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Soft, Fleshy Fruit – Papaya

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Abstract

Papayas are a soft, fleshy fruit that can be used in a wide variety of culinary ways. Papaya have more on the health benefits, it is a tall herbaceous plant in the genus carica, its edible fruit is also called as papaya. It is native to tropical region of America, mainly from southern Mexico to Central America. chemical constituents like carbohydrates, protein, vitamins, alkanoids, saponins, tannins, steroids, flavonoids, are present. papaya have many biological activities and many pharmacological activities like, Antioxidant activity, Antiulcer activity, Antibacterial activity, Antifungal activity, Anti-amoebic activity, Wound-healing activity, Antihelmintic activity, Antiulcerogenic activity, Hypolipidemic activity, Hypertensive activity, Diuretic activity, Anti-fertility activity.

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INTRODUCTION:

Medicinal plants also called medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. Plants synthesize hundreds of chemical compounds for functions including defense against insects, fungi, diseases, and herbivorous mammals. Numerous phytochemicals with potential or established biological activity have been identified. However, since a single plant contains widely diverse phytochemicals, the effects of using a whole plant as medicine are uncertain. Further, the phytochemical content and pharmacological actions, if any, of many plants having medicinal potential remain unassessed by rigorous scientific research to define efficacy and safety. [1]

The possible health benefits of consuming papaya include a reduced risk of heart disease, diabetes, cancer, aiding in digestion, improving blood glucose control in people with diabetes, lowering blood pressure, and improving wound healing. [2]

Papayas are a soft, fleshy fruit that can be used in a wide variety of culinary ways. Here we will explore more on the health benefits, uses, how to incorporate more of them into your diet, and what nutritional value papayas have. [2]

SCIENTIFIC CLASSIFACTION:	
Scientific name	Carica papaya
Kingdom	Plantae
Phylum	Angiosperms
Class	Eudicots
Order	Brassicales
Family	Caricacea
Genus	Carica
Speices	C.papaya

Synonym:

Carica papaya, Paw paw, Papaia

Biological source:

Papaya is a tall herbaceous plant in the genus carica, its edible fruit is also called as papaya. It is native to tropical region of America, mainly from southern Mexico to Central America. Now these plants are grown in all tropical regions of the world. Papayas are plants of tropical regions and for the growth and fruit production, they need a warm climate. They cannot live with low temperatures. [3]

Geographical distribution:

Native to Mexico and northern South America, papaya has become naturalized throughout Caribbean islands, Florida, Texas, California, Hawaii, and other tropical and subtropical regions of the world. [3]

Cultivation & Collection:

Papaya plants grow in three sexes: male, female, hermaphrodite. The male produces only pollen, never fruit. The female will produce small, inedible fruits unless pollinated. The hermaphrodite can self-pollinate since its flowers contain both male stamens and female ovaries. Almost all commercial papaya orchards contain only hermaphrodites. Originally from southern Mexico (particularly Chiapas and Veracruz), Central America, and northern South America, the papaya is now cultivated in most tropical countries. In cultivation, it grows rapidly, fruiting within three years. It is, however, highly frost-sensitive, limiting its production to tropical climates. Temperatures below −2 °C (29 °F) are greatly harmful if not fatal. In Florida, California, and Texas, growth is generally limited to southern parts of the states. It prefers sandy, well-drained soil, as standing water will kill the plant within 24 hours. For cultivation, however, only female plants are used, since they give off a single flower each time, and close to the base of the plant, while the male gives off multiple flowers in long stems, which result in poorer quality fruit. Two kinds of papayas are commonly grown. One has sweet, red or orange flesh, and the other has yellow flesh; in Australia, these are called "red papaya" and "yellow papaw", respectively. Either kind, picked green, is called a "green papaya". The large-fruited, red-fleshed 'Maradol', 'Sunrise', and 'Caribbean Red' papayas often sold in U.S. markets are commonly grown in Mexico and Belize. In 2011, Philippine researchers reported that by hybridizing papaya with Vasconcellea quercifolia, they had developed conventionally bred, non-genetically engineered papaya resistant to PRV. [4]

