



Tamarind (*Tamarindus indicus* L) Fruit of Potential Value But Underutilized in Nigeria

Mohammed D. Toungos (Ph.D.)

**Crop Science Department, Adamawa State University Mubi,
Adamawa State, Nigeria**

Corresponding Author Email: dahiru.toungos@gmail.com; toungosm@adsu.edu.ng.

ABSTRACT

Tamarind (*Tamarindus indicus* L) is a leguminous tree indigenous to tropical Africa particularly Sudan. It belongs to the family *Fabaceae* and genus *monotypic taxon*. Known as *inli* in Hindu-Urdu, *asana jawa* in India, *tamarindo* in French, *tamarin*, *tamariner*, *tamarier des Indes* in Dutch and German, *tamarinde* in Italian, *taman* in Philippines and locally called Jabbe, Stamiya in Fulfulde and Hausa in Nigeria. Tamarind tree produces pod-like fruit that contains an edible pulp used as cuisines around the world. The fruits are flattish, bean like, irregularly curved and bulged pod, are borne in great abundance along the new branches and usually vary from 2.5cm - 8.75cm long and 2cm - 3.2cm in diameter. Its cultivation has spread to almost all tropical areas of the world since it is such a useful and desirable source of nutrition that also comes with a unique of flavor. With all these, many in Nigeria, particularly northern Nigeria do not recognize its potentiality and was allowed to waste and underutilized only by peasant farmers and the low income elderly, despite the fact that, all of the fruit trees of the tropics, none is more widely distributed than the tamarind. The pods may be cinnamon- brown or greyish-brown externally and at first are tender skinned with green, highly acid flesh and soft, whitish, underdeveloped seeds. As they mature, the pods fill out some what and a juicy aciduous pulp turns brown or reddish -brown. The skin thereafter becomes brittle, easily- cracked shell and the pulp dehydrates naturally to a sticky paste enclosed by a few coarse strands of fiber extending length wise from the stalk. The 1 - 12 fully matured seeds are hard, glossy-brown, squarish in form 1.1cm - 1.25cm in diameter and each is enclosed in a parent like membrane. The uses are many; the tender, immature, very sour pods are cooked as seasoning with rice, fish and meat; they are roasted and eaten. The pulp is made into a variety of products, important ingredient in Chutneys', curries and sauces and barbecue sauce. It is be made as a popular drink and bottled in carbonated form in Guatemala and Puerto Rico. Health benefits include the ability to reduce inflammation through the body, improve vision, boost respiratory health, heal skin conditions and improves the digestive system. Improves nervous function and weight loss when used as spice due to hydroxy citric acid (HCA) a unique compound that can be extracted from tamarind. Manges diabetes and also suitable for expectant mothers. It also relieves pain, strengthens the immune system, reduces fever, lowers cholesterol to improve cardiovascular health, treats piles and protects against parasites and worms. It is considered a natural laxative and its dietary fiber content is a major reason for this property. Oddly enough, the fiber also reduce loose stools. Studies have also shown tamarind to be effective against chronic diarrhea as well. Tamarind is mostly available in dry season and its seeds is a rich source of magnesium, phosphorus, potassium, calcium, vitamin C and amino acids. With all these potentialities of the seed, sadly it is mostly underutilized in Nigeria. With these potentials, it is hoped that, it will be given the due attention by researchers and awareness be made by both Governmental and Non-governmental organizations to the populace so as to benefit them from the numerous uses of the seed.

Keywords: Tamarind, juicy, pulpy-brown, fiber, hydroxy citric acid (HCA).

INTRODUCTION

Tamarindus indica is probably indigenous to tropical Africa, but has been cultivated for so long on the Indian subcontinent that it is sometimes reported to be indigenous there, where it is known as *imli* in Hindi-Urdu, Raghavan (2006). It grows wild in Africa in locales as diverse as Sudan, Cameroon, Nigeria, Zambia and Tanzania. In Arabia, it is found growing wild in Oman, especially Dhofar, where it grows on the sea-facing slopes of mountains. It reached South Asia likely through human transportation and cultivation several thousand years BC. It is widely distributed throughout the tropical belt, from Africa to South Asia, northern Australia, and throughout Oceania, Southeast Asia, Taiwan and China.

