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THE MULTIFACETED USES AND BENEFITS OF TAMARIND: A COMPREHENSIVE REVIEW

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Abstract: The tamarind (Tamarindus indica L.) belongs to the family Leguminosae, or Fabaceae. Tamarind is widely utilized as a natural remedy in Asia, Africa, and America. It has several uses, such as studying the healing properties of tamarind seeds on wounds. the gum derived from extract from tamarind seeds. Tamarind seeds are used in the culinary, textile, and pharmaceutical industries as a mucoadhesive polymer. Tamarind seeds enhance the suppleness of the skin. Smoothen and hydrate the skin. Hyaluronic acid, which is present in it, moisturizes the skin and minimizes fine lines and wrinkles. Because they dissolve in water, tamarind seeds are utilized in serums, gels, and facial toners. Tamarind seed kernel flour contains 16.2% crude protein, 1.16% ash, 57.88% nitrogen-free extract, lipids, and crude fiber.

Key words: Tamarindus indica, fabaceae, herbal treatment, mucoadhesive polymer, hyaluronic acid.

1. INTRODUCTION

The tamarind, or Tamarindus indica L. of the Fabaceae, subfamily Caesalpinioideae, is a staple meal throughout the tropics. It's a multipurpose tree, with almost all of its parts serving a useful purpose, whether it medicinal or nutritious. Despite being indigenous to tropical Africa, tamarind has been introduced and allowed to naturally occur in over five countries globally [1]. Tamarindus indica L. is one of the natural fruit tree species that has traditionally contributed to food security and environmental stability in sub-Saharan Africa. We believed that the native people of Eastern Uganda had been using T. indica for a long time and had developed traditions that supported its continued usage. We expected that most of them had a sophisticated indigenous knowledge (IK) system and that most of them have planted the species [2]. The tamarind tree, often called the "Assam tree," is called an imli, or "Indian date." The sticky acidity of the

pulp. The fruit of the tamarind tree has long been used as a spice and medicine. Specifically, the pulp of the edible fruits can be eaten raw or utilized in curries, pickles, sherbet, and other recipes. The seeds that contain starch are utilized in textile manufacturers and eaten raw or cooked. Known as ambli, the fruit was marketed for two dirhams per seer during the time of Mughal emperor Akbar the Great. Tamarind trees are a multipurpose sort of tree, with almost every portion having some use. About the pulp (55.0%), seed (34.0%), shell (11.0%), and fiber in a pod make up the fruit.

It is mostly produced for its fruit pulp, which is recognized as a herbal cure in many parts of the world and used to flavor drinks, sweets, curries, and sauces. The tamarind seeds, which are crimson or purple-brown, are incredibly hard, shiny, and tough [4]. At its peak, the tree may grow to a height of 25 m and a crown diameter of 12 m. The tamarind crop may thrive in any climate since it can tolerate five to six months of drought, but it is most suited for arid, dry areas, especially those that are prone to prolonged drought.The tamarind tree requires little upkeep and is easy to cultivate. A healthy tree may yield 150-500 kg of pods yearly at the age of 20, and it can live for 80-200 years without severe pests or diseases. Every season, the tree's branches are covered in an abundance of curved fruit pods [5]. The two primary types of tamarind—which are primarily from Thailand—are sweet and sour. Raw (ripe or unripe)tamarinds can be eaten, processed into other products, or used in combination [6]. An Ethiopian study found that compared to the sour tamarind trees, the sweet ones produced much more fruit pulp, seed, seed size, and seed weight. They also observed that the fruit of tamarinds might be curved or straight. While the fresh pulp and pods of the sweet variety are usually a deep dark color, those of the sour kind are often lighter in color. Ripe fruits are packed with a fibrous, yellowish or brown pulp that tastes sweet and acidic (10%) but still pleasant. This pulp is caused by tartaric acid. According to the author, tamarind is the sweetest and most acidic fruit. The World Health Organization (WHO) states that, except from tryptophan, tamarind may be regarded as a source of every necessary amino acid. Other organic acids including tartaric, succinic, and malic acid are also present. [10]

According to Indian botanist Brandies, tamarind is an imported plant, not a natural one (1906). Originating from India and Burma (Myanmar), it was transported by sea. According to Richie (1979), the plant was first transported to India and other Asian countries by Arab traders. If so, where did it originate as Arabian nations are unable to support its growth? The Sabaeans were a group of traders who traveled by land from the Nile to the Indus River, while another group of traders from Arabia traveled by sea to Gujarat. They traded with India and were from the southwestern part of the Arabian Desert. Because their competitors were ignorant of the desert routes, they had a monopoly on the market [3].

