



REVIEW ON: Psidium guajava linn,multipurpose medicinal plant

NAME

Miss Khatik Priyanka Dilip

COLLEGE

Dharmaraj Shaikshnik Pratishthan's College Of B Pharmacy,walki ,Ahamednagar (5462).

(Under Dr.Babasaheb Ambedkar Technological University)

PRINCIPAL

Dr.Urmilesh Jha Sir

GUIDE TEACHER

Prof. Manali Joshi Madam

Abstract :

The psidium guajava Linn the common guava has many nutritional and medicinal properties. This review provides an updated overview to the active component of psidium guajava Linn. It shows health benefits of guava and describes pharmacological activities of guava. This review designed to know the health promoting bioactivities of psidium guajava Linn and with the special focus on its antidiabetic potentials from Polysaccharides and other Constituents of guava. Leaves and fruits has many pharmacological activities such as anti-cancer ,anti -allergy, anti-hypertensive etc. are also mentioned.

Keywords: Psidium guajava Linn,Diabetes mellitus.

Introduction :

The herbal tree psidium guajava Linn , also called as "Guava" belonging to the myrtaceae family is cultivated all over India. The central portion of the country is more commendatory for production of delicious fruits, , seeds , bark and leaves of the tree which are used most generally in ayurvedic and ancient practices. Guava is well-known for its delicious fruits which are sweet with flavour cooling in nature.

The bark and leaves of guava tree has used as medicinal aspects till today. Guava leaves extract has been reported to presence of triterpenoids. Guava leaves extract shows hypoglycemic effects. The leaves of guava plant are studied for it's health benefits which are credited to their more than phytochemicals like guajaverin, apigenin, avicularin, quercetin, kaempferol, hyperin, myricetin , gallic acid, catechin, epicatechin, chlorogenic acid, epigallocatechin gallate and caffeic acid.

The aqueous extract of guava leaves has effects on type 2 diabetes. (Hyperglycemia) It lowers the glucose level by preventing absorption of glucose in blood. Flavonoids and polysaccharides of guava leaves are reported for it's antidiabetic potentials in several studies. The potential of guava leaf extracts for diarrhoea treatment was also studied. The flavonoids present in guava leaf extract mainly determine their anti-bacterial activity, while quercetin, which is most predominant flavonoid of guava leaves , exhibits strong anti-diarrheal activities. The anti-diarrheal activity of quercetin is showed to its relaxing effects on the intestinal muscle lining which prevents bowel contractions. Guava leaf polysaccharides (GLPs) is utilized as an antioxidant additive in food and for diabetes treatment.

Guava fruits and seeds also showed anti- diabetics potentials in several studies and they also has many health benefits.The fruit has been used as a tonic and laxatives and for the treatment of bleeding gums, also accustomed treat hypertension. Guava seeds are rich in antioxidants ,fiber and potassium.guava bark has been used medically to treat diarrhoea in children's and used as an astringent . The bark has an antibacterial property which is beneficial to treat cuts, wounds and ulcers. The vitamin C content of the plant is aslo seen within the bark and has antioxidant properties. It is also useful for skin. The flower are accustomed treat bronchitis and eye sores and to cool down the body.

The quantity diabetes patient cases increaseing in recent year. In 2000 a complete of 171 million (2.8%) people with diabetes from the world population was estimated by World Health Organisation in specific cases of type 2 diabetes mellitus are increasing in contrast to cases of Type 1 diabetes mellitus , leading to the destruction of insulin producing Beta cells of the pancreas and causing failure to supply of insulin .So ,the prevention of T2DM become one among the essential concern. T2DM is usually characterized by hyperglycemia , insulin resistance and obesity .Obesity is additionally related to not only type 2 diabetes but also hyperlipidemia and hypertension. Insulin resistance is accounted as a key feature of those diseases.

Objectives :

- 1.To know the phytochemical properties of guava.
- 2.To know the medicinal and traditional use of guava.
- 3.To get the overviews on every parts of plant.
- 4.To find the active content present in every part of plant.
- 5.To know the background history of guava.

