JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A REVIEW ON SYZYGENIUM CUMINI SUSPENSION

[1] *Waggh Jyotsnaa .H, [2] Gite Shashikant. S, [3] Patil Nilesh. D, [4] Raut Sayali. R, [5] Vasaikar Vaishnavi. S,

[1,2,3,4,5] Student
K.V. N. Naik Institute Of Pharmaceutical Education and Research Nashik,422005

Abstract:-Syzygium cumini also as "Jamboan", or "Eugenia cumini"."kaala Jamun" in India sygygium cumini belongs to the family Myrtaceae. Syzygium cumini is being practiced as a traditional, alternative, and complementary medicine in India and other countries. Different parts of Syzygium cumini have been used medicinally in the treatment of various diseases. The present study is conducted taking into consideration of Syzygium cumini seeds. Syzygium cumini seeds are used to treat diabetics. The main objective of this work is to understand the medicinal and nutritional importance of Jamun seeds. It has diverse pharmacological actions. Several studies have been carried out in the past to observe the health benefits of jamun seeds. It was observed very good source of medicine for curing diabetes because of its effect on the pancreas. Hence this review briefs on the anti-diabetes and potential applications of Jamun seeds.

Keywords:- Syzigium cumini, Diabetic mellitus, Suspension.

Introduction :-

Syzium cumin belongs to the family myrtaceae[1,2]. It is a worldwide medicinal plant traditionally used in herbal medicines for various properties against diabetic disorders which include anti-inflammatory, cardioprotective, and antioxidant properties[3]. Myrtaceae family comprises about 121 genera with 3800-5800 species of shrubs and trees distributed mainly in tropical and subtropical areas of the world. The genus syzium, a leading member of this family, embrace1100 species with deserving attention to Syzygium cumini (L) Skeel (syn; Eugenia jambolana, Syzygium jambolanum) which has been used in the treatment of numerous diseases, especially diabeties [4,5]. Syzygium cumini Skeels is one of the best-known species and it is very often cultivated. The synonyms of s. cumini are Eugenia jambolana Lam, Eugenia djouant perr, calytranthes jambolana wild; Eugenia caryophyllifolia Lam. It is commonly known as the jambolana; black plum, jamun, java plum, Indian blackberry, Portuguese plum, Malabar plum, purple plum, Jamaica, and damson plum. Jambolan is the evergreen tree. Its wood is brown-white, close-grained, and durable. leaves are leathery elliptic 6 to 12 cm long, smooth, and shining. The fruit is dark violet colored with an astringent taste and also a combination of sweet, mildly sour, and astringent flavors and tends to color the tongue purple. The plant produces small purple plums, which have a sweet flavor[6].

Fig.1:- Parts of Jamun plant.

The use of Syzygium cumini was introduced in western medicine in the mid-nineteen century; when the first reports on the investigation of its anti-diabetic properties were published. S.cumini is a native tree from India but is now widely distributed in many countries in Asia, Africa, and South America. But it is most popular in India 'Jambul ''or Indian Syzygium cumini is a minor and highly perishable fruit enriched with vitamin c, garlic acid; anthocyanins, phenolic compounds, flavonoids, and antioxidants. Hence the jambul seeds and other parts of Syzygium cumini are used as anti-diabetic, anti-diuretic, anti-bacterial, anti-neuroprotective, and hypoglycemic [7,8]. The plant seed is rich in protein and calcium.

The seeds contain tannins, ellagic acid, gallic acid, glycosides jamboline, starch, and medical alcohol in the un sampled fraction of seeds and a small quantity of pale yellow essential oil is also present. The widespread use of Syzgium cumin in traditional medicine reflects its pharmacological importance. The edible pulp of plant form 75% of the whole fruit. Various minerals and vitamins were reported like Ca, Mg, P, Cu, S, Cl, Vitamin C, riboflavin, nicotinic acid, choline, and folic acid. Glucose and fructose are the principal sources of sweeteners in ripe fruit with no trace of sucrose.[9]

Chemical Compounds:-[9]

Table 1:- chemical compounds.

