



Review Article

International Journal of Pharmacy and
Natural Medicines

www.pharmaresearchlibrary.com/ijpnm



To Demystify Savory *Tamarindus indica* Linn. for Healthcare

Raaz K Maheshwari*¹, Bhanwar Lal Jat², Sabiha Khan³, Rajnee³, Manisha Mavai⁴,
Urmila Chaudhary⁵

¹Department of Chemistry, SBRM Govt. PG College, Nagaur, Rajasthan, India

²Department of Botany, SBRM Govt. PG College, Nagaur, Rajasthan, India

³Department of Zoology, Govt. PG College, Ajmer, Rajasthan, India

⁴Department of Physiology, M G Medical College, Jaipur, Rajasthan, India

⁵Department of Physiology, SN Medical College, Nagaur, Rajasthan, India

Received: 25 June 2014, Accepted: 28 August 2014, Published Online: 15 December 2014

Abstract

Tamarind pods come from the tamarind tree (deliciously tangy and one of the most highly prized natural foods in South Asia, the tamarind (*Tamarindus indica* Linn.) tree produce an abundance of long, curved, brown pods filled with small brown seeds, surrounded by a sticky pulp that dehydrates naturally to a sticky paste.), which originally came from Africa, but can now be commonly found, and used in the cuisine of, Asia, Arabia, Australia, Mexico, and South America. In Mexico and some other Latin American countries, it is called tamarindo. Tamarinds contain high levels of tartaric acid, just as citrus fruits contain citric acid, providing not just a zing to the taste buds, but evidence of powerful antioxidant action zapping harmful free radicals floating through physiological system. Other phytochemicals found in tamarinds include limonene, geraniol, safrole, cinnamic acid, methyl salicylate, pyrazine, and alkyl thiazoles. Known to be useful in traditional medicine for diabetes and obesity, tamarind seed extract underwent examination to see if its high levels of polyphenols and flavonoids might increase glucose uptake in such patients. The positive expression showed a marked anti-diabetic effect, indicating the possibility of formulating a new tamarind seed extract-based herbal drug for diabetes therapy. Tamarind seed extract, which is appetizingly flavorful, is one of the most highly prized foods in Asian and Indian cuisine. Tamarind per 100g contain calories (239), carbohydrates (62g), fibre (5g), protein (3g), impressive amounts of essential nutrients. Other prominent benefits include niacin, vitamin C, fiber, and pyridoxine, proving it to be a uniquely beneficial food. The aim of the present review is to describe phytochemical constituents and to explore medicinal and pharmacologic activities of *T. indica*'s potential as multipurpose tree species.

Keywords: Phytochemicals, Antioxidants, Geraniol, Alkyl thiazoles, Diabetes, Obesity, Antibacterial activity, Tartaric acid Antimicrobial activity, TKP

Contents

1. Introduction	174
2. Ayurveda Practice & Gastronomic Usage.	176
3. Abbreviation.	177
4. Conclusion.	178
5. References	178