1.Plant description and habitat: [22]

Guava (*Psidium guajava*), shey or small tropical tree of the family myrtaceae, cultivated for its edible fruits. Guava trees are native to tropical America, and are grown in tropical and subtropical areas worldwide.

The common guava has quadrangular branchlets, oval to oblong leaves about 7.6cm in length and four petaled with flowers about 2.5 cm broad. The fruit are round to pear shaped and measure up to

7.6cm in diameter. Their pulp contains many small hard seeds. The fruit has yellow skin and white, yellow or pink flesh. The musky at times pungent, odour of the sweet pulp is not always appreciated.

2.Cultivation: [22]

Propagation is usually by seeds but improved varieties must be perpetuated by plant parts. The plant has hard dry wood and thick bark prevent cutting and conventional methods of grafting. The plant is not frost resistance but is successfully grown throughout southern Florida ; in several tropical regions it grows so abundantly in a half wild state as to have become a pest.

3.Scientific classification :

kingdom : *plantae*

Division : *Magnoliophyta*

Class : *Magnoliopsida*

Order : *Myrtales*

Family : *Myrtaceae*

Genus : *psidium L.*

4.Parts of guava plant :

4.1 Leaf:

Leaves of guava contain polysaccharides which showed antidiabetic effects in several studies. For long time in Asia and North America guava leaves have been used as herbal tea to treat diabetes.

Antidiabetic potentials of *psidium guajava* are associated with phytochemical constituents such as various flavonoids, terpenoids and glycosides. Many scientists believe that the high levels of antioxidants and vitamins in guava leaves can help to protect your heart from damage by free radicals.

4.1.1 Health benefits of guava leaves :

Guava leaves contain anti-diabetic potentials, they possess other health benefits also :

- May help in relief from painful symptoms of menstruation.
- Guava leaves are also beneficial for digestive system.
- May aid weight loss
- May help to boost your immunity.



Fig. 1. guava leaves

The leaves of the guava plant have been studied for their health benefits which are attributed to their plethora of phytochemicals, such as quercetin, avicularin, apigenin, guaijaverin, kaempferol, hyperin, myricetin, gallic acid, catechin, epicatechin, chlorogenic acid, epigallocatechin gallate, and caffeic acid .

4.1.2 Guava leaf tea :

Guava leaf tea is a great addition to our herbal regimen. It is especially used in diabetes ,menstrual pain or as an anti -diarrhoea support.

Guava leaf tea is government approved for controlling the blood sugar in Japan. As the interest in traditional medicine grown up in recent years, guava leaf tea has attention for its potential health benefits.

4.1.3 Management of diabetes by herbal tea of guava leaf : [25]

Guava leaf tea inhibits several enzymes that convert carbohydrates in digestive tract into glucose , potentially slowing its uptake into blood. Guava leaves are rich in dietary fibres which reduces sugar level and helps diabetic patients to control their health .The compound in leaves help to regulate blood sugar levels after inhibiting absorption of two types of Sugars namely maltose and sucrose.

The previous studies verified that anti-hyperlipidemic activity of guava leaf tea, third long-term clinical trial investigated the effects of consecutive intake for 8 week on the parameters of hyperlipidemia ,diabetes and safety.

It showed that the injection of guava leaf tea significantly reduced blood HbA1c% greater than 6.5 % in diabetic subjects and significantly increased serum adiponectin level. This suggested that the trial findings where due to the effects of injection of guava leaf tea. There were no abnormal changes in parameters of liver and kidney function .Also Side effects such as hypoglycemia due to the abnormal interaction between guava leaf tea and HMG-CoA reductase inhibitor, colestimide or ethyl icosapentate were not observed

4.2.Fruit :

The fertilization occurs in flowers which converted into seeds and the ovary wall makes the protective covering to the seeds called as fruit. Many fruits have been used as drug. Guava is one of the most commonly used fruit as a food source. It is low glycemic index food. Guava fruit without peel is more influence in lowering the blood sugar levels and cholesterol level also. Guava fruit possesses typical fragrance as like lemon but not more sharp.