Chemical compounds	Plant part
Glycoside Jamboline	Seed
Tannins Seed,	Leaves
Galitanins Seed,	Leaves
Essential oil Seed,	Leaves
Tannins Seed	Leaves

Syzygium cumini seeds:-

Fig.2:- Jamun seeds

Syzigium cumini seeds contain polyphenols including flavonoids, alkaloids, glycosides, and phenolic compounds, fatty oil. Quercetin. Rutin,3,5,7,4 tetrahydrox flavones, caffeic acid, ellagic acids, lauric acids, lauric, myristic, palmitic, steric, oleic acids, linoleic, malic and vitriolic acids, and phytosterols this identified compounds given in syzigium cumini seeds.

Traditionally jambhul seeds are used as a Ayurvedic medicine. Seeds are mostly used as anti-diabetes because of glycocieds and jamboline. Syzigium cumini seed shows antidiabetic as well as anti-oxidant, anti-microbial, and anti-bacterial properties[9].

Syzigium cumini is a broadly disperse plant in India and Indian folk medicine mentions it is used for the treatment of diabetic mellitus. Decoction of the dry leaves of s.cumini has shown a hypoglycemic effect.

The fruit and seeds contain jamboline and ellagic acids which are announced to have the potential to check the changing of starch into sugar. Jambun has remarkable antioxidant and antidiabetic properties as a contrast to papaya and other fruit [10].

Pharmacological action of syzygium cumini -

1) Its anti-oxidant property:-

Syzygium cumini is commonly known as the black jambun. It has medicinal properties and nutraceutical properties due to the presence of antioxidants such as ascorbic acids, acanthocytosis, and phenol content. These antioxidant compounds inhibit oxidation. These antioxidant compounds help to defend against the cells and damage caused by harmful molecules mostly the jambul seeds contain antioxidant compounds in the presence of phenols.

Antioxidant compounds deal with hypertension and also help to regulate blood pressure. Jamun is recognized as a source of natural antioxidant and thus play an important role in the chemoprevention of diseases and aging[11,12].

Vasti and Austin reported that 50% aqueous ethanol syzygium cumini seed extract causes a six–fed grater scavenging activity against ABTS, No, FRAP, and DPPH as compared to the standard trolox. Furthermore, a significant alteration was observed against the elevated level of peroxides and reduced levels of antioxidants such as including catalase, superoxide dismutase, glutathione, and ascorbic acid after oral administration[13].

2) Its anti-inflammatory property:-

The anti-inflammatory property of the syzygium cumini is to reduce inflammation. The use of anti-inflammatory drugs reduces the pain and also relieves the symptoms of the pain. Syzygium cumini provides the antioxidants such as anthocyanins. It also gives relief to swelling, redness, and fever.

Jambool is the sources of the dietary poly phenols . Syzygium cumini seed has been reported to possess anti-inflammatory activity against histamine, serotonin and prostaglandin .Jambun seeds contain anti inflammatory property which is beneficial for the heart disease. reduce inflammation , boost immune system and reducing the cholesterol .Jamun seeds have antioxidant property but now preclinical data suggest that the it shows the anti inflammatory effects.

syzygum cumini is a medicinal plant that show the anti-inflammatory activity the standard diclofenac shows the anti-inflammatory potential similar to flavonoid rich fraction of syzygium cumini report a anti-inflammatory reactions in the human lymphocytes ,neutrophils ,and monocytes against the hepatitis B[14,15].

Also the ethanol ,methanol, ethyl acetate and water syzygium cumini extract show the effect in the edema in wister rat. Syzygum cumini also inhibit the or reduce the acute subacute inflammation[16].