Tamarind is a leguminous tree in the family *Fabaceae* and scientific name is *Tamarindus indica*. Indigenous to tropical Africa, particularly Sudan, but its cultivation has spread to almost all tropical areas of the world since it is such a useful and desirable source of nutrition that also comes with a unique flavor. The genus *Tamarindus* is a monotypic taxon. The tamarin tree produces pod-like fruit that contains an edible pulp used in cuisines around the world. Other uses of the pulp include, traditional medicine and metal polish. The wood can be used for woodworking and tamarind seed oil can be extracted from the seeds. Because of tamarind's many uses, it is cultivated around the world in tropical and subtropical zones.

It has been cultivated for thousands of years. Of all the fruit trees of the tropics, none is more widely distributed or more appreciated as an ornamental than the tamarind, *Tamarindus indica* L. (syns. *T. occidentalis* Gaertn.; *T. officinalis* Hook.), of the family Leguminosae. Most of its colloquial names are variations on the common English term. In Spanish and Portuguese, it is *tamarindo*; in French, *tamarin*, *tamarinier*, *tamarinier des Indes*, or *tamarindier*; in Dutch and German, *tamarinde*; in Italian, *tamarandizio*; in Papiamentu of the Lesser Antilles, *tamarijn*. In the Virgin Islands, it is sometimes called *taman*; in the Philippines, *sampalok* or various other dialectal names; in Malaya, *asam jawa*; in India, it is tamarind or *ambli*, *imli*, *chinch*; in Cambodia, it is *ampil* or *khous me*; in Laos, *mak kham*; in Thailand, *ma-kharm*; in Vietnam, *me*. It is locally called Jabbe and Stamiya in Fulfulde and Hausa in Nigeria. The name "tamarind" with a qualifying adjective is often applied to other members of the family Leguminosae having somewhat similar foliage.

In the 16th century, it was introduced to Mexico, and to a lesser degree to South America, by Spanish and Portuguese colonists, to the degree that it became a staple ingredient in the region's cuisine.

Today, India is the largest producer of tamarind, Tamarind Database (2018). The consumption of tamarind is widespread due to its central role in the cuisines of the Indian subcontinent, Southeast Asia, and the Americas, especially Mexico.

Morphology: The tamarind is a long-lived, medium-growth tree, which attains a maximum crown height of 12 to 18 meters. The crown has an irregular, vase-shaped outline of dense foliage. The tree grows well in full sun. It prefers clay, loam, sandy, and acidic soil types, with a high resistance to drought and aerosol salt (wind-borne salt as found in coastal areas). Tamarind monograph (2018).

The evergreen leaves are alternately arranged and pinnately lobed. The leaflets are bright green, elliptic-ovular, pinnately veined, and less than 5 cm in length. The branches droop from a single, central trunk as the tree matures, and are often pruned in agriculture to optimize tree density and ease of fruit harvest. At night, the leaflets close up.

As a tropical species, it is frost-sensitive. The pinnate leaves with opposite leaflets give a billowing effect in the wind. The tamarind flowers (although inconspicuously), with red and yellow elongated flowers. Flowers are 2.5 cm wide, five-petaled, borne in small racemes, and yellow with orange or red streaks. Buds are pink as the four sepals are pink and are lost when the flower blooms.

The tamarind, a slow-growing, long-lived, massive tree reaches, under favorable conditions, a height of 24 - 30m, and may attain a spread of 12m and a trunk circumference 7.5m. It is highly wind-resistant, with strong, supple branches, gracefully drooping at the ends, and has dark-gray, rough, fissured bark. The mass of bright-green, fine, feathery foliage is composed of pinnate leaves, 7.5-15cm in length, each having 10 to 20 pairs of oblong leaflets 1.25 - 2.5cm long and 5 - 6mm wide, which fold at night. The leaves are normally evergreen but may be shed briefly in very dry areas during the hot season. Inconspicuous, inch-wide flowers, borne in small racemes, are 5-petaled (2 reduced to bristles), yellow

with orange or red streaks. The flower buds are distinctly pink due to the outer color of the 4 sepals which are shed when the flower opens.