Guava fruit contains number of vitamins, minerals and essential oil. Some reports have been published showing the volatile compounds in guava fruit. Mixture of 2-methyl propyl acetate, hexyl acetate, benzaldehyde, ethyl decanoate, beta Caryophyllene, and alpha -selinene with a guava like aroma and 40 volatile compounds identified in the guava. Enantioselective gas chromatography revealed an enantiomeric distribution closed to the racemate in 3-sulfanyl hexyl acetate as well as in 3-sulfanyl-1-hexanol. In further more, two fruity smelling diastereomeric methyl 2-hydroxy-3-methyl pentanoates were identified as the (R, S)- and the (S,S)- isomers were as the (S, R)- and (R,R)- isomers were absent. Seven odorants were identified for the first time in guava's. Enantioselective gas chromatography revealed an enantiomeric distribution closed to the racemate in 3-sulphanylhexyl acetate as well as in 3-sulphanyl-1-hexanol in further more, two fruity smelling diastereomeric methyl 2-hydroxy-3-methylpentanoates were identified as the (R, S)- and the (S,S)- isomers were as the (S, R)- and (R,R)- isomers were absent. Seven odorants were identified for the first time in guava's.



Fig no. 2. Guava fruit

Table no. 1. Nutritional profile of guava fruit per 100g: [24]

Carbohydrates	14.32g
Sugars	8.92g
Dietary fiber	5.4g
Protein	2.55g
Fat	0.95g
Energy	285 KJ

Table no 2.Vitamins : [24]

Vitamins	Percentage (%)	Quantity
Vitamin K	2%	2.2 micrograms
Vitamin c	275%	228.3mg
Vitamin A	4%	31 micrograms
Thiamine(B1)	6%	0.067mg
Riboflavin (B2)	3%	0.04mg
Folate(B9)	12%	49micrograms
Vitamin B6	8%	0.11mg
Niacin	7%	1.084mg
Pantothenic acid (B5)	9%	0.451mg

Table no. 3.Minerals : [24]

Minerals	Percentage	Quantity
Magnesium	6%	22mg
Iron	2%	0.26mg
Calcium	2%	18mg
Manganese	7%	0.15mg
Zinc	2%	0.23mg
Sodium	0%	2mg
Potassium	9%	417mg
Phosphorus	6%	40mg

4.3.Flower:

The flower consist five of petals, white in colour with numerous stamens. Most guava's have pure white, five-petaled flowers with long, multiple central stamens. Pineapple guava has red to pink stamens and white petals spotted with pink and lavender. The stamens of both look like a fountain or fireworks display.It is used to treat bronchitis and also used to treat sore throat.

4.4.Pulp :

The pulp has been used for food processing industry. It is also rich in glycosides and flavonoids .Strictini , isostrictinin and pedunculagin improved sensitivity of insulin and it has been used in clinical treatment of diabetes mellitus.White guava pulp is widely used in food processing industries . It is mostly used in the manufacturing of guava fruit juice, beverages, drinks as well as fruit bars. As guavas contain high levels of pectins, it is ideal for the manufacturing of jams, jellies and candies and other food products.

4.5 Bark : [23]

Bark shows anti-bacterial properties which is used to treat wounds and cuts. It also possesses anti-oxidant properties and used for removal of free radicals of skin. It is an effective astringent, helping with acne and other skin conditions. All parts of plant possesses oxallic acid, which can cause stinging sensation and should be used in moderation typically.

4.6.Seeds: [24]

2.6.1Guava seed oil:

It has cosmetic use used in cosmetic products ,is a source beta carotene ,vitamin A, vitamin c , selenium, zinc and copper and specially rich in linoleic acid.

5.Phytochemical constituents:

Leaves contains Flavonoids such as guaijaverin, avicularin and polysaccharides. Ascorbic acid 103mg and 1717mg Gallic acid equivalents per gram total phenolic compounds.