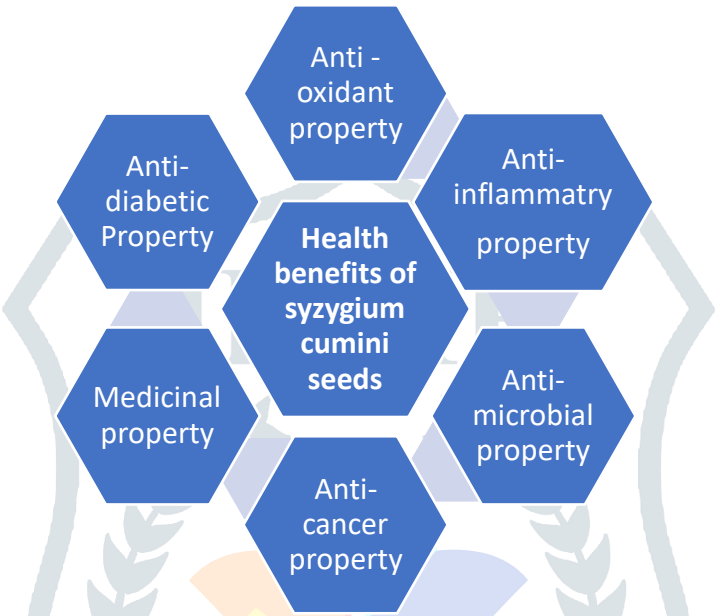

Fig 3:- Health benefits of Syzygium cumini seeds

3) Its anti-bacterial property:

Antimicrobials are agents which inhibit the growth of microorganisms. Methanol extract from syzgium cumini seeds was tested for antimicrobial activity and toxicity which showed that the extract inhibits the growth of bacteria.

The aqueous, ethanolic, methanolic, acetic acid and petroleum ether extracts of the Syzygium cumini seed were evaluated for their antibacterial activity against four gram-positive and six gram-negative pathogenic stains.

The different solvent extracts of antimicrobial activity against tested microorganisms as compared to acetic acid and petroleum ether extract so Syzygium cumini seeds are potential sources of the antimicrobial agent. Hence Syzygium cumini seeds show anti-bacterial and anti-microbial effects [21].

4) Its anti-cancer property:-

Cancer is the abnormal cells divide uncontrollably and destroy body tissue. Cancer is a group of more than 100 different diseases. It can develop almost 16 anywhere in the body. Cells are the basic unit that makes up the human body Cells grow and divide to make new cells die when they get too old or damaged. Then new cells take their place. Cancer is a non-communicable killer disease.

cancer is treated by surgery, radiotherapy, or chemotherapy and a combination of effects. The drug which treats cancer is known as an anticancer drug. Bioactive phytochemicals including anthrocynasis and polyphenols. Epidemiological data suggest that the intake of antioxidants via increased consumption of dark-colored fruits like jamun contributes toward a reduced risk of a certain type of cancer.

Cancer can be treated by the isolation of the active constituent by jamun seeds. Hence the jamun seed shows anti-cancer properties. Syzygium cumini crude and methanol extract evaluated for cytotoxic activity against the human cancer cells. The anthocyanins isolated from S.cumini fruits and acidified with methanol.s.cumini inhibit the growth of colon cancer cells. S.cumini ethanol extract was reported to inhibit the bit proliferation of HT-29 cells further confirmed by a DNA damage assay wherein DNA lost its integrity through apoptosis[22,23].

5) Its anti-diabetic property :-

Diabetic mellitus is a metabolic disorder that affected the endocrine system[17].

WHO recommended these traditional medicines for the treatment of diabetic mellitus Traditional medicinal uses reduce the blood glucose level in the body with minimum side effects.

Syzgium cumini is a traditional medicinal plant which having anti-diabetic properties hence this plant is used for the treatment of diabetics. Antidiabetic properties refer to all the medicinal treatments of diabetes[18,19].

All these agents aim to reduce excessive urination, and ketoacidosis. Jam is very preventive to cure diabetes mellitus synzygium seed powder gives a hypoglycemic effect. Jambun seed helps to convert starch into energy and check the blood sugar level in the blood. Syzygium cumini and its extract helps to reduce diabetes and urination[20].