The fruits, flattish, beanlike, irregularly curved and bulged pods, are borne in great abundance along the new branches and usually vary from 2 to 7 in long and from 2 - 3.2cm in diameter. Exceptionally large tamarinds have been found on individual trees. The pods may be cinnamon-brown or grayish-brown externally and, at first, are tender-skinned with green, highly acid flesh and soft, whitish, under-developed seeds. As they mature, the pods fill out somewhat and the juicy, acidulous pulp turns brown or reddish-brown. Thereafter, the skin becomes a brittle, easily-cracked shell and the pulp dehydrates naturally to a sticky paste enclosed by a few coarse strands of fiber extending lengthwise from the stalk. The 1 to 12 fully formed seeds are hard, glossy-brown, squarish in form, 1.1 - 1.25cm in diameter, and each is enclosed in a parchmentlike membrane.

Fruit: The fruit is an indehiscent legume, sometimes called a pod, 12 to 15cm in length, with a hard, brown shell, Imam S, *et al* (2007); USAD, 2019.

The fruit has a fleshy, juicy, acidulous pulp. It is mature when the flesh is colored brown or reddish brown. The tamarinds of Asia have longer pods (containing six to 12 seeds), whereas African and West Indian varieties have shorter pods (containing one to six seeds). The seeds are somewhat flattened, and a glossy brown. The fruit is best described as sweet and sour in taste, and is high in tartaric acid, sugar, B vitamins, and, unusually for a fruit, calcium, Nurhanani, R, *et al* (2012); (2015).

The fruit is harvested by pulling the pod from its stalk. A mature tree may be capable of producing up to 175 kg of fruit per year. Veneer grafting, shield (T or inverted T) budding, and air layering may be used to propagate desirable cultivars. Such trees will usually fruit within three to four years if provided optimum growing conditions. Tamarind monograph, (2018)

Benefits: The food uses of the tamarind are many. The tender, immature, very sour pods are cooked as seasoning with rice, fish and meats in India. The fully-grown, but still unripe fruits, called "swells" in the Bahamas, are roasted in coals until they burst and the skin is then peeled back and the sizzling pulp dipped in wood ashes and eaten. The fully ripe, fresh fruit is relished out-of-hand by children and adults, alike. The dehydrated fruits are easily recognized when picking by their comparatively light weight, hollow sound when tapped and the cracking of the shell under gentle pressure. The shell lifts readily from the pulp and the lengthwise fibers are removed by holding the stem with one hand and slipping the pulp downward with the other. The pulp is made into a variety of products. It is an important ingredient in chutneys, curries and sauces, including some brands of Worcestershire and barbecue sauce, and in a special Indian seafood pickle called "tamarind fish". Sugared tamarind pulp is often prepared as a confection. For this purpose, it is desirable to separate the pulp from the seeds without using water. If ripe, fresh, unhydrated tamarinds are available, this may be done by pressing the shelled and defibered fruits through a colander while adding powdered sugar to the point where the pulp no longer sticks to the fingers. The seeded pulp is then shaped into balls and coated with powdered sugar. If the tamarinds are dehydrated, it is less laborious to layer the shelled fruits with granulated sugar in a stone crock and bake in a moderately warm oven for about 4 hours until the sugar is melted, then the mass is rubbed through a sieve, mixed with sugar to a stiff paste, and formed into patties. This sweetmeat is commonly found on the market in Jamaica, Cuba and the Dominican Republic. In Panama, the pulp may be sold in corn husks, palm leaf fiber baskets, or in plastic bags.

Tamarind has long been a popular drink in the Tropics and it is now bottled in carbonated form in Guatemala, Mexico and Puerto Rico. *Tamarindus indica*, Health online 2018.

Medicinal Uses

Medicinal uses of tamarind are uncountable.

The health benefits of tamarind have been well-studied and they include its ability to reduce inflammation throughout the body, improve vision, boost respiratory health, heal skin conditions, and improve the digestive system. Tamarind also relieves pain, strengthens the immune system, reduces fever, lowers cholesterol and improve cardiovascular health, treats piles, and protects against parasites and worms. *Tamarindus, indica* Health online, 2018.