Table no. 5.Chemical composition of leaves:

Constituents	Percentage
Moisture	82.47%
Ash	3.64%
Fat	0.62%
Protein	18.53%
Carbohydrates	12.74%

5.1Polysaccharides:

Guava leaves contains Polysaccharides which are also beneficial in several way. Polysaccharides consists of long polymeric chains ,which contains monosaccharides unit. These polysaccharides prooven different biological and Physiochemichal properties like anti- diabetic, anti-inflammatory, anti-oxidants and anti-tumour activities.

5.1.1 Anti-diabetic potential of polysaccharides:

GLPs found to be useful in treatment of diabetes mellitus. Acarbose is used for treatments of type 2 diabetes. It acts as an inhibitor of glycoside hydrolases like alpha glucosidase and alpha amylase and hence prevent rapid glucose release from carbohydrates. This activity causes some of the incompletely digested complex carbohydrates to remain in the intestine and which transported in colon. These complex carbohydrates digested by intestinal microflora showing gastro-intestinal problems such as the diarrhoea and flatulence. A study reported that GLP inhibited alpha glucosidase much efficiently than acarbose without blocking alpha amylase activity. Therefore GLPs can be used as a substitute of acarbose for diabetes management.

Table no. 6 List of active components in psidium guajava :

Active components	Biological activity	Source
Vitamin B6	Anti-diabetic	Fruits
Isoflavonoids	Anti-oxidative.	Leaves
Carbohydrates	Anti-oxidative	Bark
Vitamin C	Wound healing activity	Fruit
Folate (B9)	Conversion of food into carbohydrate	Fruit
Leukocyanidins	Anti-inflammatory	Root
Tannins	Protein digestive activity	Fruit
Gallic acid	Anti-neoplastic, Anti-inflammatory	Leaves
Kaempferol	Anti-diabetic, Anti-oxidant	Leaves
Flavonoids	Anti-oxidative, anticancer, Anti-inflammatory, Anti-viral	Fruits
Essential oils	Anti-fungal, Anti-microbial, Anti-cancer	Fruits
Phenolic components	Anti-inflammatory, Anti-allergic, Analgesic	Fruits

6. Pharmacological study :

6.1 Antibacterial activity: [8] [9]

Guava extract exhibit anti-bacterial activity against gram positive as well as gram negative bacteria. In-vitro evaluation of the effects of aqueous mixtures and water soluble methanol extract from guava leaves and bark against multidrug resistance vibrio cholera and found to have strong anti-bacterial activity.

It concluded that this plant offers the potential for controlling epidemics of cholera. Villagers generally avoid market medicines and prefers natural remedies like guava leaves to be chewed and swolled for the treatment of infections in childrens. Guava leaves extract shows better activity against vibrio cholera , intestinal microbes causative organism for cholera. Therefore the latter can be used in places where drug of choice are difficult to find.

6.2 Anti-diarrheal activity: [11] [12]

New tender guava leaves boiled in a pot containing warm water and drinking it in empty stomach while being stilled warm has been found to be very effective in controlling diarrhoea. Researchers founded that Psidium Guajava leaves have a broad spectrum antimicrobial action that could be effectively used in controlling pathogenic origin or diarrhoea. The anti-diarrheal activity could be assigned to the presence of high flavonoids contained in guava leaves. Guava bark was also used to treat diarrhoea in children's.

6.3 Anti-cancer activity: [10]

Lycopene an antioxidant , which is present abundantly in guava plays a key role in preventing and fighting cancer. Mostly Breast cancer and prostate cancer responds the best. Red flesh guava contains more lycopene as compare to other varities. Lycopene acts by scavenging the free radicals and prevents further formation of free radicals too. Many research founded that aqueous extract of guava leaves have anti-prostate cancer activity in a cell line model and stated that they are promising anti-androgen sensitive prostate cancer agent. Further more guava contains a good concentration of carotene as well and it is known to prevent oral and lungs cancer too.