***Corresponding author**

Raaz K Maheshwari

Department of Chemistry,
SBRM Govt. PG College, Nagaur,
Rajasthan, India

Manuscript ID: IJPNM2186



PAPER-QR CODE

Copyright © 2014, IJPNM All Rights Reserved

1. Introduction

Tamarind that is not ripe is also useful as an ingredient in a wide range of cuisines in Asia. Tamarindus is a monotypic genus and belongs to the subfamily Caesalpinioideae of the family Leguminosae (Fabaceae), Tamarindus indica L., commonly known as Tamarind tree is one of the most important multipurpose tropical fruit tree species in the Indian subcontinent. The pods of this fruit have both seeds and pulp that is dried and when dry it turns sour. This pulp is the most important part that is used in foods and has innumerable health benefits. Tamarind, a popular Indian spice ingredient in curries and chutneys, is used medicinally as a laxative, antinauseant, and vermifuge. It is also beneficial for jaundice, hyperacidity, flatulence, and fevers. An infusion of tamarind is employed as a gargle for sore throats. The herb is excellent for clearing heat in people with deficiency, with such symptoms as night sweats and ringing in the ears. Tamarind has a taste of sweet, aromatic and a temperature of cool. Most parts of the tamarind tree are medicinal and offer various health benefits to us. The seeds, fruit pulp, leaves, flowers, bark all have medicinal uses. The dietary fiber helps in lowering cholesterol by binding the bile salts and preventing their absorption [1-10]. It is helpful in preventing constipation, binding toxins in the digestive tract and thereby reducing risk of colon cancer. The pulp is made into a poultice and applied on swollen joints for relief. Potassium effectively regulates blood pressure while the iron in tamarind keeps the hemoglobin levels up. Tamarind purifies the blood while it also has digestive and laxative effects. A poultice made from tamarind leaves is effective in treating boils, sprains and swelling of the joints. Tamarind is used to cure jaundice as it cures bile disorders. Tamarind bark is effective in getting rid of open sores while its seeds can be made into a paste and applied on boils for relief. The leaves have astringent and antiseptic properties and a decoction of the leaves is effective in killing intestinal worms in children. Tea made of tamarind leaves reduces malarial fever. Juice of tamarind flowers is used to treat piles. Tamarind pulp relieves flatulence, indigestion and vomiting. Gargling with tamarind water relieves sore throat. The pulp prevents sunstroke. The polysaccharides increase resistance to infections by stimulating and boosting the immunity. The bark is used to relieve abdominal pain due to flatulence. A paste made of the seeds and applied at the site of a scorpion bite draws out the poison and is an excellent antidote to scorpion bites. Tamarind juice acts as an antidote in intoxication due to opium and other intoxicants. Tamarind consumption removes fluoride from the body [11].

Effect of tamarind ingestion on fluoride excretion in humans was studied and found that intake of tamarind is likely to help in delaying progression of fluorosis by enhancing urinary excretion of fluoride. [42]. One of the most known health benefit of tamarind, is its use as medicine since the ancient times. It has been known to be useful for treating constipation and liver problems among others [12]. For years, tamarind has proven to be particularly useful for treating liver and gall disorders and has been studied severally on the role it plays in treating bile problems. Tamarind is particularly useful for managing pain and inflammation on joints. It has been seen that leaves and pulp crushed and applied on swollen joints provides great relief and reduces inflammation. Tamarind used for treating sore throat. It is either gargled or drunk as tamarind juice to help relief pain and discomfort of sore throats. [13-17].

Try taking some tamarind when you have a sore throat and you will get great relief. There are many eye drops that have been used for years to treat inflammation of the conjunctiva in the eye and the primary ingredient is tamarind. The eye drop treatment ointment is made from tamarind seeds and is useful for curing conjunctiva inflammation due to many causes like bacterial infection or the common condition referred to as dry eye syndrome. Tamarind is used as a remedy for bile disorders, jaundice and associated dieresis problems. Tamarind is useful for treating constipation since it acts like a laxative helping loosen stool and help prevent or treat constipation. Tamarind juice is an important consideration for people suffering from constipation to help them get some relief. [18-21]. Tamarind is an important source of antioxidants that help in fighting cancer by reducing the increase of free radicals that predispose you to cancer. Like other sources of antioxidants tamarind has high amount of antioxidants that help to curb cancer. Like mentioned earlier tamarind is a potent agent for reducing inflammation and is therefore useful for management of colds and fever. It helps to protect you from colds by just taking a glass of tamarind in boiled water. Tamarind is useful for treating diarrhea and dysentery and helps as a good stomach ache relief. Tamarind seed' covering is the useful part for treatment or management of diarrhea. Tamarind like other organic foods plays an

important role in the body of lowering potentially harmful cholesterol levels and keeping your heart healthy. By lowering cholesterol tamarind prevents development of heart and cardiovascular diseases thereby increasing longevity and chances of living a healthy and disease free life. [22-24]



Figure 1: Tamarind Tree and seeds

Nutritional Status of *Tamarindus indica* L.

