		Caripill
		3
Carica papaya mother tincture		
Sbl carica papaya dilution		
Platerise plus sachet		
Can dengue drops		
Carica papaya mother tincture		
Papaya leaf powder		
4	<i>Carica papaya</i> leaf capsule	Platigen
		Platewin plus

#### 4. Discussion

The whole plants of plant has its own medicinal important. Many enzymes and vitamins present in plant of *Carica papaya* and make in neutralceutical plant. The papaya has wide variety of pharmacological properties. The present review is about the pharmacological activities and uses of its chemical constituents.

#### 5. Conclusion

The present review is mainly focused on finding the secrets behind the papaya leaves reveals, the importance of using *Carica papaya* L. as a medicine and a natural promising herb. *Carica papaya* has the great potential against a number of ailments and health problem. The key purpose of papaya leaves is to control platelet level in the body. *Carica papaya* leaves precisely effective in specific diseases, too. The separate study reveals that Papaya leaves support papaya immune system as a powerful cancer fighter that is efficient against multiple cell lines, and leaves extract is also useful in cosmetic preparation and offers immunity to other diseases such as antiviral, ant diabetic, dysmenorrhoea, antispasmodic, anti-fungal, etc.

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#### Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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