Review on nutritional, medicinal and pharmacological properties of Papaya (*Carica papaya* Linn.)

K L Krishna1*, M Paridhavi2 and Jagruti A Patel3

1JSS College of Pharmacy, SS Nagar, Mysore-570 015, Karnataka, India
2Rajiv Gandhi Institute of Pharmacy, Trikarpur-671 310, Kasargod District, Kerala, India
3Institute of Pharmacy, Nirma University of Science & Technology, Ahmedabad-382 481, Gujarat, India

*Correspondent author, E-mail: krishpharm@rediffmail.com
Phone: 0821-249 7583, 249 5900; +91-9886610010 (Mob.)

Received 31 May 2007; Accepted 7 April 2008

**Abstract**

Papaya (*Carica papaya* Linn.) is commonly known for its food and nutritional values throughout the world. The medicinal properties of papaya fruit and other parts of the plant are also well known in traditional system of medicine. Since, each part of papaya tree possesses economic value, it is grown on commercial scale. During the last few decades considerable progress has been achieved regarding the biological activity and medicinal application of papaya and now it is considered as valuable nutraceutical fruit plant. It can be chosen as a source of papain for the development of various industrial and pharmaceutical products. 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.

**Keywords:** Papaya, *Carica papaya*, Medicinal plant, Nutraceutical, Fruit, Papain.

**IPC code; Int. cl.** A61K 36/00, A23L 1/00

**Introduction**

The papaya tree belongs to a small family — Caricaceae having four genera 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* Lennie & 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 industries1-3. Papaya contains broad spectrum of phytochemicals including, polysaccharides, vitamins, minerals, enzymes, proteins, alkaloids, glycosides, fats and oils, lectins, saponins, flavonoids, sterols, etc. (Table 1)1-3,4.

The present paper deals with origin and distribution, brief morphological characters, nutritional value and results of reported research findings on its medicinal properties.

**Origin, Distribution and Morphology**

Papaya is probably originated in southern 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 3-10 m 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 racemes.
with 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 present. Papaya is a common man’s fruit, which is reasonably priced and has a high nutritive value. It is low in calories and rich in natural vitamins and minerals. Papaya places first among the fruits for vitamin C, vitamin A, riboflavin, folate, calcium, thiamine, iron, niacin, potassium and fibre. The comparative low calories content (32 kcal/100g of ripe fruit) makes this a favourite fruit of obese people who are into weight reducing regime. Papaya has more carotene compared to other fruits such as apples, guavas, sitaphal and plantains, which help to prevent damage by free radicals. Unripe green papaya is used as vegetable, it does not contain carotene but all other nutrients are present (Table 2). It is also used in salads, pies, sherbets, juices and confections. Papaya when consumed regularly will ensure a good supply of vitamin A and C, which are essential for good health especially for eyesight and can help to prevent early age blindness in children. The fruit is a rich source for different types of enzymes. Papain, vegetable pepsin present in good amount in unripe fruit is an excellent aid to digestion, which helps to digest the protein in food at acid, alkaline or neutral medium. Thus, it can be prescribed for dyspeptic patients, as papain may help in the digestion of proteins. The celiac disease patients, who cannot digest the wheat protein gliadin, can tolerate it, if it is treated with crude papain. Papaya has the property of tenderizing meat. This knowledge is being put to use by cooking meat with raw papaya to make it tender and digestible.

The fermented papaya fruit is a promising nutraceutical as an antioxidant. It improves the antioxidant defence in elderly patients even without any overt antioxidant deficiency state at the dose of 9g/day orally. The papaya lipase, a hydrolase enzyme tightly bonded to the water insoluble fraction of crude papain, is considered as a "naturally immobilized" biocatalyst. The dried fruit skin is a potential source as dietary ingredient for broiler chickens, it gives similar food consumption, food conversion efficiency, survivability and meat yields to a control diet when used up to 120g/kg of diet. Fouzder SK et al have reported that, dried papaya skin could safely be used up to different types of enzymes. Papain, vegetable pepsin present in good amount in unripe fruit is an excellent aid to digestion, which helps to digest the protein in food at acid, alkaline or neutral medium. Thus, it can be prescribed for dyspeptic patients, as papain may help in the digestion of proteins. The celiac disease patients, who cannot digest the wheat protein gliadin, can tolerate it, if it is treated with crude papain. Papaya has the property of tenderizing meat. This knowledge is being put to use by cooking meat with raw papaya to make it tender and digestible.