Raw tamarind per 100g contains energy (239kcal/1,000kJ); carbohydrate (62.5g); total fat (0.60g); dietary fibre; (5.1g); protein (2.80g); cholesterol (0mg); Vitamin – folates (14µg); niacin (1.938µg); pantothenic acid (0.143g); pyridoxin (0.066mg); thiamin (0.428mg); Vit. A (30IU); Vit. C (3.5mg); Vit E. (0.10mg); Minerals– Na (28mg); K (628mg); Ca (74mg); Cu (0.86mg); Fe (2.80mg); Mg (92mg); P (113mg); Zn (0.10mg); Se (1.3µg) [Source: USDA National Nutrient data base]

Phytochemical investigation

Tamarind grows in in countries with tropical climates such as Africa, India and Thailand. Inside its brittle shell, it has a fibrous, sticky, brown pulp and large seeds in the middle. Tamarind has a sweet and sour complex flavor and is often used for sauces, chutneys and juices. Rich in vitamins and minerals, it offers nutritional value in your diet. Similar to most fruits, tamarind's calories are derived mostly from carbohydrates. Tamarind, unlike many fruits, is rich in B vitamins such as thiamin and niacin, and also is a good source of Mg and K. In parts of the world where medicine isn't always readily available, treatment of ailments is discovered based on what is around them. Among other medicinal plants, tamarind has been shown to be very effective in treating digestive disorders. Tamarind can help against diarrhea, constipation, vomiting, stomach pain and even food poisoning. Tamarind is effective in treating fevers, sunstroke and has been seen restoring some sensation in cases of paralysis. It can also be used to treat sore throats as a gargle, and can be used to treat wounds as a dressing. Tamarind has also been known to have anti-bacterial and anti-fungal properties as well as to have the ability to enhance the effectiveness of ibuprofen. Consuming tamarind while drinking alcohol can lessen the alcohol's effects, according to the study.[25-29]

Tamarind also comes packed with a range of antioxidants. Phenols one class of antioxidants -- found in tamarind are beneficial for cardiovascular health Phenols particularly help protect free radicals from oxidizing low-density lipoproteins and causing more of them to adhere to arterial walls. The leaf oil contains 13 components among which linonene and benzyl benzoate are most predominant. Bark of *T. indica* showed the presence of n-hexacosane, eicosanoic acid, b-sitosterol, octacosanyl ferulate, 21-oxobehenic acid, and (+)-pinitol. The volatile constituents of the fruit pulp were furan derivatives (44.4%) and carboxylic acid (33.3%) of the total volatiles. The major fatty acids of seeds were palmitic acid, oleic acid, linoleic acid, and eicosanoic acid. The unsaponifiable matter from the seed oil of *T. indicashowed* presence of -amyrin, compesterol, -sitosterol and seven hydrocarbons. The aerial parts of this plant have demonstrated the presence of tartaric acid [56], acetic acid, and succinic acid, gum, pectin, sugar, tannins, alkaloid, flavonoids, sesquiterpenes, and glycosides. *T. indica* seeds and pericarp contain phenolic antioxidants. The profile of polyphenolics in Tamarind pericarp was dominated by proanthocyanidins in various forms, such as apigenin , catechin , procyanidin B2, epicatechin, procyanidin dimer, procyanidin trimer, along with taxifolin, eriodictyol, naringenin, of total phenols, respectively. The content of Tamarind seeds comprised only procyanidins, represented mainly by oligomeric procyanidin tetramer, procyanidin hexamer, and procyanidin pentamer with lower amounts of procyanidin B2 epicatechin (Figure 4. i-xi). [30-38]