6.4 Anti-diabetic activity : [5] [6]

Guava leaves are peeled and taken empty in stomach against diabetes. Guava fruits and leaves has the power to lower the blood sugar levels ; when the fruit is taken without skin. The inhibition of intestinal glycosidases by the effects of Psidium guajava leaves related to postprandial hyperglycemia, suggesting a break through in the treatment of type 2 diabetes mellitus.

Anti-diabetic potential of polysaccharides:

GLPs found to be useful in treatment of diabetes mellitus .Acarbose is used for treatments of type 2 diabetes. It act as an inhibitor of glycoside hydrolases like alpha glucosidase and alpha amylase and hence prevent rapid glucose release from carbohydrates. This activity causes some of the incompleated digested complex carbohydrates to remain in the intestine and which transported in colon. These

complex carbohydrates digested by intestinal microflora showing gastro-intestinal problems such as the diarrhoea and flatulence. A study reported that GLP inhibited alpha glucosidase much more efficiently than acarbose without blocking alpha amylase activity. Therefore GLPs can be used as a substitute of acarbose for diabetes management.

6.5 Antacid and ulcer protectant activity: [13] [14]

The alkaline nature of guava leaves gives better response against hyperacidity. It has also been found that, in most villages guava tea is prepared by adding 10 to 12 no. of young fresh guava leaves boiled in water and it is used to drink to get rid of acidity still today. The methanolic extract assigned the maximum ulcer healing and antacid property in-vitro. The saponin and flavonoids in guava fruit and leaves founded an effective treatment in counteracting ulceration and acidity in stomach. 500 and 1000 mg per kg body weight methanolic extract of psidium guajava leaves lead to significant reduction in ulcer index of ethanol induced ulcer in the stomach of wister rats.

6.6 Antihypertensive and Hypolipidemic activity: [17] [18] [19]

Guava is useful for the treatment of hyperlipidemia, heart disease and hypertension. It also contains little amount of potassium which can help to relax blood vessels and controlling blood pressure. Further more guava has a high concentration of pectin which causes a reduction in blood lipids by delaying absorption of the foods and thereby decrease the risk of cardiovascular illness. Higher potassiums and fibers in fruit shows the significant reduction in blood pressure and blood lipids by consuming guava fruit on daily basis. Several studies assigned that the gallic acid, catechins, epicatechins, rutin, naringenin and kaempferol in the leaves are responsible for the inhibition of enzyme pancreatic cholesterol esterase showing in lower cholesterol in blood. Quercetin has been associated with decreased mortality from heart diseases and reduced incidence of stroke associated with hyperlipidemia and hypertension. Catechins are important as a preventive therapy for hypercholesterolemia. Guava prevents stroke, improves heart health by controlling high blood pressure and lowering cholesterol which is credited to the presence of a moderate quantity of potassium.

6.7 Laxatives : [1]

Leaves and fruits contain sufficient amount fiber that makes the base for the treatment of constipation. Young guava leaves are specially rich in fiber and roughage which are crucial for treatment and prevention of constipation and hemorrhoids. 100 gm of guava fruit contains near by 36 gm of dietary fibers. The guava fruit is richest source of dietary fibers and ascorbic acid which is quite high in comparison to other fruits.

6.8 Guava for cold and cough: [7]

Guava leaves possess specially effective in treatment of cold and cough. Guava is rich in source of iron and ascorbic acid which reduces lungs congestion and mucous formation and at the same time it keeps the respiratory tract pathogen free. Vitamin C present in rich amount in guava which had been found to very effective in treatment of cough and cold related with bacteria or virus. Several studies

founded that the components of guava at like a miracle. Disintegration of mucus polymer, loosening cough and reducing further mucus production keep the respiratory tract, lungs, throats microbes free and inhibits existing microbial activity due to its astringent properties of decoction made from immature leaves of guava.