### Nutritional value

Papaya is a common man’s fruit, which is reasonably priced and has a high nutritive value. It is low in calories and rich in natural vitamins and minerals. Papaya places first among the fruits for vitamin C, vitamin A, riboflavin, folate, calcium, thiamine, iron, niacin, potassium and fibre. The comparative low calories content (32 kcal/100g of ripe fruit) makes this a favourite fruit of obese people who are into weight reducing regime. Papaya has more carotene compared to other fruits such as apples, guavas, sitaphal and plantains, which help to prevent damage by free radicals. Unripe green papaya is used as vegetable, it does not contain carotene but all other nutrients are present (Table 2). It is also used in salads, pies, sherbets, juices and confectons. Papaya when consumed regularly will ensure a good supply of vitamin A and C, which are essential for good health especially for eyesight and can help to prevent early age blindness in children. The fruit is a rich source for different types of enzymes. Papain, vegetable pepsin present in good amount in unripe fruit is an excellent aid to digestion, which helps to digest the protein in food at acid, alkaline or neutral medium. Thus, it can be prescribed for dyspeptic patients, as papain may help in the digestion of proteins. The celiac disease patients, who cannot digest the wheat protein gliadin, can tolerate it, if it is treated with crude papain. Papaya has the property of tenderizing meat. This knowledge is being put to use by cooking meat with raw papaya to make it tender and digestible.

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### Table 1: Chemical composition of various parts of Papaya plant

<table>
<thead>
<tr>
<th>Part</th>
<th>Constituents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>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-glucose and four isomeric malonated benzyl-β-D-glucosides.</td>
</tr>
<tr>
<td>Juice</td>
<td>N-butric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic and cis-vaccenic and oleic acids.</td>
</tr>
<tr>
<td>Seed</td>
<td>Fatty acids, crude protein, crude fibre, papaya oil, Carpaine, benzylisothiocyanate, benzylglucosinolate, glutotropacolin, benzylihourea, hentriacontane, β-sitosterol, carcin and an enzyme myrosin.</td>
</tr>
<tr>
<td>Root</td>
<td>Carposide and an enzyme myrosin.</td>
</tr>
<tr>
<td>Leaves</td>
<td>Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E.</td>
</tr>
<tr>
<td>Bark</td>
<td>β-Sitosterol, glucose, fructose, sucrose, galactose and xylitol.</td>
</tr>
<tr>
<td>Latex</td>
<td>Proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapains A, B and C, peptidase A and B and lysozymes.</td>
</tr>
</tbody>
</table>

### Table 2: Nutritive value of 100g of Papaya fruit

<table>
<thead>
<tr>
<th>Constituents</th>
<th>Ripe papaya</th>
<th>Green papaya</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>0.6 g</td>
<td>0.7 g</td>
</tr>
<tr>
<td>Fat</td>
<td>0.1 g</td>
<td>0.2 g</td>
</tr>
<tr>
<td>Minerals</td>
<td>0.5 g</td>
<td>0.5 g</td>
</tr>
<tr>
<td>Fibre</td>
<td>0.8 g</td>
<td>0.9 g</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>7.2 g</td>
<td>5.7 g</td>
</tr>
<tr>
<td>Energy</td>
<td>32 kcal</td>
<td>27 kcal</td>
</tr>
<tr>
<td>Total carotene</td>
<td>2,740 µm</td>
<td>0</td>
</tr>
<tr>
<td>Beta carotene</td>
<td>888 µm</td>
<td>0</td>
</tr>
</tbody>
</table>
90g/kg in the diet of growing pullets\textsuperscript{10}. The papaya seed is also used in the ethnoveterinary practices\textsuperscript{11}.