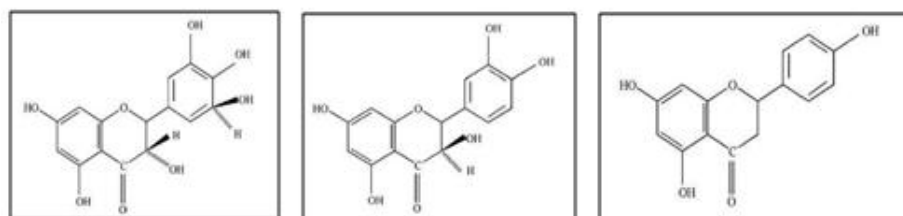


Figure 4: Chemical structures

Polymers are complex carbohydrates having good mechanical properties for application as fiber, films, adhesives, rheology modifiers, hydrogels, emulsifiers, and drug delivery agents. TSP is a glucosaminoglycan derivative extracted from the kernel of seeds of *Tamarindus indica* Linn.. A polymer consists of cellulose-type spine that carries xylose and galactoxylose substituents. It can be used as a binder in tablets, as a mucoadhesive for buccal or sublingual delivery of drugs, in gastro-intestinal targeting as a bioadhesive tablet, and for ocular delivery of drugs for achieving zero-order controlled release. They also act as a carrier for delivery of certain drugs. TSP future perspective is wide application as a promising polymer in pharmaceutical industry as a novel carrier of drugs in various bioadhesive and other sustained release formulations. [53].

2. Ayurveda Practice & Gastronomic Usage

Sweet and tangy fruit, tamarind or imli definitely makes your taste buds drool and it therefore is indispensable part of our cuisines for making appetizing chutney (Fig.5), sweet candy, jelly and much more. The hard green edible pulp of a young fruit is considered by many to be too sour, but is often used as a component of savory dishes, as a pickling agent. The ripened fruit is considered the more palatable, as it becomes sweeter and less sour (acidic) as it matures. It is used in desserts as a jam, blended into juices or sweetened drinks, sorbets, ice creams and all manner of snacks. In most parts of India, tamarind extract (dried tamarind available commercially is heated in water and strained out leaving the extract) is used to flavor foods ranging from meals to snacks. Along with tamarind, sugar and spices are added to (regional) taste for chutneys or a multitude of condiments for a bitter-sweet flavor. The immature pods and flowers are also pickled and used as a side dish. In regional cuisines, such as Rajasthan, MS (chinch), TN (- called puli) and AP, (called Chintha pandu) it is used to make rasam, amtee, sambhar, vatha kuzhambu, puliyogare and chutneys and pickles. In Andhra Pradesh and TN, tender leaves of tamarind called chintha chiguru and puliyankozhunthu, respectively, are used with lentils to make raw chutney. In the state of AP "Chintha pandu" (Tamarind) is an essential ingredient in their "Pulihora" "Fish Pulusu", majority of "vegetable Pulusu curries", "Chaar" "Pappu Chaaru" "Nilava Patchallu" and "Chethi Patchallu". Curries made of "Chintha Chiguru" (Tender leaves of Tamarind tree) mixed with prawns, meat or pulses ("Chintha Chiguru Royyala Koor", "Chintha Chiguru Maamsam Koor" or Chintha Chiguru Pappu" respectively) are great delicacies in AP, Karnataka, India, the tamarind, called hunasae hannu, is used in saaru (lentil soup), sambhar or sambar (vegetable soup), gojju (sauce), and several types of chutneys.

In southern parts of Kerala, mostly along the coastal belt, it is added to fish curry masalas, with ground coconut for flavoring. It is also used extensively as preservative and in pickles (thokku). A salad dish of tamarind leaves, boiled beans, and crushed peanuts topped with crispy fried onions. It is also sometimes eaten preserved in sugar with chili as a sweet-and-spicy candy. Tamarind is eaten fresh or processed into a sweet, sour and sometimes spicy candy. Drink juice of tamarind leaves for benefit. - Soak 50 grams of tamarind in 500 ml water for 2 hours or till the pulp turns soft. Mash it well and blend it in the water. Add sugar, candy sugar, brown sugar or jaggery as per taste and preference. Mix well, strain and drink. This concoction gives relief in sunstroke and its effects, uneasiness, nausea etc, clears bowels and removes the effects of opium and alcohol intoxication, burning sensation in the body. If there is bad taste in the mouth replace the sugar with salt to taste, add some black pepper powder and roasted ground caraway seeds. This will improve the taste of the mouth and relieve anorexia. To a glass of water add 10 grams of tamarind and blend it in when soft. Strain, add sugar to taste and drink. This is an excellent cooling drink. Use Jaggery instead of sugar for more effectiveness. The following is an in-depth outline of the various health benefits of Tamarind [39-47].