Anti-diabetic activity:-

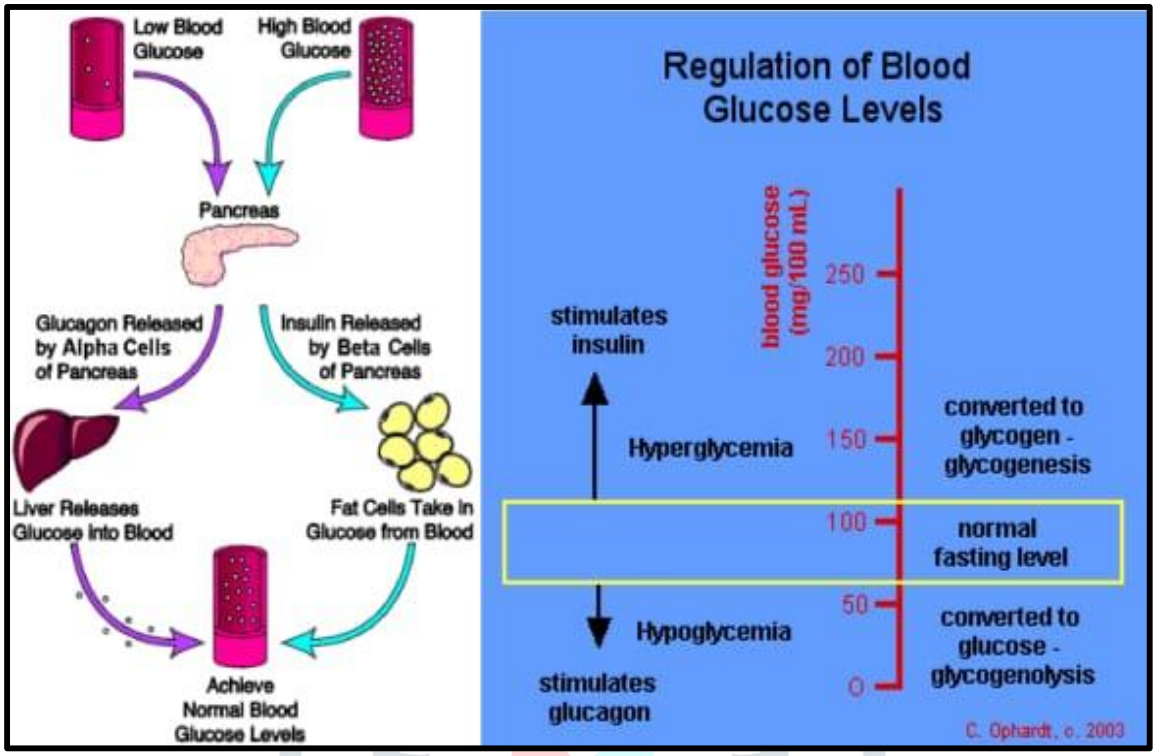

Fig 4:- Anti-diabetic activity

Phytochemistry :-

Phytochemicals are non-nutritive plant chemicals that have a protective effect and disease-preventive properties. Syzygium cumini fruits contain the major constituent of malic acid and a small amount of oxalic acid is also present in the fruits. Gallic acid and tannins contain the astringent properties of fruits. Cyaniding glycosides give purple color to the fruit. The brown color shows the parenchymatous cells' numerous oval; rounded starch spots of rain

Syzgium cumini seeds are used in various pharmacological actions such are anticancer properties, anti-inflammatory properties, and bacterial properties. Antidiabetic properties, antioxidant properties. Phytochemicals such as saponins, terpenoids, flavonoids, tannins steroids, and alkaloids have anti-inflammatory effects [24].

Syzygium cumini seeds are responsible for their antioxidant properties. Syzygium cumini seeds contain fatty oils such as oleic acids and as their main constituents stearic acid, lauric acid, linoleic acid sterculic acid, and malic acid are also present in small quantities.

The seed oil is mainly comprised of 1- chloro octadecane followed by tetracontane, decahydro8a-ethyl-1,1,4a, and 6- tetramethyl naphthalene. Butanol, octadecane, octacosane, heptacosane and eicosane respectively. Leaves contain the minerals such as potassium, zinc, magnesium, lead, chromium, calcium, and sodium. So the Syzygium cumini fruit contains a high amount of vitamins, minerals, and fibers.