There are many different ways to consume this nutritious fruit.

- i. It can be consumed raw,
- ii. It can be added to dessert once it is fully ripe
- iii. It can be dried and ground into a spice
- iv. It is often used in jams and sauces
- v. It is dried and processed into candies in some parts of the world.

It is a normal ingredient in soups and dishes throughout Asia and South America, owing to the health benefits this little seed pod contains.

Tamarind has long been considered a natural laxative and its dietary fiber content is a major reason for this property. Eating it as a fruit or as a spice can increase the efficiency of one's digestive system, as the fiber can bulk up the stool, making it move through the smooth muscles of the intestinal tract easily. It is also a bilious substance, meaning that it stimulates the activity of the bile, which can help dissolve food faster, and the fiber stimulates gastric juices to speed up digestion, Razali, N. *et al* (2015).

All of this together means that, things run through the digestive system tract faster, making it a powerful laxative of one is suffering from chronic constipation. But oddly enough, the fiber can also reduce loose stools, and studies have shown that, tamarind can be effective against chronic diarrhea as well. Additionally, a study by Dr. Silas Bhattacharya, Indian Institute of Technology, Kharagpur, India, shows that, the soluble protein and amino-acid composition of tamarind make it the best digestive.

Protect heart Health: A study published in the Food and Chemical Toxicology journal on tamarind have shown it to be effective in reducing blood pressure and cholesterol. The fiber content in tamarind certainly has something to do with the reduction of cholesterol, since it is known to scrap excess LDL cholesterol from the veins and arteries. The potassium in tamarind may be responsible for a reduction in blood pressure since it is known as a vasodilator that reduces the stress on the cardiovascular system.

The impressive level of vitamin C in it also has something to do with it as well. Vitamin C is an antioxidant that can reduce the impact of free radicals, the pesky by-product of cellular metabolism that have been linked to heart disease and a number of other health conditions.

Improves Circulation: Tamarind is a very good source of iron and a single serving can provide more than 10% of one's daily requirements. A healthy supply of iron in the body guarantees proper red blood cell count in the body, which can ensure appropriate oxygenation of different muscles and organs to function properly. Also, iron deficiency results in anemia, which is characterized by weakness, fatigue, headache, cognitive disorders, and stomach issues. So tamarind is advised to be eaten in plenty to keep anemia at bay.

One of the most significant vitamins in tamarind is the B complex. Thiamine, an important part of the vitamin family, is found in high quantities within tamarind. Thiamine is responsible for improving nerve function, as well as muscle development, which can help one to remain active, and maintain the reflexes and makes one stay strong.

Weight Loss: one of the unique compounds that can be extracted from tamarind or gain as a benefit from it when used as spice is the hydroxy citric acid (HCA). HCA is connected to weight loss because it has been shown to inhibit an enzyme in the body that specifically helps to store fat. Furthermore, it has been known to suppress the appetite by increasing the neurotransmitter serotonin. But research is still going in these respective areas, and it shows promising signs as a weight loss supplement.

Manage Diabetes: Along with the ability to stop weight gain, it also inhibits the enzyme alpha -amylase, which mainly stops carbohydrates from being absorbed. A carbohydrate – heavy diet can increase the chances of uncontrolled glucose and insulin levels, which is the biggest problem for people suffering from diabetes. Tamarind can help to monitor and control these fluctuations . According a study conducted at the Center of Magnesium Education & Research, Hawaii, almost half (48%) of the US population consumed less than the required amount of magnesium, which is the cause of various diseases including type-2 diabetes. Thus, the high content of magnesium in tamarind further helps to alleviate diabetes.

Anti-inflammatory Capacity: Lupeol in USDA, (2019) found in tamarind possesses anti-cancer properties, according to a study done at the University of Wisconsin-Madison, Madison. The essential oil of tamarind has been connected to a number of anti-inflammatory abilities, including the reduction of joint pain and inflammation, arthritis, rheumatic condition, and gout. It also reduces eye irritation; one of the

most common forms of which is conjunctivitis, also known as pink eye. It has shown a definite soothing and anti-inflammatory ability and is, therefore, used in many herbal remedies for inflammation.