Consume tamarind juice made of the leaves; 30 ml each time twice a day; once in the morning on empty stomach and then in the evening before dinner, for 5 days. Avoid salt and spices during this period. Rub the seeds on a grinding stone and apply this paste on the eyes for relief from pain and burning. This is an excellent remedy. Dry tamarind flowers in the shade. Powder and add equal quantity of candy sugar. Mix well and store in a tightly closed bottle. For relief from liver problems, take 5 grams of this mixture before lunch and dinner. Massage the palms of the hands and soles of the feet with tamarind pulp. It will provide relief. Soak 30 grams tamarind in a glass of water. Mash it well in the water once soft. drink this water for relief. Fluorosis occurs when water with excess fluoride is consumed. The immediate effects are seen in the teeth. It causes teeth to become yellow and decay due to enamel erosion. Long term consumption of fluoride leads to calcification effects on the bones. The joints and movements become restricted and painful.

The spinal column too becomes stiff and painful. The muscles and ligaments may also calcify, cause pain and lose their free movements. Drinking tamarind water destroys the fluoride ions and thereby prevents fluorosis. Adding salt to tamarind water tremendously increases the capacity of this water to remove the fluoride from the water. Tamarind has been found safe in usage at levels used in foods. However, it increases risk of bleeding if taken along with drugs that have a propensity for increasing risk of bleeding. like, aspirin, ibuprofen, anti coagulants, anti platelet drugs and

non steroidal anti inflammatory drugs. Though there is no known contraindication for use in pregnant and breastfeeding women.. It may cause lowering of blood sugar levels. Hence diabetics should take note of this. [48-55]

Tamarind Juice & its Therapeutic & skin care applicability

Tamarind juice is widely used in many states of India for making curries, salad dressing, etc..Add juice to vegetables for a refreshing finish. Fresh drink can also be prepared by mixing sugar and tamarind juice with 2 cups of cold water and lemon wedges. Tamarind juice boosts the metabolism that in turn is an excellent way to reduce weight loss. Use of tamarind juice treats inflammatory bowel diseases such as ulcerative colitis and Crohn's disease. Tamarind pulp juice helps to keep stomach ulcers and stomach acids at bay. Mix this with honey, milk, lemon and dates to help indigestion. They are rich sources of fiber that regulates bowel movements and cures constipation, intestinal worms and parasites in children. This is a great natural way to cure diarrhea and dysentery, and lower inflammation caused due to hemorrhoids. Tamarind pulp juice contains carb-blocking properties that help your body to absorb carbohydrates. This lowers the blood glucose levels of diabetic patients after meals. Tamarind juice is a traditional method to cure diabetes and lower blood-sugar levels. Tamarind juice prevents oxidative damage in the pancreas which is linked with diabetes. Diabetic patients can also develop coronary heart disease. Drinking tamarind juice regularly reduces risks of this and other related diseases. This juice contains many antioxidants that are beneficial for good health. This also improves the immune system and other problems related to it like cold, cough, flu, etc. Tamarind juice is a very rich source of antioxidants that protects your body from hazardous free radicals. This juice has the power to prevent the oxidation process of cholesterol, which can stop cholesterol sticking to the walls of your arteries and blocking them. This will lower the risk of coronary heart disease and high cholesterol levels. Many people with obesity need to lose weight to maintain their body weight. Tamarind juice (Figure 6) can be very beneficial in such cases for weight loss and for treating obesity. This is very high in antioxidants that are useful to lower the risk of cancer and improve the body's immune system. This imparts a cooling effect to your body temperature. Hence, the drink is to be consumed to cure sun strokes in the tropical regions.