Morphology:

Leaf - The long-petioled (stemmed) leaves, which may be 30 to 105 cm long (1 to 3.5 ft.) and 30 to 60 cm (1 to 2 ft.) wide, are deeply divided into 5 to 9 main segments, which are further lobed. Both leaves and stems contain large amounts of white, milky latex. [4]

Stem - The papaya plant has a hollow, green or purple stem, and can grow 1.8 to 3 m (6 to 10 ft) in a year, eventually reaching heights of 6 to 9 m (20 to 30 ft.). [4]

Root - Young roots show well-differentiated epidermis, cortex, and endodermis, enclosing an exarch vasculature in which six xylems and six phloem poles alternate. Cambium formation in a concentric ring triggers secondary growth and root thickening while maintaining succulence. The papaya root is predominately a non-axial, fibrous system, composed of one or two 0.5–1.0 m long tap roots. Secondary roots emerge from the upper sections and branch profusely. These second-order feeding roots remain shallow during the entire life of the plant and show considerable gravitropic plasticity. Many adventitious, lower-order categories of thick and fine roots are also observed in excavated specimens. Healthy roots are of a whitish cream color, and no laticifers have been observed in them. [5]

Chemical constituents:

Leaf - In reference to the phytochemical analysis of *Carica papaya L.*, Caricaceae, leaf extract, the presence of flavonoids, tannins, alkaloids and organic acids in a methanolic extract has been previously. The main compounds contained by *C. Papaya* leaves are phenolic acids, as well as trace amounts of chlorogenic acid, compared to flavonoids and coumarin compounds. In their study, the authors suggested that the presence of such phenolic and coumarin compounds in *C. papaya* leaves could partially explain the pharmacological properties of this plant. Different bioactive phytochemicals found in *C. papaya* possess a wide range of biological activities that can be of valuable therapeutic index. However, the absence or presence of metabolites may be due to differences in polarity of the solvents used for the extraction. [6]

Stem- The *Carica papaya* stem, among several chemical constituents has carbohydrates, protein, ash, vitamins and moisture in various quantities. In addition, phytochemical like alkanoids, saponins, tannins, and steroids were found present. [7]

Fruit - Chemical components of per 100 g orange fresh papaya fruit [8]

Nutrient	Units	Value per 100 grams
Proximates		
Water	G	88.83
Energy	Kcal	39
Energy	Kj	163
Protein	G	0.61
Total lipid (fat)	G	0.14
Ash	G	0.61
Carbohydrate, by difference	G	9.81
Fiber, total dietary	G	1.8
Sugars, total	G	5.90
Minerals		
Calcium, Ca	Mg	24
Magnesium, Mg	Mg	10
Potassium, K	Mg	257
Sodium, Na	Mg	3
Zinc, Zn	Mg	0.07
Vitamins		
Vitamin C, total ascorbic acid	Mg	61.8
Niacin	Mg	0.338
Pantothenic acid	Mg	0.218
Folate, total	Mcg	38

Folate, food	Mcg	38
Folate, DFE	mcg_DFE	38
Choline, total	Mg	6.1
Vitamin A,IU	IU	1094
Vitamin A, RAE	mcg_RAE	55
Virtamin E (alpha-tocopherol)	Mg	0.73
Vitamin K	Mcg	2.6
Lipids		
Fatty acids, toital saturated	G	0.043
Fatty acids, total monosaturated	G	0.038
Fatty acids, total polysaturated	G	0.031
Other		
Carotene, beta	Mcg	276
Cryptoxanthin, beta	Mcg	761
Lutein+Zeaxanthin	Mcg	75

USES:

1. **Age-related macular degeneration**
   Zeaxanthin, an antioxidant found in papaya, filters out harmful blue light rays. It is thought to play a protective role in eye health, and it may ward off macular degeneration. However, a higher intake of all fruits has been shown to decrease the risk of and progression of age-related macular degeneration. [10]
2. **Asthma prevention**
   The risk of developing asthma is lower in people who consume a high amount of certain nutrients. One of these nutrients is beta-carotene, contained in foods like papaya, apricots, broccoli, cantaloupe, pumpkin, and carrots. [10]
3. **Cancer**
   Consuming the antioxidant beta-carotene, found in papayas, may reduce cancer risk. Among younger men, diets rich in beta-carotene may play a protective role against prostate cancer, according to a study published in the journal *Cancer Epidemiology and Prevention Biomarkers*. [10]
4. **Bone health**
   Low intakes of vitamin K have been associated with a higher risk of bone fracture. Adequate vitamin K consumption is important for good health, as it improves calcium absorption and may reduce urinary excretion of calcium, meaning there is more calcium in the body to strengthen and rebuild bones. [10]
5. **Diabetes**
   Studies have shown that people with type 1 diabetes who consume high-fiber diets have lower blood glucose levels, and people with type 2 diabetes may have improved blood sugar, lipid, and insulin levels. One small papaya provides about 3 grams of fiber, which is equivalent to just 17 grams of carbohydrates. [10]
6. **Digestion**
   Papayas contain an enzyme called papain that aids digestion; in fact, it can be used as a meat tenderizer. Papaya is also high in fiber and water content, both of which help to prevent constipation and promote regularity and a healthy digestive tract. [10]
7. **Heart disease**
   The fiber, potassium, and vitamin content in papaya all help to ward off heart disease. An increase in potassium intake along with a decrease in sodium intake is the most important dietary change that a person can make to reduce their risk of cardiovascular disease. [10]
8. **Inflammation**
   Choline is a very important and versatile nutrient found in papayas that aids our bodies in sleep, muscle movement, learning, and memory. Choline also helps to maintain the structure of cellular membranes, aids in the transmission of nerve impulses, assists in the absorption of fat, and reduces chronic inflammation. [10]
9. **Skin and healing**
   When used topically, mashed papaya appears to be beneficial for promoting wound healing and preventing infection of burned areas. Researchers believe that the proteolytic enzymes chymopapain and papain in papaya are responsible for their beneficial effects. Ointments containing the papain enzyme have also been used to treat decubitus ulcers (bedsores). [10]
10. **Hair health**

Papaya is also great for hair because it contains vitamin A, a nutrient required for sebum production, which keeps hair moisturized. Vitamin A is also necessary for the growth of all bodily tissues, including skin and hair. Adequate intake of vitamin C, which papaya can provide, is needed for the building and maintenance of collagen, which provides structure to skin. [10]

Phytochemical analysis of paw-paw (*Carica papaya*) leaves:

On the basis of this work, the phytochemical analysis of *Carica papaya* leaves showed the presence of alkaloid, flavonoid, Saponin, Tannin and Glycosides, and also the plant can have characterized by multiple pharmacological activity and broad spectrum of therapeutic actions. *Carica papaya* leaves contain, saponin, tannin, flavonoid, alkaloid (like, Mayer, Wagner) and Glycoside. The standard method of analysis used to identify really that *Carica papaya* leaves contain Alkaloid, Saponin, Tannin, Glycoside and Flavonoids. A direct dose-dependent spasmodic action with increased frequency and amplitude was observed with PLE in all non-gravid uterine preparations. Pretreatment of the tissue with phenoxybenzamine (PB) non-competitively blocked the effect of PLE. Blocking of the 5-HT receptors with methysergide partially blocked the excitatory response to PLE. From this work the crude papaya latex have an uterotonic principle which can bring to mind sustained contraction of the uterus acting mainly on the alpha adrenergic receptor of the uterus at different stages. [11]

Papaya - An Innovative Raw Material for Food and Pharmaceutical Processing Industry:

In this review, Nutritional value of fruits and medicinal properties of various part of papaya are discussed and also we have studies that, papaya is not only known as for its nutritional benefits it also considered to its medicinal properties. It has low calories but rich in natural vitamins and minerals (such as, vitamin A, B, C and fibre etc.). Many biologically active phytochemicals have been isolated from papaya and studied for application. Almost all parts of the plant (leaves, latex, seed, fruit, bark, peel, roots) have important biologically active substances that can be isolated for application predominantly in the pharmaceutical industry. Papain found in papaya latex has natural digestive properties beneficial to the human digestive system. Papaya used in most of the pharmaceutical and in the food industry. [12]

Biological activities of carica papaya (Linn):

The different plant parts of C. papaya have many biological activities and many pharmacological activities like, Antioxidant activity, Antiulcer activity, Antibacterial activity, Antifungal activity, Anti-amoebic activity, Wound-healing activity, Antihelmintic activity, Antiulcerogenic activity, Hypolipidemic activity, Hypertensive activity, Diuretic activity, Anti-fertility activity. [13]

REPORTED ACTIVITIES

Antimicrobial Properties of *Carica papaya* (Papaya) Different Leaf Extract against E. coli, S. aureus and C. albicans:

Papaya plants are used medicinally in different countries and are sources of many potent and powerful drugs. Antimicrobial and antifungal activity of *Carica papaya* (Papaya) plant different leaves extract is tested by methods reported in literature. Phytochemical screening of leaves extracts for alkaloids, carbohydrates, saponins, proteins, amino acids, tannins, flavonoids, glycosides, terpenoids is also done by standard test procedure reported in literature. The researcher used four extracts but the strongest activity showing in methanol extract. Methanolic extract showing inhibition against in S. aureus than E. coli and C. albicans. [14]

Anti-ulcerogenic action of aqueous extract of *Carica papaya* seed on indomethacin-induced Peptic ulcer in albino rats:

As per the reported activity, the pretreatment with aqueous extract of *Carica papaya* seed exhibited anti ulcerogenic and antioxidant effects, which may be due to the enhanced antioxidant enzymes. On the basis of this research article, find out or investigated the anti-ulcerogenic and antioxidant activities of aqueous extract of *Carica papaya* seed against indomethacin-induced peptic ulcer in albino rats. [15]

Therapeutic benefits of carica papaya leaf extracts in dengue fever patients:

This research will helpful in chiefly dengue fever patients, because the plant leaf extract will increase the platelet count in the suffering patients. *Carica papaya* leaf extract could be used as an added or as a harmonizing drug in acute febrile illness patients with thrombocytopenia, it accelerates the increase in the platelet count. Rise of platelet count from 55000/µl to 168000/µl after *C. papaya* leaves extract in dengue fever patient was reported. [16]

Antifertility effect:

An oral administration of crude ripe papaya seeds at 100 mg/kg body weight for 8 w showed degeneration of the germinal epithelium and germ cells, a reduction in the number of Leydig cells and the presence of vacuoles in the tubules. [18]

Anxiolytic and sedative actions:

Many medicinal plants are also having the property of anxiolytic and sedative effects. The ethanolic

extract of *C. papaya* pulp shows role as Anxiolytic and sedative actions in mice. On the basis of this study was performed to evaluate the Anxiolytic and sedative effects of ethanolic extract of *C. papaya* pulp. Various medicinal plants or their constituent's shows role as Anxiolytic and sedative effects. A study was performed to evaluate the anxiolytic and sedative effects of ethanolic *C. papaya* pulp extract in mice, and the results confirmed that extract at 100 mg/kg showed Anxiolytic effect. [19]

Antioxidant activity:

The present reported activity describes the antioxidant and antimicrobial activities of *C. papaya*. Plant contain high amount of Phenol and Phenolic compounds which are secondary metabolites and plays a vital role in the antioxidant as well as antimicrobial activity. Phenol content was higher in aqueous and methanol extracts compaired to petroleum ether extract. Aqueous extract had the highest total phenol concentration (57.6 ± 4.69 mg gallic acid equivalents (GAE)/g extract) which is much higher than the Malaysian *C. papaya* peel (15.18 µg GAE/mL) and seed (6.75 µg GAE/mL). On the other hand, methanol extract shows highest flavanoid content (0.34 ± 1.34 µg Quercetin equivalents (QE)/g extract). [20]

Hypolipidemic activity:

Diabetes was induced in albino rats by administration of alloxan monohydrate (120 mg/kg, i.p.). Rats were divided into 6 groups of 6 animals each. First group served as non-diabetic control, second group as diabetic control, third group as standard and was treated with 0.1 mg/kg/day of glibenclamide. Group 4, 5, and 6 received 100, 200, and 400 mg/kg body weight of AECPL. Blood samples were analyzed for blood glucose on day 0, 1, 7, 14, 21 and lipid profile on day 21. The AECPL showed significant reduction (P<0.01) in blood glucose level and serum lipid profile levels with 400 mg/kg body weight in alloxan-induced diabetic rats as compared with the control. It is concluded that AECPL is effective in controlling blood glucose levels and in improving lipid profile in diabetic rats. [21]

Antiulcer activity:

Treatment with 500 mg/kg of hydroalcoholic extract of *Carica* papaya fruits efficacious in reducing ulcer index in pyloric ligation induced gastric ulcer model. Hydroalcoholic extract *Carica* papaya of showed a dose dependent decrease in ulcer and reduces ulcer index which was supported by morphological and histological studies. Thus it can be concluded that hydroalcoholic extract of *Carica* papaya fruits have antiulcer activity, which can be attributed to its antioxidant mechanism of action. [22]

Anti-amoebic activity:

Antiamoebic activity of methanol extract of mature seeds of *Carica papaya* was tested *in vitro* on axenic culture of *Entamoeba histolytica* using metronidazole as a reference amoebicidal agent. The MIC of seed extract was >62.5 µg/mL as compared to <0.8 µg/mL for metronidazole. The present study suggests that the mature seeds of *C. papaya* have antiamoebic effect but less pronounced than metronidazole. [23]

Wound healing activity:

The aqueous extract of *C. papaya* fruit (100 mg kg (-1) day (-1) for 10 days) was evaluated for its wound healing activity in streptozotocin-induced diabetic rats using excision and dead space wound models. Extract-treated animals exhibited 77% reduction in the wound area when compared to controls which was 59%. The extract treated wounds were found to epithelize faster as compared to controls. The wet and dry granulation tissue weight and hydroxyproline content increased significantly when compared to controls. The extract exhibited antimicrobial activity against the five organisms tested. *Carica papaya* promotes significant wound healing in diabetic rats and further evaluation of this activity in humans is suggested. [24]

Anti-hypertensive activity:

This reported activity was to evaluate the antihypertensive effects of the standardized methanolic extract of *Carica papaya*, its angiotensin converting enzyme inhibitory effects in vivo, its effect on the baroreflex and serum angiotensin converting enzyme activity, and its chemical composition. The chemical composition of the methanolic extract of *C. papaya* was evaluated by liquid chromatography-mass/mass and mass/mass spectrometry. The angiotensin converting enzyme inhibitory effect was evaluated in vivo by Ang I administration. The antihypertensive assay was performed in spontaneously hypertensive rats and Wistar rats that were treated with enalapril (10 mg/kg), the methanolic extract of *C. papaya* (100 mg/kg; twice a day), or vehicle for 30 days. The baroreflex was evaluated through the use of sodium nitroprusside and phenylephrine. Angiotensin converting enzyme activity was measured by ELISA, and cardiac hypertrophy was evaluated by morphometric analysis. The methanolic extract of *C. papaya* was standardized in ferulic acid (203.41 ± 0.02 µg/g), caffeic acid (172.60 ± 0.02 µg/g), gallic acid (145.70 ± 0.02 µg/g), and quercetin (47.11 ± 0.03 µg/g). The flavonoids quercetin, rutin, nicotiflorin, clitorin and manghaslin were identified in a fraction of the extract. The methanolic extract of *C. papaya*

