

## Review Article

# Anti-Diabetic Property of *Catharanthus roseus* leaves and *Psidium guajava* Leaves

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## ABSTRACT

**Background:** *Sadabahar* (*Catharanthus roseus*) termed as periwinkle all over India, belongs to 'Apocynaceae' family, and is an evergreen ever-blooming bushy herb in tropical parts of the world like India, America, Australia and Malaysia. The leaves consist of alkaloids like vincristine and vinblastine that provide medicinal benefits like anti-diabetic, anti-cancer and anti-microbial traits. Guava (*Psidium guajava*) is a fruit consumed in various countries, harvested in tropical and subtropical areas. It is an evergreen tree, belongs to Myrtaceae family. Guava leaves are rich in flavonoids, carotenoids, aldehydes, tannins and vitamin C. The leaves are effective in management of diabetes and obesity. Diabetes mellitus is a metabolic disorder caused by changes in carbohydrate, protein, and fat metabolism, expressed with high sugar or glucose levels in the blood. The disease for prolonged period of time leads to retinopathy, high blood pressure and cardiovascular disease.

**Aim:** To study the health benefits of *Sadabahar* and guava leaves for diabetic patients.

**Methods:** Research papers related to the benefits of *Sadabahar* and guava leaves are studied and the finding of each article reviewed.

**Result and Conclusion:** The diabetic patients must include dried *Sadabahar* and Guava leaves powder regularly in their daily dietary routine, as the use of herbal products in treating diabetes is increasing day by day because of no side effects. Therefore, there is an increased need for product development using *Sadabahar* and guava leaves for diabetes.

**Keywords:** *Catharanthus roseus*, Alkaloids, *Psidium guajava*, Diabetes Mellitus

## Introduction

Diabetes or diabetes mellitus (DM), is a metabolic disorder that results in a higher glucose level in the blood.<sup>1</sup>

Hyperglycemia either occurs from the defects in pancreas for insufficient production of insulin or in the insulin work in

the body or shall be both, i.e., it may be insulin dependent or non-insulin dependent.<sup>2</sup>

## Types of Diabetes

This disorder is divided and elaborated in the two categories



that is type 1 and type 2 diabetes mellitus. The diabetes in which the patient is dependent on insulin is called type 1 DM; in this case, the pancreas of the patient did not produce insulin in this case and the diabetes in which there is no need of insulin is called as type 2 diabetes; i.e., in this case, the insulin is formed by the pancreas but its action is not fully functional due to various factors. Some of them may have obesity and insulin resistance, etc.<sup>3</sup>

The hyperglycemic condition of any person if not treated till long time then such people show prolonged effects of this disease in their body like the development of retinopathy, cardiovascular disease, etc. However, these effects are sometimes severe and sometimes not, depending upon the time period of suffering from this problem and also upon the type of diabetes mellitus. In current scenario, it is very normal in children to be a diabetic and due to insulin deficiency, symptoms such as weight loss, polyuria, blurred vision, and polydipsia occur in children. Death may also happen due to uncontrolled diabetes.<sup>4</sup>

Diabetes also leads to variation in fat, protein and carbohydrate metabolism. The use of herbal plants with anti-diabetic property is very popular around the world. The demand of using plants which has medicinal effects is higher these days as such plants have natural ability to treat diseases and also there are not any side effects of using natural products in case of diseased condition as compared to the medicines that are not natural and are not plant based but is prepared from chemicals and thus cannot be used for the longer period of time. There are many plants that have anti-diabetic property in Ayurveda science.<sup>5,6</sup>

## Prevalence

The prevalence of diabetes is increasing very rapidly throughout the world, mostly in the middle-income countries. Every year the new cases of hyperglycemia that are diagnosed are more than 79000. Mostly adults of 15 years to 20 years of age are more prone towards type 1 diabetics in America. The cases of type 1 condition are more in the United States as compared to the other countries in the world. Even, in the world, type 1 hyperglycemic patients is not much popular as there are less cases in such situation is known. The prevalence of type 2 diabetes-mellitus is more than that of type 1 DM; so, the people from 20 to 79 years of age and above mostly have this type 2 disease. Also, 90% of the people suffering from high blood sugar levels belong to this category only.<sup>4</sup>