Origin: - Although tamarind trees are widely grown in Africa, Asia, and South America, India is the world's leading producer. Maker of tamarind-related goods. In the Indian states of Madhya Pradesh, Bihar, Andhra Pradesh, Karnataka, Tamil Nadu, West Bengal, Orissa, and Kerala, tamarind is in plentiful supply [7] .

2. DESCRIPTION: SCIENTIFIC CLASSIFICATION

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Superdivision	:	Spermatophyta
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Subclass	:	Rosidae
Superorder	:	Rosanae
Order	:	Fabales

Family	:	Fabaceae
Subfamily	:	Caesalpinoideae
Tribe	:	Detarieae
Genus	:	Tamarindus
Species	:	*Tamarindus indica*

3. TAMARIND'S INTRODUCTION TO AYURVEDA

The question therefore becomes: When was the plant originally brought to India? Originally found in Ayurveda? In early Ayurvedic texts like the Sushruta Samhita and the Caraka Samhita, it is called "amla". Furthermore, it's thought that kokam, not Tamarindus indica, was the acidic plant that Caraka may have mentioned and utilized. In Amarsimha's Amarkosha, it is also known as tintidi, cinca, and amlika. The Garcinica species (Guttiferae) G. cambojia or G. indica (kokam) are referred to by the names tintidi, tintdik, and vriksha amla, which likewise mean tamarind [3]. While every component of the tamarind tree serves a purpose and has economic value, the fruit is the tree's most famous product and its marketability has grown throughout time. Asia is the region that produces the most tamarind; India is said to be the leading producer, producing 300,000 tonnes of tamarind annually. According to the Indian Spice Board, 10 200 tons were exported from a production area of 58 624 hectares in 2006–2007. The possibility of Indian exports during the past five years suggests that there is a substantial market for tamarind, especially in Europe and the Gulf States. Thailand is the world's second-largest producer of tamarind, with 140 thousand tonnes produced in 1995; in 1999, the nation exported about 7000 tons. Sri Lanka exported 6903 tons of tamarind in 1997. Other Asian countries cultivate and export tamarind on a significantly smaller scale than India and Thailand.

With an annual yield of over 220 tons, Costa Rica is one of the Americas' leading tamarind producers. Puerto Rico produces 23 tons of tamarind yearly, whereas Mexico produces 37 tonnes. Whereas North America and Europe are the main export destinations for American tamarind, Asia, Europe, and North America are the main markets for the export of Asian tamarind. Most producing countries do not cultivate tamarind on a big scale; instead, it is grown in home gardens or in the wild. Although tamarind is extensively planted throughout Africa, no country in the continent cultivates tamarind for commercial purposes, and most of the fruit is consumed locally. In a similar vein, most tamarind produced in Thailand and India is eaten locally. The most popular variety is the sour tamarind, which produces 95% of all tamarinds worldwide. Thailand is the leading producer of sweet tamarind, accounting for 30% of global production.

4. MORPHOLOGY

The tamarind tree may reach a maximum crown height of 12 to 18 meters and has a long lifespan with a medium growth rate. Thick foliage envelops the top in an amorphous, vase-like structure. The tree does best in full sun. It prefers loam, clay, sandy, acidic, and soil types that are highly resistant to drought.