6.9 Oral cavity issues : [2] [3] [4]

Dental plaques is the main cause of period on it is as plaques when left unattended without any care ultimately leads to gingivitis and period on it is. Some of the common pathogens are responsible for periodontitis are aggregatibacter actinomyce temcomitans, porphyromonas gingivitis ,fusobacterium bickering. Guava has rich in concentration of quercetin which has been shown to exhibit incredible antibacterial activity against such pathogens. The mechanism of quercetin in periodontitis could be due to cell membrane disruption and inactivation of crucial protein by forming irreversible complexes with the protein in susceptible microbes. Guava extract acts against oral plagues without disturbance to the oral cavity homeostasis. It is also prevents adherence of bacteria to the oral cavity thus discouraging further development of plague as well. The second one and most common problem associated with buccal cavity is scurvy. (bleeding from gums) Ascorbic acid present in rich amount in guava makes it good candidate to treat scurvy. It may also be used in ulcers due to its astringent property. Leaves can be directly chewed to get instant relief from toothache. Thus psidium guajava has an incredible remedy for treating problems related with oral cavity.

6.10 Wound healing activity : [15]

Guava leaves have been special history on wound healing of mankind. In India, the guava leaves handmade paste by grinding with some amount of water had been used to applying to the wound surface to treat the wounds. Flavonoids and tannins shows faster healing of wound when methanolic extracts of guava leaves applied on the surface of wound twice a day. Many studies showed that guava leaves ointment healing wound faster than other.

6.11 Anti-Allergy: [16]

The methanol and aqueous extract of psidium guajava leaves and it showed the inhibition of histamine release from mast cells and blocked IL-10-mediated, invitro induction of T regularity (Tr) cells from CD4+ splenocytes of C57BL/6 in mice. Guava leaf extracts reduced an allergic reaction mediated T cells in mice.

CONCLUSION:

The long term use of allopathic medicines in the prevention and treatment of various diseases has contributed to rapid development of drug resistance. Drug resistance is the most frequent cause of failure in drug therapy. Amongst all, drug resistance is mostly experienced during anti-microbial therapy. However the development of resistance in case of natural therapy or ayurvedic therapy is very infrequent which motivates people to move from allopathic to ayurvedic therapy. Although the active ingredient is very difficult to extract from the crude natural compound which becomes a enormous challenge for the researchers for which Clarified method has to be developed. The utilization of natural therapy in the prevention and treatment of diseases is not only safe, fluently available but is inexpensive as well. Currently even practioners and physians are looking

for substitute treatment of medicines for curing various diseases, therefore importance must be given to evolution of traditional herbal medicines from natural resources.

References:

1. John NR, Gala VC, Sawant CS. Inhibitory effects of plant extracts on multi-species dental biofilmformation in-vitro. *International Journal of Pharma and Bio Sciences*. 2013; 4:487-95.
2. Razak FA, Othman RY, Rahim ZH. The effect of Piper betle and Psidium guajava extracts on the cell-surface hydrophobicity of selected early settlers of dental plaque. *Journal of Oral Science*. 2206; 48:71-75.
3. Shu Y, Liu Y, Li L, Feng J, Lou B, Zhou X et al. Antibacterial activity of quercetin on oral infectious pathogens. *Afr J Microbiol Res*. 2011; 5:5358-61.
4. Bansal S, Rastogi S, Bajpai M. Mechanical, chemical and herbal aspects of periodontitis: A review. *International Journal of Pharmaceutical Sciences and Research*. 2012; 3:1260-7.
5. Sharma H, Chandola HM. Prameha in Ayurveda: correlation with obesity, metabolic syndrome, and diabetes mellitus. Part 1-etiology, classification, and pathogenesis. *Journal of Alternative and Complementary Medicine*. 2011; 17:491-496.
6. Shen SC, Cheng FC, Wu NJ. Effect of guava (*Psidium guajava* Linn) leaf soluble solids on glucose metabolism in type 2 diabetic rats. *Phototherapy Research*. 2008; 22:1458-1464.
7. Malavika athavale. Fruit myths: Basket of wrong beliefs. Retrieved, 2011. from <https://completewellbeing.com/article/fruit-myths>
8. Shu Y, Liu Y, Li L, Feng J, Lou B, Zhou X et al. Antibacterial activity of quercetin on oral infectious pathogens. *African Journal of Microbiology Research*. 2011; 5:5358-61.
9. Prabu GR, Gnanamani A, Sadulla S. Guaijaverin, a plant flavonoid as potential antiplaque agent against *Streptococcus mutans*. *Journal of Applied Microbiology*. 2006; 101:487-495.
10. Yadav VR, Prasad S, Sung B, Kannappan R, Aggarwal BB. Targeting inflammatory pathways by triterpenoids for prevention and treatment of cancer. *Toxins*. 2010; 2(1):2428-2466.
11. Birdi T, Daswani P, Brijesh S, Tetali P, Natu A et al. Newer insights into the mechanism of action of *Psidium guajava* L. leaves in infectious diarrhoea. *BMC Complement Altern Med*. 2010; 10:33.
12. Lozoya X, Reyes-Morales H, Chavez-Soto M, MartínezGarcía Mdel C, Soto-González Y et al. Intestinal antispasmodic effect of a phytodrug of *Psidium guajava* folia in the treatment of acute diarrheic disease. *J Ethnopharmacol*. 2002; 83:19-24.
13. Livingston Raja NR, Sundar K. *Psidium guajava* Linn confers gastro protective effects on rats. *Eur Rev Med Pharmacol Sci*. 2006; 16:151-156.
14. Uduak U, James T, Sunday AM, Wilson OH. Ulceroprotective Effect of Methanol Extract of *Psidium guajava* Leaves on Ethanol Induced Gastric Ulcer in Adult Wistar Rats. *Asian Journal of Medical Sciences*. 2012; 4(2):75-78.

15. Okoli CO, Ezike AC, Akah PA, Udegbunam SO, Okoye TC, Mbanu TP, Ugwu E. Studies on wound healing & antiulcer activities of extract of aerial parts of *Phyllanthus niruri* L.(Euphorbiaceae). *Am J Pharmacol Toxicol*. 2009; 4(4):118-26.
16. Seo N, Ito T, Wang, NL, Ya XS, Tokura Y, Furukawa Fet al. Anti-allergic *Psidium guajava* extracts exert an antitumor effect by inhibition of T regulatory cells and resultant augmentation of Th1 cells. *Anticancer Res*.2005 ;25 :3763-3770
17. Singh RB, Rastogi SS, Singh NK, Ghosh S, Gupta S et al. Can guava fruit intake decrease blood pressure and blood lipids. *Journal of Human Hypertension*. 1993; 7:33-38.
18. Deguchi Y, Miyazaki K. Anti-hyperglycemic and antihyperlipidemic effects of guava leaf extract. *Nutritional Metabolism*. 2010; 7:9.
19. Obarzanek E1, Sacks FM, Vollmer WM, Bray GA, Lin PH, Karanja NM et al. Effects on blood lipids of a blood pressure-lowering diet: the Dietary Approaches to Stop Hypertension (DASH) Trial. *Am J Clin Nutr*. 2001;74(1):80-9.
20. Teixeira R, Camparoto ML, Mantovani MS, Vicentini V. Assessment of two medicinal plants, *Psidium guajava* L and *Achillea millefolium* L, in in vitro and in vivo assays. *Genet Mol Biol*. 2003; 26:551-555.
21. Arima H, danno G. Isolation of antimicrobial compounds from guava (*Psidium guajava* L). *Biosc Biotech Bioch*.2002; 66:727-730.
22. Encyclopaedia Britannica, Nov 23,2021
23. Bonnie L. Grant, certified urban Agriculturist
24. en.m.wikipedia.org.
25. Asano T, Tuji A, Deficit Y, Makini k. Clinical effect of guava tea (*Bansoureicha*) on diabetes patient. *Jap Nutrition Assess*. 2005 ;11: 81-85. In Japanese.