elicited angiotensin converting enzyme inhibitory activity. The antihypertensive effects elicited by the methanolic extract of *C. papaya* were similar to those of enalapril, and the baroreflex sensitivity was normalised in treated spontaneously hypertensive rats. Plasma angiotensin converting enzyme activity and cardiac hypertrophy were also reduced to levels comparable to the enalapril-treated group. These results may be associated with the chemical composition of the methanolic extract of *C. papaya*, and are the first step into the development of a new phytotherapic product which could be used in the treatment of hypertension. [25]

Diuretic activity:

Water extract of *Carica papaya* was administered orally at doses of 5 mg/kg to Spraque Dawley rats. Other groups were given commercial diuretics, furosemide and hydrochlorothiazide at 10 mg/kg. Urine volume, urine pH, urine density and urine electrolytes were determined every hour for 4 hours. Blood was taken to determine the serum level of glucose, albumin, blood urea nitrogen (BUN) and creatinine. *C. papaya* extract exhibited moderate to potent diuretic activity. Roots of *C. papaya* activity were statistically similar potency to the activity of furosemide and hydrochlorothiazide. However, care must be taken when using these herbs as increased urinary K+ being excreted and marginal increase of serum BUN and creatinine were detected. [26]

Conclusion: Papaya consumption occurs worldwide, with the U.S. and Europe constituting the main consumer markets. The fruit is grown in various tropical countries of the world. Among its notable nutritional characteristics, elevated levels of vitamins A, B_1, B_2 and C are commonly cited, as well as being an excellent source of sugars; glucose, fructose, and sucrose compose a total of up to 13% of the fresh fruit weight. From a pharmacological point of view, the papaya has been cited as a laxative, anti-fertility agent, and meat tenderizer, among other uses. Despite this, some physiological disorders compromise the quality of the fruit.

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REFERENCES

1. Ahn, K. (2017). "The worldwide trend of using botanical drugs and strategies for developing global drugs". BMB Reports. **50** (3): 111–116.
2. Chia, C. L., & Manshardt, R. M. (2001). Why some papaya plants fail to fruit. Retrieved from https://scholarspace.manoa.hawaii.edu/handle/10125/12186.
3. Morton, Julia F. "Papaya and related species". Retrieved 20 July 2009. , "Papaya fruit facts". California Rare Fruit Growers. Retrieved 19 July 2006.
4. Bailey et al. 1976, FAO 2012, Hedrick 1919, Morton 1987, van Wyk 2005
5. https://books.google.co.in/books?id=9UrYkSDLoJ4C&pg=PA20&dq
6. Natarjan Sudharkar, Theivanai @ Vidhya R M. Potential medical properties of Carica papaya Linn, Int J Pharm Sci 2014; 6(2):168-173
7. http://www.pharmatips.in/Articles/Pharmacognosy/Pharmacognosy-Of-Papain.aspx
8. Chen, C.-C., & Tsai, S.-W. (2005). Carica papaya lipase: a novel biocatalyst for the enantioselective hydrolysis of (R, S)-naproxen 2,2,2-trifluoroethyl ester. Enzyme and Microbial Technology, 36(1), 127-132.
9. Mozaffarieh, M., Sacu, S., & Wedrich, A. (2003). The role of the carotenoids, lutein and zeaxanthin, in protecting against age-related macular degeneration: a review based on controversial evidence. Nutrition Journal, 2(1), 20.
10. Starley, I. F., Mohammed, P., Schneider, G., & Bickler, S. W. (1999, November). The treatment of paediatric burns using topical papaya. Burns, 25(7), 636-639J Ethnopharmacol. 2000 Jun;70(3):205-12
11. Ikeyi Adachukwu P, Ogbonna Ann O and Eze Faith U, (July 2013), "phytochemical analysis of paw-paw (carica papaya) leaves", International journal of life science biotechnology and pharma research, Vol. 2, No. 3 5(3), 2017, 5(3), 88-93
12. Vijaya Shrivastava Kaushal, (2016). "Biological activities of carica papaya Linn: a short review", WJPPS, Volume 5, Issue 12, 1622-1633.
13. Brij B. Tewari, Gomathinayagam Subramanian, (2014), "Antimicrobial Properties of Carica papaya (Papaya) Different Leaf Extract against E. coli, S. aureus and C. albicans", American Journal of Pharmacology and Pharmacotherapeutics, ajpp., 1(1): 025-039.
14. Hussein O. B. Oloyede, Matthew C. Adaja, Taofeek O. Ajiboye, (2015), "Anti-ulcerogenic activity of aqueous extract of Carica papaya seed on indomethacin-induced peptic ulcer in male albino rats", Journal of Integrative Medicine, vol.13, no.2;13, 2, (105-114), (2015).
15. Ahmad N, Fazal H, Ayaz M, Abbasi B H, Mohammad I, Fazal L, (2011), Dengue fever treatment with Carica papaya leave extract. Asian Pac J Trop Biomed; 1(4): 330-333.
16. Lakshmi kanta kanthal1, (2012), prasenjit mondal, et, al, "pharmacology evaluation of anthelmintic activity of carica papaya latex using pheritima posthuma", International journal of life science and pharma research, vol 2-issue 9(2): 251