They contain low amounts of calories and fat. The most important nutrient contact in the part of Syzygium cumini trees are moisture, carbohydrates, proteins, fats, crude oils, etc[25].

Scientific classification of syzygium cumini :- [26]

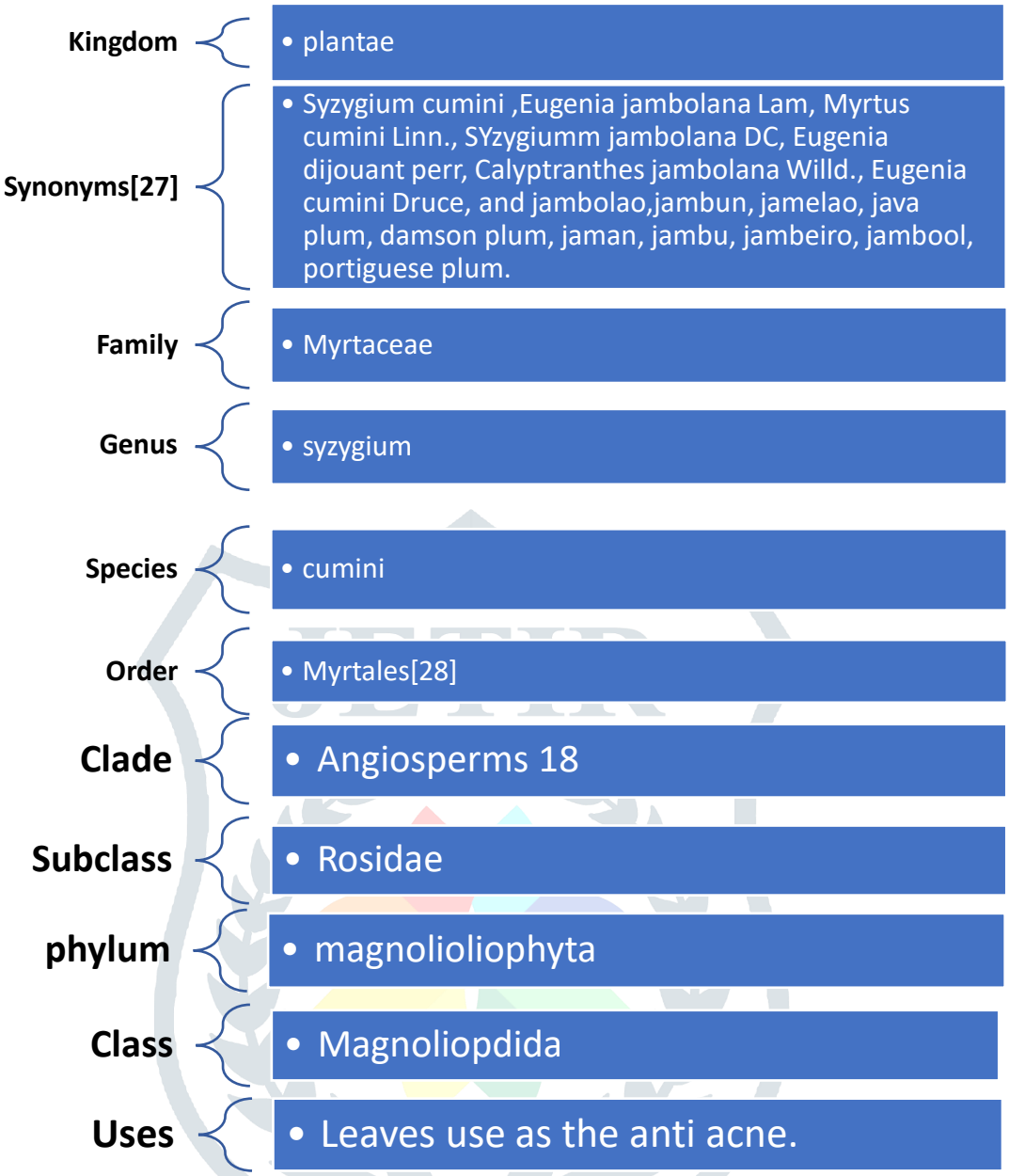

Fig.5 :- Scientific classification of syzygium cumini

➢ **Characteristic characters in Ayurveda:- [29]**

Fig.6:- Characteristic characters in Ayurveda

Nutrition in jamun[30]:

The composition of jamun fruits depends on the region, cultivated area, and climate of that particular region. Climate plays an important role in the composition of vitamins and minerals.