The 3% of the total population in the world is dealing from diabetes and by the year 2025 it shall be doubled.<sup>7</sup> The number of people will be 37 million by 2030 with diabetic disorder.<sup>3</sup>

Asia is considered as the center of the disease, i.e., diabetes,

as more than 60% of people suffering from this disorder are in Asia which contributes to the global load of patients dealing with this problem. Among the two types of diabetes mellitus, the type 2 DM is very common that occurs in most cases. In India, there are around 69.2 million people who are dealing with type 2 diabetes and India is the second highest country next after the China in the world with the people suffering from type-2 DM. The number of patients is raising very rapidly in India suffering from the disease and within the coming five years India will turn into the world's first country with the maximum number of people living with hyperglycemia globally.<sup>8</sup>

## **Catharanthus roseus**

*Catharanthus roseus* is also known with other various names which are periwinkle, old maid and *Vinca rosea*. It is also named as evergreen ever blooming plant. It is pronounced by the name of *Sadabahar* in Hindi. It is believed that this plant was brought to India in the 18<sup>th</sup> century, by the Portuguese mercenaries in the state Goa. This is the most studied and researched plant by a number of researchers. It is an evergreen, bushy herb. The leaves are formed in opposite pairs with a pale midrib and glossy green color in appearance.<sup>9</sup> The shape of leaves is oval to oblong, that are 1 to 3.5 cm. broad and 2.5 to 9.0 cm long.<sup>10</sup>

The plant is native to and was first evaluated in the Indian Ocean island of Madagascar and is widely cultivated and is naturalized in tropical parts of the world like India, America, Australia, China and Malaysia.<sup>11</sup>

It consists of more than 100 alkaloids. It is also identified as one of the 21000 natural medicinal importance plants. Different parts of the plant contain contrasting various alkaloids which are produced in different numbers. Its most interesting and important property is its conventional use in the treatment of diabetes.<sup>10</sup>

Different alkaloids present in *Vinca rosea* possess different medicinal effects against various diseased conditions, from which some alkaloids act as anti-hyperglycemic (bring down the glucose level of the body), some of them work like antioxidant for cells and anti-microbial effects, whereas some help in lowering down the blood pressure and some help in providing the treatment of cancer, etc. However, leaves perform action of anti-cancer drug therapy also. Vincristine and vinblastine are the two important alkaloids that have been isolated and extracted from the plant due to their anti-cancer properties.<sup>6</sup>

## **Nutritional composition of *Catharanthus roseus* leaves**

*Sadabahar* leaves consist of various nutrients and some amount of anti-nutrients. The minerals that are present in the leaves are calcium, iron, sodium, phosphorus and potassium. Vitamin C is also present in the leaves but in little

amount, i.e., 0.08 mg/100 g. It acts as an antioxidant in the body. Moisture content of the leaves is very high, i.e., 84% which therefore reduces its shelf life. Crude protein, crude fiber, crude lipid and carbohydrate are also present in the leaves. The amount of ash content of the leaves is 3.89%.<sup>12</sup>

Some amount of anti-nutrients is also present in the leaves, which includes total oxalates, soluble oxalates, phytates and tannins. Alkaloids are also present in the leaves. The anti-diabetic activity of the leaves is because of the alkaloids present in the leaves. As, the substances like tannins, phytates which are antinutrients present in *Vinca rosea* leaves may work against the dangerous effects of diabetes mellitus by acting as antioxidant in the body through calming free radical effects.<sup>12</sup>