Figure 6: Tangy & flavorful iced tamarind juices with lemon wedges, jaggery & ginger

Tamarind juice is anti-inflammatory that can be useful to cure a sore throat. Gargle with tamarind juice to reduce the pain and soothe a sore throat. It can also be applied on to the joints to soothe inflammation and pain. Tamarind juice is excellent for the health of your skin and to treat burns and prevent edema. Apply the juice to maintain glowing and healthy skin. This can also reduce or remove common acne or chickenpox scars from the face and other parts of the body. Tamarind juice has enzymes, fiber, Vitamin B, Vitamin C and AHA that remove dead skin cells. Tamarind juice is also used in cosmetics such as tamarind face mask and face scrub. This contains acids, minerals, dietary fiber and Vitamin C which is a good blood purifier. Take 3/4 cup of fresh tamarind pulp juice. Mix with 2 tablespoons of lemon juice, some baking soda and 2 tablespoon of brown sugar. Blend well until this turns into a smooth paste. Exfoliate with a loofah while taking shower for glowing skin. Tamarind juice is a mild laxative. This is used to treat bile disorders and helps the body to fight against viral infections such as cold and fever. The tamarind pulp juice can be used to cure conjunctivitis. Eye drops are prepared by the traditional method using tamarind seeds to cure dry eye syndrome. The tamarind flower's juice is extracted and this is to be drunk to cure bleeding piles.[30-40]

3. Abbreviation

ESI-MS (nano-electrospray-ionisation mass spectrometry); GC-MS (gas chromatography–mass spectrometry); NMR.(nuclear magnetic resonance);HPLC (high performance liquid chromatography); DPPH (2,2-diphenyl-1-picrylhydrazyl); TKP (turmeric kernel powder) TJC (Tamarind Juice Concentrate); TPP (Tamarind Pulp Powder); PMC.(Pittsburgh Medical Center); HCA (hydroxycitric acid); DD (Drug Digest); AHA (-hydroxy acid); HLA(hyaluronic acid); UMHS (University of Michigan Health System); UPMC (University of Pittsburgh Medical Center); TSP(Tamarind seed polysaccharide); USDA (United States Dietary Association)

4. Conclusion

The sticky pulp of the brown pods is edible and has a sweet and sour flavor. It is used in dishes for a tangy component and in desserts, beverages, syrups, sauces, and candy. Tamarind has been a long-time folk remedy with a long list of uses, including treatment of sore throats and sun stroke. It may also have antibiotic properties. Animal studies have shown that tamarind can lower cholesterol and blood sugar levels. However, studies on humans have yet to confirm this. Tamarind is still a source of carbohydrates, and it must be limited and factored into a well-balanced diet. It is best eaten plain in small amounts or used as a condiment to spruce up the flavor of food and beverages. This food is an excellent source of vitamin B, vitamin C, potassium, magnesium, iron, thiamine, phosphorus, riboflavin, and fiber. It is used traditionally in abdominal pain, diarrhea and dysentery, helminthes infections, wound healing, malaria and fever, constipation, inflammation, cell cytotoxicity, gonorrhoea, and eye diseases. It has numerous chemical values and is rich in phytochemicals, and hence the plant is reported to possess antidiabetic activity, antimicrobial activity, antivenomic activity, antioxidant activity, antimalarial activity, hepatoprotective activity, antiasthmatic activity, laxative activity, and anti-hyperlipidemic activity. Every part of the plant from root to leaf tips is useful for human needs. Thus the aim of the present review was taken in account to describe and explore the phytochemical constituents, commercial utilization of the parts of the plant, and medicinal and pharmacologic activities so that **T. indica**'s potential as multipurpose tree species could be understood. From this a large number of chemical compounds were isolated and used extensively in pharmaceutical arena. Its taste is sour, sweet, cool and astringent, due to its ingredients. Many parts of the Tamarind tree have been used in traditional medicines to treat diseases as well as symptoms. There are several digestive problems that can be successfully treated with this fruit. For example, people who suffer from constipation and dysentery should consume this fruit. For the people who have troubles with appetite or bile disorders, tamarind fruit is a good solution to cure these problems. As we have already said, this fruit is high in vitamin C and therefore, it is very good for treating vitamin C deficiency, fevers and common colds. It is found that tamarind fruit is rich in antioxidants which are very important for fighting against the free radicals. As we all know, free radicals can cause cancer development and therefore, tamarind fruit should be consumed in order to provide a natural defense against any kind of cancers. There are several researches that proved that this fruit is very good for lowering the blood sugar levels and lowering the levels of cholesterol, which means that many diseases of the cardiovascular system can be prevented by consumption of this fruit. It is also proven that tamarind fruit can effectively cure sore throat. It is recommended to boil it in the water and to rinse the mouth and throat with it. It should be done several times a day even after the sore throat is cured completely. Apart from very good taste, tamarind fruit has high nutritional value and thus should be included in the everyday diet. Considering the overall benefits of the tamarind, it can be advocated as a safe, highly important, medicinal plant for healthcare.