The naturally lobed evergreen leaves that are arranged alternately. The leaflets are elliptic-ovular, brilliant green, intrinsically veined, and less than 5 cm long. In agriculture, trees are regularly pruned to increase tree density and make fruit picking easier as they mature because their branches droop from a single, central stem. At night, the leaflets fold up. It is susceptible to frost because it is a tropical plant. The pinnate leaves, which have opposing sides, billow in the wind. The tamarind has long red and yellow blossoms that are subtle. Five-petaled yellow blooms with orange or red streaks are produced in little racemes with a diameter of 2.5 cm. Pink also adorns the four petals of the flower's four buds, which shed as the bloom opens. With a long lifetime and a slow growth rate, the tamarind tree may reach heights of 24 to 30 meters, a spread of 12 meters, and a trunk diameter of 7.5 meters under the right circumstances. This tree resists wind well because

of its dark-gray, rough, fissured bark and strong, flexible branches with gorgeously dropping terminals. The thin, fluffy, bright-green foliage is composed of 10–20 pairs of oblong leaflets, each measuring 1.25–2.5 cm in length and 5–6 mm in width, arranged in a pinnate leaf mass that is 7.5–15 cm long. At night, the leaflets fold. During the heat season, typically evergreen leaves may momentarily fall off in extremely dry areas. Inconspicuous, inch-wide flowers with five petals in little racemes. The distinctive pink color of the flower buds is caused by the four sepals that are lost as the flower opens [8].

5. BOTANY

Tamarindus indica belongs to the monotypic genus Tamarindus (Caesalpinoideae). The chromosomal numbers of tamarinds, a diploid species, are 2n = 24 (x = 12). This enormous, prickly, evergreen tree may reach a diameter of up to 12 meters in its spreading crown, and its substantial shadow canopy can reach a height of 20 to 30 meters. It provides protection and shade because of its large crown. It is also often used as a windbreaker due to its durability to storms. It is also known to have allopathic effects, which inhibit the growth of other plants on top of it or adjacent to it. It's a beautiful evergreen ornamental tree with magnificent blossoms that may be planted as an avenue in parks, beside roads, and by rivers. The stem is quite rough and scaly, and it is thick, short, fissured, and colored brown and grey. Compound leaves can grow up to 15 cm long and are grouped in pairs along a central axis. They consist of a large number of tiny leaflets that expire at night. The flower buds are small, gorgeous, and rose-red when they open. Their diameter is around 2.5 cm, and they contain two tiny, almost noticeable thread-like petals in addition to three golden petals with either pinkish-red or yellowish-red veins. Usually, the tree starts bearing fruit after eight or ten years. It ripens in Magh-Chait (January to April) and yields fruit in Asad-Bhado from June to September [3].



Fig 1: Tamarind tree

6. COLLECTION OF TAMARIND

Farmers used to climb trees to gathertamarind pods. They will crack open the shell by hitting it with a little wooden object. This is a labor-intensive and time-consuming activity. It used to be a family activity that involved every member. after the removal of the seed and shell. They'll hit the pulp with a piece of wood to

soften it. A machine was made to separate the seed and tamarind cover from the pods. The machine's capacity is 100 kg/h, and its efficiency rate is 90% [08].

Tamarind seed



Fig 2: Tamarind seed

When fruit pulp is used for commercial reasons, the by-product that results is considered to be thetamarind seed. The endosperm (70–75%) and testa (20–30%), sometimes referred to as the seed coat, make up the seed. Among other things, the tannin in the seed testa is used to manufacture ink and fix colures. The young seed pods of tamarind are pickled and eaten as a side dish in various parts of India, and the flowers are also used to flavor food and snacks. Tamarind is a popular food ingredient that may be used to enhance the viscosity and texture of processed foods. Observes that as the term "jellose" captures both of the seed's jelly-forming qualities, it has been proposed as a name for the plant. Cattle are fed seeds because of their high protein content. The roasted seeds of the tamarind fruit are ground up and used in place of coffee, and some ruminants and pigs are often given its flour. One of the numerous applications for tamarind seeds was found to be the potential use of tamarind seed powder as an affordable bio-adsorbent for fluoridating water. Tamarind seeds are eaten boiled or roasted during off-seasons and periods of food shortage. After the seeds are roasted, the edible kernel's testa are frequently decorticated. Roasted tamarind seeds can be used in place of coffee. The edible seed oil is suitable for cooking. About 46 to 48% of the tamarind seed kernel is made up of a gel-forming substance called jellose or polyose, which has several applications in the food industry. Jellose is mainly a polysaccharide that may be applied to meals to stabilize, thicken, and gel them. Rather than using fruit pectin [13], use tamarind seed gel. There have been occasions when people have eatentamarind seeds. They consist of around 63 percent starch, 14–18% albuminoids, and 4.5–6.5% semidrying oil. Before being boiled or fried, they can be reduced to a flour or starch, roasted, and then soaked to remove the seed coat.