## **Health Benefits**

The ancient Indian system to cure diseases is Ayurveda that focuses on the medicinal properties of plants. *Vinca rosea* is the plant that is studied and well recognized by Ayurvedic sciences. This plant has been well known for its various medically beneficial properties that can be useful for disease people; it belongs to Apocynaceae family and is used to prevent many disease conditions naturally.<sup>13</sup>

- **Anti-diabetic**

The *Sadabahar* leaves possess anti-diabetic activity as the leaves extract has been proven to decrease blood glucose levels on a dose dependent basis in many studies as compared to the standard drug (glibenclamide). The anti-diabetic effect is due to the alkaloids packed in the leaves which increases insulin production; cells of pancreas are repaired and side by side glucose usage in the liver is enhanced.<sup>14</sup>

The anti-hyperglycemic activity of the leaves is due to their action on liver as the leaves increase the utilization of glucose in the liver. The alkaloid present in the leaves which possess anti-diabetic effect is named as vinculin which has been isolated from the leaves of the plant and is studied pharmacologically and is marketed for use in diabetes treatment.<sup>14</sup>

- **Anti-cancer**

There are two alkaloids namely vincristine and vinblastine that are found to be there in the leaves of *Sadabahar*, and the anti-cancer action of the leaves is due to the presence of these two alkaloids only. Out of which, vincristine is effectual and is used in the treatment of leukemia in the children and is sold with the name of oncovin in the market. Whereas vinblastine is used for neoplasms and specified for Hodgkin disease and is available with the name of velban.<sup>6</sup>

- **Anti-microbial**

The old maid leaves possess anti-microbial outcome against

various microorganisms such as *Salmonella typhimurium*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*, etc. The leaves can be used in long-term wounds cleaning and to treat numerous diseases.<sup>10</sup>

- **Anti-oxidant**

The extract of periwinkle leaves shows anti-oxidant activity as alkaloids, vitamin C content, tannins in the leaves acts as antioxidant against the free radicals in the body.<sup>15</sup>

- **Hypotensive activity**

The methanolic extract of the leaves of *Vinca* possesses hypotensive effects, which is proven in many research studies. The hypotensive activity is due to the content of various active substances and alkaloids.<sup>10</sup>

## ***Psidium guajava***

*Psidium guajava* is commonly called as guava. Guava is the fruit that is commonly ingested in India and other parts of the world. It is the shrub from *Psidium* genus. It belongs to the Myrtaceae family. It is an evergreen tree. Guava trees are native to tropical countries. The color of the Guava leaves is dull green.<sup>16</sup>

The word guava is derived from Arawak guayabo, through the Spanish word guayaba. Generally, the guava fruit is eaten in the raw form, its juice is also prepared industrially and is consumed by many people. Jellies and jams are also prepared from the guajava and consumed. The skin of the fruit is green to yellow in color with white or yellowish flesh.<sup>17</sup>

This plant has various medicinal advantages besides providing the nutrients to the body. It has been used since from very long time in the Ayurveda and conventionally across the world in treating various diseases. The whole plant including its all parts has been used for treating varied disease conditions. Its roots, leaves, fruit and bark is commonly used in treating gastric disorder such as diarrhea, stomachache etc. in various countries. Its leaves are proven to be successful in treating diabetes mellitus, by bringing high glucose levels in the blood down near to the normal and therefore possess anti-diabetic activity. The seeds and pulp of its fruit are normally being used in providing relief from gastrointestinal disorders, respiratory disorders, act as anti-inflammatory and lower down high blood pressure.<sup>3</sup>

## **Nutritional Composition of *Psidium guajava* Leaves**

There are certain minerals and other nutrients present in the leaves which provide body with the nutritional benefits and help in meeting the requirement of the body's nutrients. Along with the nutritional needs, the leaves provide various medicinal advantages also.