Description of seed:- [31,32]

➢ **Macroscopy of seed –**

The seed is brownish and astringent. It consists of a single-layer epidermis; mesophyll composed of isodiametric thin-walled and parenchymatous cells fully composed of starch grains, oval rounded measuring diameter 7-28u. Schizogenoues cavities are also found in powder.

➢ **Powder characteristics of seed:-**

Brown-colored oval rounded starch grains; show parenchymatous cells and numerous diameters.

Fig 7:- Powder characteristics of seed

➢ **Identity; purity and strength:-**

- **Foreign matter:**- less than 1
- **Total ash:**- less than 5
- **Acid-insoluble ash:**- less than 1

- **Alcohol soluble extractive:-** more than 6
- **Water-soluble extractive:** - more than 15

Important marketed products and doses:-

- Panchapallava yoga
- Pattaya churna
- Brihallavangangadya churna
- Jambvadya taila
- Amradi kvatha
- Karanjadya ghritam
- Pusyanuga churna
- Usirasava

Preparation of jamun seed powder:- [33,34,35,36,37,38]

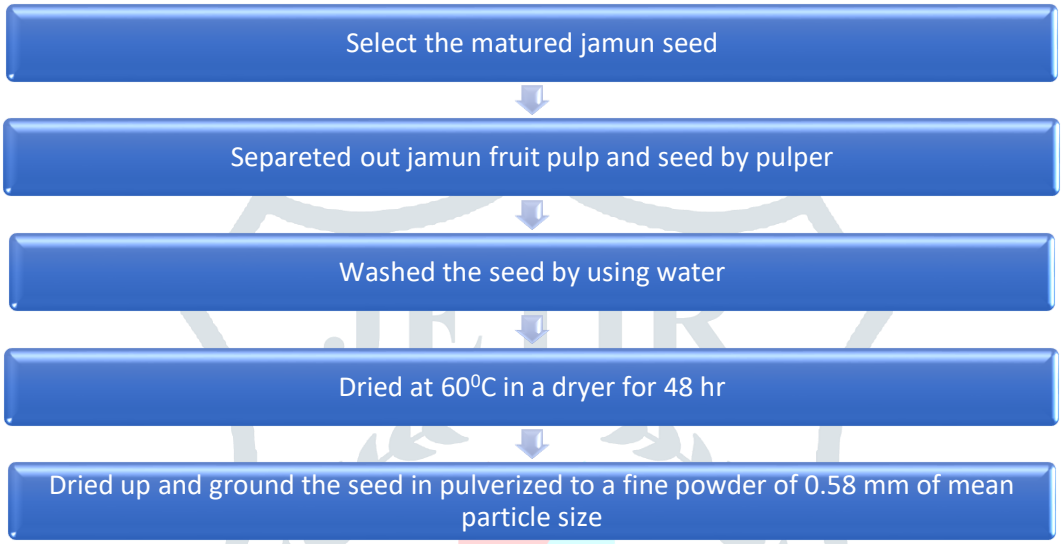

Fig 8:- preparation of jamun powder

Jamun seed extraction:-

Table 2:- Jamun Seed Extraction

Test	Observation	Interference
Benedict's test:-	Filtrates were treated with benedict's reagent and heated gently.	Orange precipitates formed.
Detection of tannins:- **Ferric chloride test**:-	A 1% gelatin solution containing sodium chloride was added.	The formation of white color precipitated in the presence of tannins.
Detection of flavonoids:- **Alkaline reagent test:-** **Lead acetate test:-**	Extract treated with a few drops of sodium hydroxide solution. Extract treated with the addition of dilute acid showing the presence of flavonoids. The extract is treated with a lead acetate solution.	Formation of deep yellow color. It becomes colorless. Formation of yellow color precipitate in the presence of flavonoids.
Detection of proteins and amino acids: **Xanthoproteic test:-** **Ninhydrin test:-**	Extract treated with nitric acid. Extract 0.25% w/v ninhydrin reagent was added with boiled for few min.	Formation of the yellow color in presence of proteins. Formation of blue color in presence of amino acid.