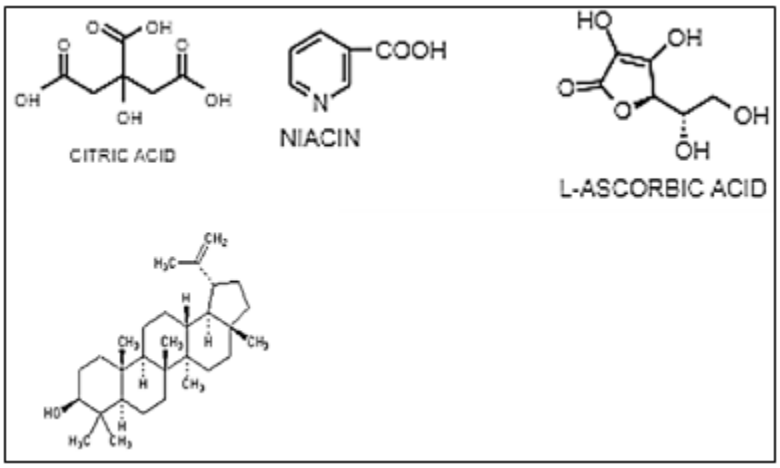
In India, the amount of leftover seeds is expected to reach 132,000 tons per year, yet most of them have traditionally been discarded. In 1942, T. P. Ghose and S. Krishna, two Indian scientists, found that 46-48% of a gel-forming material was present in the decorticated kernels. Their study led to the introduction of tamarind kernel powder into the Indian textile sector. Additional industrial applications include the creation of a wood glue and structural plastic, as well as textile color printing, paper size, and leather treatment.It is typically used to adorn handmade blankets. Dr. G. R. Savur of the Pectin Manufacturing Company, Bombay, has patented a method for creating a purified product called as "pectin," "polyose," or "jellose," which has been demonstrated to be superior to fruit pectin in the creation of jellies, jams, and marmalades. It

may be used for fruit preservation with or without acids and gelatinizes with sugar concentrations even in cold water or milk. It is advised to be used as a stabilizer in ice cream, cheese, and mayonnaise [14].

7. PHYTOCHEMISTRY

Table 1: Phytochemistry

Parts	Chemical constituents
Leaves	Pulps contains invert sugar, citric acid, pipecolic acid nicotinic acid, 1-malic acid, volatile oils (geraniol, limonene), pipecolic acid, lupanone, lupeol, orientin, isoorientin, vitamin B3, vitamin C, vitexin, isovitexin, benzyl benzoate (40.6%), cinnamates, serine, pectin, beta alanine, proline, phenylalanine, leucine, potassium, 1-malic acid, tannin, glycosides.
Fruits	Fruits Furan derivatives and carboxylic acid. Phlorotannins, apple acid, grape acid, succinic acid, citric acid, tartaric acid, pectin, invert sugar.
Seeds	Campesterol, β-amyrin, β-sitosterol, palmitic acid, oleic acid, linoleic acid and eicosanoic acid. The Mucilage, arabinose, xylose, galactose pectin, glucose and uranic acid was also found. A new bufadienolide (Scilliroside 3-O-β-D glucopyranosyl-(1-2)-Lrhamnopyranoside) and a cardioid (uzarigenin-3-O-βDxylopyranosyl (1-2)-α-L rhamnopyranoside) were identified from the seed extract. Cellulose, albuminoid. amyloids, phytohemagglutinins, chitinase.
Stem bark	Tannins, saponins, glycosides, peroxidase and lipids.
Root bark	The n-hexacosane, eicosanoic acid, β-sinosterol, (+)-pinitol, octacosanyl ferulate, 21-oxobehenic acid.



8. FORMULATION METHODS

Tamarind seed powder preparation

The pulp and fibers that held the seeds in each tamarind fruit pod were removed by hand breaking the pods. The pulp and fiber strands were easier to remove from the tamarind seeds, so they were steeped in fresh, portable water (1: 3 w/v) for the entire night. The seeds were then cleaned using pure distilled water. The cleaned seeds were sun dried for fourteen days in the shade, and then they were ground into fine flour using a Wonder mill. The flour was sieved through a 300 mm screen before being used again, and it was then frozen at 18°C in an airtight container. The tamarind kernel flour was then passed through a 60 mesh filter and packaged in airtight plastic containers for further nutritional analysis. The nutritional characteristics of tamarind kernel flour were investigated in the lab using the standard methodology.