The guava leaves contain high amount of moisture, i.e., 82%

to 83%. The macronutrients which are present in the leaves are carbohydrate, protein, and lipid. The amount of protein present is 18.5 g, carbohydrate is 20 g to 21g. Vitamin C is also present in the leaves in the amount 12.5 mg.<sup>18</sup>

Certain minerals are also present in the leaves such as iron, calcium, phosphorus, and potassium. There is little amount of ash also present in the leaves. Fiber is also present in the leaves. The damaged leaves and infected leaves can be observed as by the light or dark brown spots on the leaves, or by the holes in the leaves or either by changes in color from green to dark brown color.<sup>18</sup>

In the phytochemical analysis of the leaves it is found that, there are alkaloids, triterpenes, carotenoids, vitamin C, anthocyanins, flavonoids, quercetin, essential oils and aldehydes are present in the leaves.<sup>1</sup>

## Health Benefits

Guava leaves possess medicinal properties and thus have been used to treat various diseases. It is used as the medicinal tree because all parts of this plant are used to treat different disease conditions. The leaves possess anti-microbial, anti-inflammatory, anti-diabetic, anti-allergic, anti-hypertensive and anti-cancer and the like properties. Its leaves, fruit, roots and bark are beneficial and give relief in diarrhea and stomachache. Leaves are used in the treatment of gastrointestinal disorder, respiratory disorders, anti-diabetic activity and help in controlling hypertension too.<sup>3</sup>

- **Anti-diabetic**

Guava leaf extract possesses anti-diabetic property and this effect happens due to the prohibited activity of the enzyme alpha-glucosidase (alpha-amylase, maltase) due to which carbohydrates in the body are not digested; as a result, glucose is not formed from carbohydrate after its digestion and glucose levels in the blood do not get raised. And also, it repairs pancreatic beta cells when particular amount of appropriate dose is given. Thus, it prevents increase in blood sugar levels.<sup>19</sup>

- **Anti-hyperlipidemic activity**

Guava leaves show anti-hyperlipidemic activity due to the presence of active components in the leaves such as flavonoids, polyphenols, esters, carotenoids, etc.<sup>19,3</sup>

- **Anti-cancer**

The leaves possess anticarcinogenic consequence. The active components of the leaves perform like an antioxidant and protect the body's cells from getting damaged against the harmful carcinogens in the body.<sup>3</sup>

- **Anti-inflammatory**

The whole guava fruit and its leaves possess anti-inflammatory and antispasmodic properties. Also, the

leaves prevent the inflammation of respiratory system, gastrointestinal and other organs of the body. It may be due to the presence of vitamin C, flavonoids and other compounds in the leaves.<sup>3</sup>

- **Gastro-intestinal disorder**

The leaves of guajava, its whole fruit and seeds are very beneficial in the control of gastrointestinal disorders, as they promote good digestion, possess anti-diarrheal activity, are beneficial in treating and providing comfort in stomachache, etc.<sup>3</sup>

- **Anti-oxidant**

The leaves contains vitamin C and other compounds such as flavonoids, etc., which act as antioxidant and help in protecting the body's cells from harmful free radical effects, thereby the leaves possesses antioxidant activity. Due to diabetes, the formation of free radicals in the body increases which increases the oxidative stress in body. So, the antioxidant compounds present in the leaves and the leaf extract help in preventing and protecting the body's cells from such oxidative stress also.<sup>1</sup>

## Conclusion

The above study shows that *Catharanthus roseus* leaves are rich in alkaloids and tannins whereas *Psidium guajava* leaves are rich in aldehydes, carotenoids, alkaloids, tannins, etc. These compounds in the leaves possess anti-diabetic property, along with several other therapeutic benefits. As both these leaves are natural, therefore don't have any side effects. So they can be used by the diabetic patients. As there is not any exact drug for diabetes and medicine used for this has side effects, thus cannot be used for a longer time period. Therefore, there is an increasing need for product development research using these leaves for diabetic patients, so that the products shall be made as well as be easily available in the market to help diabetic people manage blood glucose levels.

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