Effective antioxidant supplementation Bionormalizer, a natural Japanese health food prepared by the fermentation of papaya, is able to improve the haemorrheology in alcoholics either by directly affecting the ethanol related lipoperoxidation and xanthine oxidase system activation and/or by modifying red blood cell membrane characteristics\textsuperscript{12}. It also exhibits therapeutic properties against various pathological disorder including tumours and immunodeficiency. Its protective action is based on the free radical scavenging activity as well as normalization of an organism’s superoxide level. It is proposed that, normalization of an organism’s superoxide level, which is due to inactivation of the ferrous ions, the catalyst of the superoxide driven Fenton reaction, is one of the molecular mechanism of Bionormalizer activity\textsuperscript{13,14}. Papaya markedly increases iron (Fe) absorption from rice meal, which was measured in parous Indian women, using the erythrocyte utilization of radioactive Fe method\textsuperscript{15}. The fruit is rich in vitamins, minerals, proteins, polysaccharides, lectins, saponins and flavonoids, and can be used in the prevention of complications of diabetes mellitus\textsuperscript{16}. The black seeds are edible and have a sharp, spicy taste. They are sometimes ground up and used as a substitute for black pepper. In some parts of Asia the young leaves of papaya are steamed and eaten like spinach\textsuperscript{3-4}.

**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 activity\textsuperscript{17}. The purified chemopapain from commercially available spray dried latex of the fruits has shown immunological properties\textsuperscript{18}. The anthelmintic activity of papaya seed has been variously ascribed to carpine (an alkaloid) and carpasemine (later identified as benzyl thiourea) and benzylisothiocyanate\textsuperscript{19}, cysteine proteinases from papaya fruit have also been reported\textsuperscript{20}. Carpine, 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 leaves\textsuperscript{21}.

Various pharmacological action(s) and medicinal uses of different parts of papaya are well reported in the ancient literature\textsuperscript{3, 21, 22}. Some of them especially Ayurvedic have been summarized in Table 3. 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

<table>
<thead>
<tr>
<th>Part</th>
<th>Medicinal uses</th>
</tr>
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<tbody>
<tr>
<td>Latex</td>
<td>Anthelmintic, relieves dyspepsia, cures diarrhoea, pain of burns and topical use, bleeding haemorrhoids, stomachic, whooping cough.</td>
</tr>
<tr>
<td>Ripe fruits</td>
<td>Stomachic, digestive, carminative, diuretic, dysentery and chronic diarrhoea, expectorant, sedative and tonic, relieves obesity, bleeding piles, wounds of the urinary tract, ringworm and skin diseases psoriasis.</td>
</tr>
<tr>
<td>Unripe fruit</td>
<td>Laxative, diuretic, dried fruit reduces enlarged spleen and liver, used in snakebite to remove poison, abortifacient, anti-implantation activity and antibacterial activity.</td>
</tr>
<tr>
<td>Seeds</td>
<td>Carminative, emmenagogue, vermifuge, abortifacient, counter irritant, as paste in the treatment of ringworm and psoriasis, anti-fertility agents in males.</td>
</tr>
<tr>
<td>Seed juice</td>
<td>Bleeding piles and enlarged liver and spleen.</td>
</tr>
<tr>
<td>Root</td>
<td>Abortifacient, diuretic, checking irregular bleeding from the uterus, piles, anti-fungal activity.</td>
</tr>
<tr>
<td>Leaves</td>
<td>Young leaves as vegetable, jaundice (fine paste), urinary complaints &amp; gonorrhoea (infusion), dressing wounds (fresh leaves), antibacterial activity, vermifuge, in colic, fever, beriberi, abortion (infusion), asthma (smoke).</td>
</tr>
<tr>
<td>Flowers</td>
<td>Jaundice, emmenagogue, febrifuge and pectoral properties.</td>
</tr>
<tr>
<td>Stem bark</td>
<td>Jaundice, anti-haemolytic activity, STD, sore teeth (inner bark), anti-fungal activity.</td>
</tr>
</tbody>
</table>
are several reports on the therapeutic properties and pharmacological actions of papaya based on modern scientific investigations. Some have been discussed below.

**Antimicrobial**

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 toxicity. 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 method. 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*.

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*, *Salmonella typhi*, *Staphylococcus aureus*, *Bacillus cereus*, *E. coli*, *P. aeruginosa* and *Shigella flexneri*.

The antimalarial petroleum ether extract of the rind of raw papaya fruit exhibits significant antimalarial 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 activity.

**Antifungal**

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 (as indicated by transmission electron microscopy observations). Latex alone is statically effective on *C. albicans* when added to a culture during the exponential growth phase and approximately 60% was achieved. This fungistatic effect is the result of cell wall degradation due to a lack of polysaccharides constituents in the outermost layers of the fungal cell wall and release of cell debris into the culture medium. Latex proteins appear to be responsible for antifungal action and minimum protein concentration for producing a complete inhibition was reported as about 138mg/ml.