Tamarind seeds are suitable for expectant mothers, as the nutritious fiber content of the tamarind seeds is useful to the foetus and the mother. One cannot associate the seed to any scientifically proven ill consequence or side effects particularly to pregnant women.

The seeds of tamarind are roasted and used as snack in the rural areas of India. Tamarind is mostly available in the dry season and its seed is a rich source of magnesium, phosphorous, potassium, calcium, Vitamin C and amino acids.

Nutrition Facts in raw Tamarinds.

Serving size 100g

Nutrient	Value
Water [g]	31.4
Energy [kcal]	239
Protein [g]	2.8
Total lipid (fat) [g]	0.6
Carbohydrate, by difference [g]	62.5
Fiber, total dietary [g]	5.1
Sugars, total [g]	38.8
Calcium, Ca [mg]	74
Iron, Fe [mg]	2.8
Magnesium, Mg [mg]	92
Phosphorus, P [mg]	113
Potassium, K [mg]	628
Sodium, Na [mg]	28
Zinc, Zn [mg]	0.1
Vitamin C, total ascorbic acid [mg]	3.5
Thiamin [mg]	0.43
Riboflavin [mg]	0.15
Niacin [mg]	1.94
Vitamin B-6 [mg]	0.07
Folate, DFE [µg]	14
Vitamin B-12 [µg]	0
Vitamin A, RAE [µg]	2
Vitamin A, IU [IU]	30
Vitamin E (alpha-tocopherol) [mg]	0.1
Vitamin D (D2 + D3) [µg]	0
Vitamin D [IU]	0
Vitamin K (phylloquinone) [µg]	2.8
Fatty acids, total saturated [g]	0.27
Fatty acids, total monounsaturated [g]	0.18
Fatty acids, total polyunsaturated [g]	0.06
Fatty acids, total trans [g]	0
Cholesterol [mg]	0
Caffeine [mg]	0

Sources include: USDA Retrieved on 9th January, 2019.

<https://ndb.nal.usda.gov/ndb/foods/show/09322>.

Tamarind Nutrition Facts: According to USDA, tamarind provides energy and sugar along with essential nutrients like potassium, phosphorus, magnesium, calcium, and vitamin C. It also contains

Nutrition Facts in raw Tamarinds.

Serving size 100g

Nutrient

Value

iron, sodium, zinc, niacin, riboflavin, thiamin, folate, and vitamin A and K. There are also a number of organic compounds that make it a powerful antioxidant and anti-inflammatory agent.

Uses:

Tamarind, raw.

Nutritional value per 100g

Energy	239kcal(1,000kj)
Carbohydrates	62.5g
Sugars	57.4
Dietary fiber	5.1g
Fat	0.6g
Saturated	0.272g
Monounsaturated	0.181g
Polyunsaturated	0.059g
Protein	2.8g
Tryptophan	0.018g
Lysine	0.139g
Methionine	0.014g
Vitamins	Quantity % DV+
Vitamin A equiv.	0%
	2ug
Vitamin A	30 IU
	37%
Thiamine (B1)	0.42mg
	13%
Riboflavin (B2)	0.152mg
	13%
Niacin (B3)	1.938mg
	3%
Pantothenic acid (B5)	0.143mg
	5%
Vitamin B6	0.066mg
	4%
Folate B9	14ug
	2%
Choline	8.6mg
	4%
Vitamin C	3.5mg
	1%
Vitamin E	0.1mg
	3%
Vitamin K	2.8ug
Minerals	Quantity %DV+
Calcium	7%
	74mg
Copper	43%
	0.86mg

Iron		22%
		2.8mg
Magnesium		26%
		92mg
Phosphorus		16%
		113mg
Potassium		13%
		628mg
Selenium		2%
		1.3ug
Sodium	2%	
		28mg
Zinc		1%
		0.1mg
Other constituents		Quantity
Water		31.40g

Source: USDA Nutrient Database.

Key: ug = micrograms, mg = milligrams, IU= International units.