17. Udoh P, Kehinde A. (1999). Studies on the antifertility effect of pawpaw seeds (Carica papaya) on the gonads of male albino rats. Phytother Res; 13:226-8
18. Athesh K, Karthiga D, Brindha P. (2012), "Anti-obesity effect of aqueous fruit extract of carica papaya L. in rat fed on high-fat cafeteria diet". Int J Pharm Pharm Sci; 4 Suppl 5:327- 30.
19. Ang YK, et al.Antioxidant Potential Of Carica Papaya Peel and Seed Focusing On Modern Food Industry. (2012); 1:11-16.
20. Ezekwe, Ahamefula Sunday., Elekwa, Ify., Osuocha, Kelechi Uzoma. Journal of Pharmacognosy and Phytochemistry 2014; 2 (6): 109-114
21. Murugan M, Mohan VR. Evalution of phytochemical analysis and antibacterial activity of Bauhinia purpurea L. and Hiptahe benghalensis L. Kurz. J Applied Pharma Sci. 2011;01(09):157-60.
22. Sujit Kumar Sarker, Nilufar Begum, Dinesh Mondal, Md. Abdullah Siddique, Mohammad A. Rashid Bangladesh Journal of Pharmacology , Vol 5, No 1 (2010)
23. Nayak SB, Pinto Pereira L, Maharaj D, Indian J Exp Biol. 2007 Aug;45(8):739-43.
24. Girlandia Alexandre Brasil, Silas Nascimento Ronchi , Andrews Marques do Nascimento, Ewelyne Miranda de Lima,Wanderson Romão, Helber Barcellos da Costa , Rodrigo Scherer, José Aires Ventura, Dominik Lenz , Nazaré SouzaBissoli, Denise Coutinho Endringer , TadeuUggeredeAndrade, https://www.researchgate.net/publication/266626277_Antihypertensive_Effect_of_Carica_papaya_Via_a_Reduction_in_ACE_Activity_and_Improved_Baroreflex
25. Y.Adamab, A.A. Nasaruddinc , A. Zurainia , A.K. Arifahd , M.S. Omar Fauzeee Z.A. Zakariaa , M.N. Somchitaf, Diuretic Activity of Roots from Carica papaya L. and Ananas comosus L., Int. J. Pharm. Sci. Rev. Res., 23(1), Nov – Dec 2013.