**Effect on smooth muscles**

Ethanol extract of papaya seeds at 0.1-6.4mg/ml showed concentration dependent inhibition of jejunal contractions and found significantly irreversible. Thus, seed extract is capable of weakening the contractile capability of isolated rabbit jejunum. Pentane extract of papaya seeds has shown relaxation activity of matured papaya seeds has shown anti-amoebic activity against *Entamoeba histolytica*.
action on strips of dog carotid artery that had been pre-contracted with Phenylephrine. At the higher concentration, these are reported to be cytotoxic due to increasing the membrane permeability to Ca^{2+} (Ref. 45). A crude ethanol extract of unripe fruit produces a significant depression of mean arterial pressure but the extract has about 28% more depression action than hydralazine in the hypertensive rats. Fruit juice of papaya probably contains antihypertensive agent(s), which exhibits mainly alpha adenoreceptor activity 46,47. Papaya leaves extracts exhibited more than 50% relaxing effect on aortic ring preparations. This property demonstrates that many edible plants common in Asian diets possess potential health benefits, affording protection at the vascular endothelium level 48.

Rat uterine contractile activity was remarkably increased by different doses of papaya latex extract in proestrus and estrus stages compared to metestrus and diestrus stages of the estrous cycles. Crude papaya latex contain a uterotonic principle which might be a combination of enzymes, alkaloids and other substances which can evoke sustained contraction of the uterus acting mainly on the alpha adrenergic receptor population of the uterus at different stages 49. Ethanol extract (80%) of seeds causes a concentration dependent tocolysis of uterine strips isolated from gravid and non-gravid rats. High concentration extract is capable of causing irreversible uterine tocolysis probably due to the damaging effect of benzylisothiocyanate on the myometrium 50.

**Diuretic**

Aqueous root extract of papaya when given orally at a dose of 10 mg/kg to rats produces significant increase in urine output and shows similar profiles of urinary electrolyte excretion to that of Hydrochlorothiazide 51.

**Hepatoprotective**

The ethanol and aqueous extracts of the fruit possess remarkable hepatoprotective activity against CCl_4 induced hepatotoxicity. But hepatoprotective mechanism as well as active principles responsible for hepatoprotective activity of this plant is not yet known 52.

**Topical use**

Papaya fruits are used as topical ulcer dressings by registered nurses in the Spanish Town Hospital, Kingston Public Hospital and the University Hospital of the West Indies, Jamaica, which promotes desloughing, granulation and healing; it also reduces the odour in chronic skin ulcers. It is cost effective and is considered to be more effective than other topical applications in the treatment of chronic ulcers 53.

**Male antifertility**

Seed extract showed pronounced hypertrophy and hyperplasia of pituitary gonadotrophs. Whereas the male rats treated with seed extract revealed gradual degeneration of Germ, Sertoli and Leydig cells as well as germinal epithelium, which confirmed its antifertility activity 55. Aqueous extract of papaya seeds, 3 weeks after commencement of administration showed that the lumina of the seminiferous tubules were more prominent and empty in the experimental animals with no evidence of spermatids and spermatozoa 56. Verma et al have reported its effect on cauda epididymal microenvironment 57.

The benzene chromatographic fraction of the chloroform extract of the seeds possesses reversible male contraceptive potential and the effect appears to be mediated through the testis 58 and may be directly rendered on the spermatozoa 59 without adverse toxicity. Another study revealed inhibition of sperm motility due to other epididymal factors rather than the sub-cellular characteristics of testis and epididymis 60. A possible mechanism of action and preliminary studies on the antifertility effect of crude seeds on the gonads of male albino rats has been done by Udoh and Kehinde 61. A recent report revealed that it has good contraceptive efficacy in langur monkey and the action is mediated through inhibition of sperm motility 62.