Food Value

Analyses of the pulp are many and varied. Roughly, they show the pulp to be rich in calcium, phosphorus, iron, thiamine and riboflavin and a good source of niacin. Ascorbic acid content is low except in the peel of young green fruits.

Food Value Per 100 g of Edible Portion

	<i>Pulp (ripe) * Leaves (young) Flowers</i>		
Calories	115		
Moisture	28.2-52 g	70.5 g	80 g
Protein	3.10 g	5.8 g	0.45 g
Fat	0.1 g	2.1 g	1.54 g
Fiber	5.6 g	1.9 g	1.5 g
Carbohydrates	67.4 g	18.2 g	
Invert Sugars	30-41 g		
(70% glucose; 30% fructose)			
Ash	2.9 g	1.5 g	0.72 g
Calcium	35-170 mg	101 mg	35.5 mg
Magnesium		71 mg	
Phosphorus	54-110 mg	140 mg	45.6 mg
Iron	1.3-10.9 mg	5.2 mg	1.5 mg
Copper		2.09 mg	
Chlorine		94 mg	
Sulfur		63 mg	
Sodium	24 mg		
Potassium	375 mg		
Vitamin A	15 I.U.	250 mcg	0.31 mg
Thiamine	0.16 mg	0.24 mg	0.072 mg

Riboflavin	0.07 mg	0.17 mg	0.148 mg
Niacin	0.6-0.7 mg	4.1 mg	1.14 mg
Ascorbic Acid	0.7-3.0 mg	3.0 mg	13.8 mg
Oxalic Acid		196 mg	
Tartaric Acid	8-23.8 mg		
Oxalic Acid	trace only		

The pulp is considered a promising source of tartaric acid, alcohol (12% yield) and pectin (2 1/2% yield). The red pulp of some types contains the pigment, chrysanthemum.

Seeds contain approximately 63% starch, 14-18% albuminoids, and 4.5-6.5% of a semi-drying oil.

Seeds: The powder made from tamarind kernels has been adopted by the Indian textile industry as 300% more efficient and more economical than cornstarch for sizing and finishing cotton, jute and spun viscose, as well as having other technical advantages. It is commonly used for dressing homemade blankets. Other industrial uses include employment in color printing of textiles, paper sizing, leather treating, the manufacture of a structural plastic, a glue for wood, a stabilizer in bricks, a binder in sawdust briquettes, and a thickener in some explosives. It is exported to Japan, the United States, Canada and the United Kingdom.

Tamarind paste has many culinary uses including a flavoring for chutneys, curries, and the traditional sharbat syrup drink. Tamarind sweet chutney is popular in India and Pakistan-as a dressing for many snacks. Tamarind pulp is a key ingredient in flavoring curries and rice in south Indian cuisine, in the Chigali lollipop, and in certain varieties of Masala Chai tea. Across the Middle East, from the Levant to Iran, tamarind is used in savory dishes, notably meat-based stews, and often combined with dried fruits to achieve a sweet-sour tang. Raghavan, S; (2006). In the Philippines, the whole fruit is used as an ingredient in the traditional dish called sinigang to add a unique sour taste, unlike that of dishes that use vinegar instead.

Tamarind seed oil: Tamarind seed oil is the oil made from the kernel of tamarind seeds, Razali, N; *et al* (2015). Isolation of the kernel without the thin but tough shell (or *testa*) is difficult. Tamarind kernel powder is used as sizing material for textile and jute processing, and in the manufacture of industrial gums and adhesives. It is de-oiled to stabilize its color and odor on storage.

Composition of tamarind seed kernel

<u>Composition</u>	<u>Origin</u>	<u>De-oiled</u>
Oil	7.6%	0.6%
Protein	7.6%	19.0%
Polysaccharide	51.0%	55.0%
Crude fiber	1.2%	1.1%
Total ash	3.9%	3.4%
Acid insoluble ash	0.4%	0.3%
Moisture	7.1%	

The fatty acid composition of the oil is linoleic 46.5%, oleic 27.2%, and saturated fatty acids 26.4%. The oil is usually bleached after refining.