5. References

1. Doughari JH. Tropical Journal of Pharmaceutical Research, **2006**, 5(2): 597–603. doi:10.4314/tjpr.v5i2 . 14637.
2. Chowdhury SR, Sarker DK, Chowdhury, SD, Smith TK, Roy PK, Wahid MA. Poultry science, **2005**, 84 (1): 56–60. doi:10.1093/ps/84.1.56.
3. Sudjaroen Y, Haubner R, Würtele G, Hul WE, Erben GB, Spiegelhalter S, Changbumrungra, Bartsch H, Owen RW. Food and Chemical Toxicology, **2005**, 43(11): 1673–1682.
4. Ghelardina, A. Tavantia, F. Celandronia, A. Lupettia, C. Blandizzib, E. Boldrinic, M. Campaa, S. Senesia J. Antimicrob. Chemother. **2000**, 46(5): 831–834. doi: 10.1093/jac/46.5.831
5. Bhadoriya SS, Ganeshpurkar A, Narwaria, Rai G, Jain AP. Pharmacogn Rev., **2011**, 5(9): 73–81. Doi: 10.4103 /0973-7847.79102
6. Prakash D, Misra PS. Plant Foods Hum Nutr. **1988**, 38: 61–5.
7. Pino JA, Escalora JC, Licea P. J Essent Oil Res. **2002**, 14: 187–8.
8. Jain R, Jain S, Sharma A, Hideyuki I, Hatano T. J Nat Med., **2007**, 6: 355–6.
9. Wong KL, Tan CP, Chow CH, Chee SG. J Essent Oil Res., **1998**, 10: 219–21.
10. Chopra RN, Nayar SL, Chopra IC. New Delhi: CSIR; 1958. Glossary of Indian Medicinal Plants. Warda SAG, Fathia M, Amel O. Research journal of microbiology. **2007**, 2(11): 824–30.
11. Mohamedain KM, Mohamed OSA, El Badwi SMA, Adam SEL. Phytother Res., **1996**, 10: 631–4.
12. Aida P, Rosa V, Blamea F, Thomas A, Salvador C. J Ethnopharmacol. **2001**, 16: 93–8.
13. Vyas N, Gavatia NP, Gupta B, Tailing M. J Pharm Res., **2009**, 2: 1705–1706.
14. Osawa T, Tsuda T, Watanabe M, Ohshima K, Yamamoto A. J Agric Food Tapsoba H, Deschamps JP. J Ethnopharmacol. **2006**, 104: 68–78.
15. Fabiyi JP, Kela SL, Tal KM, Istifanus WA. Dakar Med., **1993**, 38: 193–195.
16. Norscia I, Borgognini-Tarli SM. S Afr J Bot., **2006**, 72: 656–60.
17. Asase A, Oteng-Yeboah AA, Odamten GT, Simmonds MSJ. J Ethnopharmacol. **2005**, 99: 273–279.

18. Maiti R, Jana D, Das UK, Ghosh D. *J Ethnopharmacol.* **2004**, 92: 85–91.
19. Maiti R, Das UK, Ghosh D. *Biol Pharm Bull.*, **2005**, 28: 1172–1176.
20. Iftekhar AS, Rayhan I, Quadur MA, Akhteruzzaman SF, Hasnat A. *J Pharm Sci.*, **2006**, 19: 125–129.