The chloroform extract of seeds has shown contraceptive efficacy and reversibility in decreasing the sperm concentration in male adult rabbits. It
produces gradual decline in the sperm concentration, reached severe oligospermia (fewer than 20 million/ml) after 75 days treatment and attained uniform azoospermia after 120 days of treatment. It also affects the sperm motility and viability after 45 days of treatment and reached less than 1% after 75 days of treatment. It may selectively act on the developing germ cells, possibly mediated via Sertoli cells, leading to azoospermia. The crude chloroform extract of seed causes suppression of cauda epididymal sperm motility, which reduces fertility to zero % within 40 to 60 days of treatment. Reversible sterility could be induced in male rats using seed’s aqueous extract without adverse effects on libido and toxicological profile, and it could serve as an effective male contraceptive in rodents. Even aqueous extract of papaya bark has potential contraceptive activity. However, aqueous extract of the seeds of papaya failed to exhibit contraceptive effects at any of the dose regimens tested on male rabbits, contrary to the observations made in the previous studies. Unaltered toxicological profiles indicated that the drug was free of side effects.

Papaya seed extract changes the biochemical parameters (except cholesterol levels) and the contractile pattern of vas deferens. The distal vas deferens will affect more than the proximal vas and recovery will be slower probably due to its higher threshold requirement for androgen. A short term administration of an aqueous extract of papaya seed manifests an androgen deprived effect on the target organs and thereby causes antifertility effect in adult male albino rats. The data revealed that functional sterility could be induced in male rats by papaya seed extract treatment, which promises to be a potential male contraceptive as also supported by its traditional use in different parts of Assam.

Female antifertility
Sharma and Mahanta have reported that the composite root extract containing papaya root extract as one of the constituent, induces morphological changes in the endometrial surface epithelium in albino rat uterus. The characteristic smooth regular pattern of normal epithelium appears to have changed at places by haphazardly oriented groups of cells and loss of microvilli indicating a disorganized picture. Whereas seeds aqueous extract has shown abortifacient properties on female Sprague Dawley rats and the petroleum ether, alcoholic and aqueous extracts inhibits ovulation in rabbits. The papaya seed extracts did not exhibit anti-zygotic, anti-implantation, early abortifacient or antifertility activity.

Normal consumption of ripe papaya during pregnancy may not pose any significant danger. However, the unripe or semi-ripe papaya (which contains high concentration of the latex that produces marked uterine contractions) could be unsafe in pregnancy.

Histaminergic
Crude latex causes contraction of the isolated guinea pig ileum strips, which is mediated via H1-receptor and dependent on extracellular Ca2+ influx. Papaya flower pollen is able to induce respiratory IgE-mediated allergy. The existence of common allergens among papaya flower pollen, fruit and papain has been demonstrated by RAST inhibition.

Immunomodulatory
The involvement of oxidative stress mechanisms in several biological and pathological processes including ageing, cancer, cardiovascular and neurodegenerative diseases has continued to fuel suggestions that processes can potentially be modulated by treatment with free-radical scavengers and antioxidants. The fermented papaya preparation has shown its ability to modulate oxidative DNA damage due to H2O2 in rat pheochromocytoma cells and protection of brain oxidative damage in hypertensive rats. It has also exhibited potential supportive role on oxidative inflammatory damage in cirrhosis caused by hepatitis C virus. The safety and antioxidative stress potential of papaya juice is found to be comparable to the standard antioxidant compound α-tocopherol. The preparation containing yeast fermented papaya as one of the constituent has antioxidant actions and that it may be prophylactic food against age related and neurological diseases associated with free radicals.

Bacteriostatic activity of papaya could be correlated to its scavenging action on superoxide and hydroxyl radicals, which could be part of the cellular metabolism of such enteropathogens. Bio-catalyzer, which contains yeast fermented papaya, may be useful as health foods against neural lipid peroxidation, traumatic epilepsy and ageing. Consumptions of guava and papaya fruits reduce oxidative stress and alter lipid profile. Thus, it could reduce the risk of disease caused by free radical activities and high cholesterol in blood.
Papaya seed extract is currently being marketed as a nutritional supplement with purported ability to rejuvenate the body condition and to increase energy. The product claims to improve immunity against common infection and body functioning. This provides the evidence for its immunomodulatory and anti-inflammatory actions85.

Fermented papaya preparation exerts both immunomodulatory and antioxidant activity in the macrophage cell line RAW 264 and it is a macrophage activator, which augments nitric oxide synthesis and TNF-alpha secretion independently of lipopolysaccharides86. The antioxidant cocktail derived from fermentation of unpolished rice, papaya and seaweeds with effective microorganisms of lactic acid bacteria, yeast and photosynthetic bacteria has shown inhibition of lipid peroxidation in vivo, a point dependent on the concentrations of bioactive flavonoids87.

Conclusion

Papaya, popularly known as food article 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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