Extracting gum from modified tamarind seeds

Gum is manufactured from modified bitter almond kernels. Crushing the tamarind seed using a mortar and pestle allowed for its extraction. The crushed material was then moved to a 1000 ml beaker and boiled in 500 ml of distilled water for a duration of 5 to 6 hours. After the raw material has completely boiled, filter it using a muslin towel. The material that was filtered was concentrated by heating it over a water bath for two to three hours. Precipitates formed when alcohol was progressively added to the concentrate after it had cooled. The precipitates were separated using vacuum filtering apparatus. The precipitates dried under the sun. To create carboxymethylated modified tamarind seed gum (CMTG), follow these instructions. The tamarind gum was carboxymethylated using tamarind seed gum. An aqueous dispersion was produced by dissolving tamarind seed gum (1.25%, W/V) in ice-cold sodium hydroxide (45%, W/W) after stirring for thirty minutes. To this, 25 ml of an aqueous solution containing 45% (w/v) monochloroacetic acid was added while stirring continuously. After 30 minutes of continuous stirring at 700 °C, the reaction mixture was cooled and suspended in 80% (vol/vol) methanol. The CMTG precipitates were then made, filtered, neutralized with glacial acetic acid, rinsed with about 80% (vol/vol) methanol, and dried in a 40 °C oven.

The carboxymethylated tamarind seed gum (CMTG) is complexed with calcium

A specific derivative containing calcium chloride is reacted to produce gum derivatives cross-linked with calcium. After dissolving 2.5 g of carboxymethyled gum in 50 ml of water, a drop at a time of a calcium chloride (5%, W/V) solution was added to the mixture to produce thick, homogeneous, and gelatinous precipitates. These precipitates were repeatedly washed with distilled water to remove gum and unreacted calcium. The washing was halted when the filtrate, when added to a standard magnesium-EDTA complex solution containing Erichrome black T indicator solution, failed to create red color from blue color.

After being cleaned, these precipitates were freeze-dried and then passed through a #80 filter [17].



Fig 3: Extracted pure Tamarind seed gum



Fig 4: Carboxymethyled Tamarind seed gum



Fig 5: Calcium complexed Tamarind seed

9. BENEFITS & USES

Table 2: Medicinal uses

Disorder category	Medicinal uses	Plant part	Preparation
Unspecified	Fortifiant	Bark and leaf	Decoction of fresh plant parts with potash used as blood tonic
	Jaundice	Bark and leaf	Decoction of fresh plant parts with potash
Circulatory	Heart disease	Fruite (unripe)	Chew with onion and swallow to treat palpitations

	Hypotension	Leaf	Infusion taken 3 times a day
Digestive System	Abdominal Pain	Bark	Well the fresh bark of young twigs in water for 24 h and drink as purgative and to treat abdominal pain
	Dairrhoea	Bark	Decoction, used as astringent
	Dysentery	Seed	Powdered seeds administered Orally
	Laxative	Bark	The fresh bark of young twigs is soaked in water for 24 h and drunk as purgative and to treat abdominal pain
	Vomiting	Fruit	In leprosy treatment to enhance the emetico-cathartic properties of Trichilia America; A mixture of Cantharides-powder and tamarind pulp is taken by the patient before the syphilis treatment starts
Endocrine System	Dibetis	Leaf	Not Specified
Genitourinary System	Aphrodisiac	Bark	Mash and add to porridge to treat impotence
	Contraceptive	Not Specified	Large quantity of 'tamarind' infusion drunk by the woman before sexual intercourse; Mixture of 'tamarind' with pepper and honey in water, called Konkori Badji
	Diuretic	Unspecified Bark	In the treatment of gonorrhea: food prepared of millet with tamarind and ground seeds of Jatropha curcas or with Trichilia emetic, Medicine prepared bark of tamarind and that of Prosopis africana (Toucouleur)
	Infertility	All aerial parts	Crush all parts and soak in water; give orally to the cattle
Infections	Cold	Fruit pulp	Mix with water and add sugar for taste, then drink
	Fever	Fruit	Fruit pulp used in the treatment of fever for refreshment followed by rubbing
	Malaria	Bark	Decoction with Mangifera indica (part used of the latter species unclear)
	Helminth infections	Bark	Macerate used in the treatment of vesical schistosomiasis
	Hepatitis A	Leaf	Not specified
	Leprosy	Bark/Root	Drink root and bark extract together with root and bark extract of Stereospermum kunthianum