Fatty acid composition of tamarind kernel oil

<u>Fatty acid</u>	<u>% Range reported</u>
Lauric acid (C12:0)	tr-0.3
Myristic acid (C14:0)	tr-0.4
Palmitic acid (C16:0)	8.7-14.8
Stearic acid (C18:0)	4.4-6.6
Arachidic acid (C20:0)	3.7-12.2
Lignoceric acid (C24:0)	4.0-22.3
Oleic acid (C18:1)	19.6-27.0
Linoleic acid (18:2)	7.5-55.4
Linolenic acid (C18:3)	2.8-5.6

CONCLUSION

With all these health benefits which include, the ability to reduce inflammation through the body, improve vision, boost respiratory health, heal skin conditions and improves the digestive system. Improves nervous function and weight loss when used as spice due to hydroxy citric acid (HCA) a unique compound that can be extracted from tamarind. **Manages** diabetes and also suitable for expectant mothers. It also relieves pain, strengthens the immune system, reduces fever, lowers cholesterol to improve cardiovascular health, treats piles and protects against parasites and worms. It is considered a natural laxative and its dietary fiber content is a major reason for this property. Oddly enough, the fiber also reduces loose stools. Studies have also shown tamarind to be effective against chronic diarrhea as well. But sadly, little attention is accorded to the plant to in order to tap the benefits in Nigeria. Tamarind is mostly available in dry season and its seeds are a rich source of magnesium, phosphorus, potassium, calcium, vitamin C and amino acids. With all these potentialities of the seed, it is mostly underutilized in Nigeria. With these potentials it is hoped that, it will be given the due attention by researchers and awareness to the populace so as to benefit from the numerous uses of the seed and also to develop a healthy and sound society. .

REFERENCES

- Abubakar, MG; Ukwuani, AN; Shehu, RA (2008). "Phytochemical Screening and Antibacterial Activity of Tamarindus indica Pulp Extract". *Asian Journal of Biochemistry*. 3 (2): 134–138.
- Imam S, Azhar I, Hasan MM, Ali MS, Ahmed SW. 2007. Two triterpenes lupanone and lupeol isolated and identified from Tamarindus indica linn. *Pakistan Journal of Pharmaceutical Sciences* 20(2):125–127.
- Nurhanani Razali, Sarni Mat-Junit, Amirah Faizah Abdul- Muthalib, Senthilkumar (2012) Subramaniam, Azlina Abdul- Aziz. Effect of various solvents on the extraction of antioxidant phenolics from the leaves, seeds, veins and skins of Tamarindus indica L. *Food Chemistry* 2012, 131(2), 441-448
- Nurhanani Razali, Sarni Mat Junit, Azhar Ariffin, Nur Siti Fatimah Ramli and Azlina Abdul Aziz. (2015), Polyphenols from the extract and fraction of T. indica seeds protected HepG2 cells against oxidative stress. *BMC Complementary and Alternative Medicine* (2015), 15:438 DOI: 10.1186/s12906-015- 0963-2
- Raghavan, Susheela (23 October 2006). *Handbook of Spices, Seasonings, and Flavorings* (2nd ed.). *CRC Press*. p. 176.
- Razali, N.; Mat Junit, S.; Ariffin, A.; Ramli, N. S.; Abdul Aziz, A. (2015). "Polyphenols from the extract and fraction of T. Indica seeds protected HepG2 cells against oxidative stress". *BMC Complementary and Alternative Medicine*. 15: 438.

Razali, Nurhanani; Abdul Aziz, Azlina; Lim, Chor Yin; *Mat Junit, Sarni (2015)*. "Investigation into the effects of antioxidant-rich extract of *Tamarindus indica* leaf on antioxidant enzyme activities, oxidative stress and gene expression profiles in HepG2 cells". *Peer J.* 3: e1292.

Tamarind monograph; PDF format; retrieved 19th December, 2018

"*Tamarind*". The Wood Database. Retrieved 20 December 2018.

"*Tamarindus indica*". Health Online. Retrieved December 16, 2018.

United States Department of Agriculture (USDA) Retrieved on 9th January, 2019.

<https://ndb.nal.usda.gov/ndb/foods/show>