	Measles	Pods/Leaves	Burnt to symbolize the disease egress through the skin
	Microbial infection	Fruit	Soaked fruit, oral administration to treat infectious diseases including STD's
Inflamation	Broncjhitis	Leaf	Leaf juice with ginger in the treatment of bronchitis
Injuries	Wounds	Bark	Not specified
Mental	sleep	Fruit pulp	Mix with water and add pepper, then drink
	Sorcery	Leaf/Bark	Mix with water and add pepper, then drink
Nervous System	Epilepsy	Root	One cup of root decoction taken twice a day
Nutritional	Appetide	Leaf	Cooled down decoction, to drink for appetite
Pain	Scurvy	Fruit pulp	Not specified
	Dysuria	Bark	Add to the soup a tablespoon of a sugared decoction of ground tamarind stem bark and Capsicum frutescens fruit pericarps
	Pain	Bark&Leaf	Decoction of fresh plant parts with potash used to treat body pains
Poisoning	Antidote	Leaf	Decoction of the leaves is used as wash on snake and insect bites
Pregnancy, Birth, puerperium	Birth	Leaf	Cooled down decoction is given to drink to sheep and goats to treat complications with delivery
	Lactation	Fruit	To increase lactation, eat Kunu (a kind of porridge) prepared with fruit of tamarind and Ximenia americana or drink a macerate of tamarind fruits in water
	Pregnancy	Fruit	Drink macerate of fruits in water to relieve pain upon labor
Respiratory System	Repertory	Bark	Macerate of the bark taken for coughs
Sensory Systesm	Earache	Leaf	Pounded, applied to ear
	Eye	Leaf Bud	Decoction used as wash
	Vertigo	Fruit pulp	Mix with water and add sugar for taste, then drink
Skin	Skin	Bark & Leaf	Decoction of fresh plant parts with potash used as skin cleanser

As a food and beverage tamarind pulp uses

The pulp's rich aroma and delectable acidic flavor make it a popular choice for both industrial and domestic uses. The pulp is used as a spice, to add flavor to curries, sweets, and sauces, and to make various drinks instead of using artificial acidulants. Tamarind pulp may be used to make a wide range of products, such as pickles, paste, concentrate, juice, and powder [5, 7]. Additionally claiming several health advantages, tamarind pulp is known for its blood tonic, expectorant, digestive, carminative, and laxative properties.The pulp has been found to have a hypolipidemic effect. The ingestion of dates delays the course of flourisis in humans by increasing the excretion of fluorine through the urine. The pulp is used topically to inflammations and gargled with it to soothe sore throats. The pulp is said to aid in the return of feeling in cases of paralysis [15].

Health benefits of tamarind seed

1. Arthritis

Due to its anti-inflammatory qualities, consuming ½ teaspoon of roasted tamarind seed powder twice a day with water helps to lubricate joints and relieve discomfort. Due to its anti-inflammatory qualities, taking a half-teaspoon of roasted tamarind seed powder twice a day with water improves joint lubrication and lessens pain.

2. High blood pressure and heart disease

Consuming dietary fat high in linoleic acid is associated with preventing cardiovascular diseases such as atherosclerosis and coronary heart disease as well as decreasing blood pressure. In addition to reducing cardiovascular conditions including atherosclerosis and coronary heart disease, dietary fat high in linoleic acid is linked to lowering blood pressure.

3. Teeth

Tamarind seeds have the ability to remove nicotine residue from teeth and treat any tooth-related issues. Teeth can be cleaned with powdered seeds.

4. Indigestion

Use tamarind seed juice to relieve indigestion and stimulate the formation of bile. Its high dietary fiber content lowers cholesterol. This is an excellent natural digestive aid and appetiser. Also beneficial for relieving constipation and curing stomatitis.

5. Diarrhea

The red outer shell of the tamarind seed works wonders for diarrhea and dysentery. As an effective fruit pectin substitute, xyloglucan can be used to treat diarrhea, dysentery, and colitis.

6. Cancer

Sticky tamarind seed juice is a preventative and therapeutic measure for colon cancer. The immune-suppressive and anticancer qualities of tamarind seeds prevent the body from acquiring cancer. Seed extract lowers oxidative stressors and hence slows or stops the growth of renal cell cancer.

7. Enhancer immunity

The immune-stimulating properties of tamarind seeds help protect against a variety of diseases and conditions. TSP has a preventive effect on red blood cells (RBCs), white blood cells (WBCs), platelets, and hemoglobin (Hb). The increased expression of CD4+ and CD8+ cells after TSP treatment suggested a strong preponderance of T cells that produce TH1 cytokines [16].

10. CONCLUSION

In this succinct study, the phytochemistry and pharmacognosy of Tamari seeds have been well described. Given its various applications, further research on activity screening and structural relationships has to be done. Commercial and home usage are both made oftamarind seeds. It will take further research to prepare tamarind seeds. Further investigation may be required to determine the optimal use of tamarind products. The material in this study will be useful in advancing research into the discovery and development of novel agents for use in medicine as well as agricultural enterprises that rely on natural plant-based goods.

11. REFERENCES

1. De Caluwé E, Halamová K, Van Damme P. Tamarind (*Tamarindus indica* L.): a review of traditional uses, phytochemistry and pharmacology.
2. Ebifa-Othieno E, Mugisha A, Nyeko P, Kabasa JD. Knowledge, attitudes and practices in tamarind (*Tamarindus indica* L.) use and conservation in Eastern Uganda. Journal of ethnobiology and ethnomedicine. 2017 Dec;13(1):1-3.
3. Shah NC. *Tamarindus indica*-Introduction in India and Culinary, Medicinal, and Industrial Uses. Asian Agrihist. 2014 Oct;18(4):343-55.
4. Gitanjali VS, Shashi J. Nutritional properties of tamarind (*Tamarindus indica*) kernel flour. Int. J Curr. Microbiol. Appl. Sci. 2020;9(05):1359-64.
5. Arudra AK. Tamarind seed processing and by-products. Agricultural Engineering International: CIGR Journal, 2015 Jun, 17(2).
6. Yahia EM. editor. Postharvest biology and technology of tropical and subtropical fruits: Mangosteen to white sapote. Elsevier; c2011 Jun.
7. Idris MM, Karamba H, Ayoubi R. *Tamarindus indica*.-A Review Paper on Efficacy of Tamarind plant in Water Treatment and Purification.
8. Toungos MD. Tamarind (*Tamarindus indicus* L) Fruit of Potential Value but Underutilized in Nigeria. International Kournal of Innovative Food, Nutrition and Sustainable Agriculture. 2019;7(1):1-0.
9. Muzaffar K, Kumar P. Tamarind-a mini review. MOJ Food Processing & Technology. 2017;5(3):296-7.
10. Chimsah FA, Nyarko G, Abubakari AH. A review of explored uses and study of nutritional potential of tamarind (*Tamarindus indica* L.) in Northern Ghana.
11. Rao AS, Kumar AA, Ramana MV. Tamarind seed processing and by-products. Agric. Eng. Int.: CIGR J. 2015 Jun;17:200-4.
12. Fischer G, Balaguera-López HE, Magnitskiy S. Review on the eco-physiology of important Andean fruits: Solanaceae. Revista UDCA Actualidad & Divulgación Científica, 2021 Jun, 24(1).
13. Zohrameena S, Mujahid M, Bagga P, Khalid M, Noorul H, Nesar A, *et al*. Medicinal uses & pharmacological activity of *Tamarindus indica*. World Journal of Pharmaceutical Sciences; c2017 Jan. p. 121-33.
14. Morton JF. The Tamarind (*Tamarindus indica* L.); Its Food, Medicinal and Industrial Uses. In Proceedings of the Florida state horticultural society. 1958;71:288-293.
15. Mishra A, Malhotra AV. *Tamarind xyloglucan*: a polysaccharide with versatile application potential. Journal of Materials Chemistry. 2009;19(45):8528-36.