Suspension:-[39]

Pharmaceutical suspensions are liquid dosage forms containing finely split into insoluble materials distributed rather uniformly across the suspending medium in which drugs show a minimum degree of solubility. This dosage form is utilized for providing a liquid dosage form for insoluble or poorly soluble drugs. Also, it is an ideal dosage form for drugs that are unsteady in an aqueous medium for a tropical period of time. The range of solid particles in suspension is 0.5 to 5.0 microns.

It is a homogeneous system in which solids are dissolved in liquids. Constituent particles of a suspension are large properly that gravity can pull them down out of the dissolving medium. These particles can be easily extracted by the filtration method from the dispersion medium. The size of particles in suspension is at least 100 times larger than the particles in the solution.

Ideal features of suspension:-

1. The finished product is physically, and chemically stable.
2. Pharmaceutical suspension should have a delicious odor, and taste.
3. Suspended particles should be small and uniformly sized in order to give smooth, graceful products free from a gritty texture.
4. Suspension must not be too viscous to pour freely from a bottle or to flow through needle strings.
5. The drug substance must not be recrystallized and change its polymorphic form during storage. Shows suspension shows the Tyndall effect
7. Constituent particles of a suspension can be extracted by filtration.
8. The size of particles in suspension is greater than 100 nm.
9. It is a heterogeneous mixture.
10. The particle of a suspension did not pass through a filter paper.

Types of suspension:-

1. Based on the route of administration

a. Oral suspension
b. Topical suspension
c. Parenteral suspension
d. Rectal suspension
e. Optic suspension
f. Ophthalmic suspension
g. Pulmonary suspension

2. Based on the concentration of the dispersed phase

a. Dilute suspension
b. Concentrated suspension

3. Based on the electro-kinetic nature of solid particles

a. Flocculated suspension
b. Deflocculated suspension

4. Based on the size of solid particle

a. Coarse suspension
b. Colloidal suspension
c. Nanosuspension.

Methods of suspension:- [40]

1.Precipitation method:-

Organic solvent precipitation:-

Precipitation by pH Double decomposition

2. Dispersion Method:-

Precipitation method for Formulation of Suspensions.

Three precipitation methods are used for the Formulation of Suspensions.

Organic solvent precipitation:-

In this method, precipitated is done by dissolving water-insoluble drugs in water-miscible organic solvent and then adding distilled water in the organic phase under suitable conditions.

Organic solvents used are methanol, ethanol, polyethylene glycol, and propylene glycol are used as organic solvents.

Precipitation by pH:-
In this method, precipitation is done by interchanging the pH of the medium.
For the drugs in which solubility is dependent on the pH value for those drugs, the method is applicable. For example, Estradiol Suspension.

Double Decomposition:-
It is a reaction in which two chemical compounds change their ions, typically with the precipitation of an insoluble product. For example, Zinc sulfide topical suspension also introduce as White Lotion (zinc sulfate and Sulfurated potash solutions are mixed together to form zinc polysulfide).

Dispersion Method for Formulation of Suspensions:-
To relieve the wetting and dispersion of the solid phase, a vehicle must be prepared in this method. To confirm uniform wetting of hydrophobic solids, the use of surfactant is useful. In this method, the use of suspending agents such as carboxymethyl cellulose and others may be indicated.

Other Methods for Formulation of Suspensions:-

Use of controlled flocculation:-
Controlled flocculation of solid particles is formed by adding flocculating agents such as Electrolytes, Surfactants, and Polymers.

Use of structured vehicles:-
Structured vehicles are also called thickening or suspending agents which are used for increasing the viscosity of the suspension. They are functioning by ensuring particles and reducing the sedimentation of particles. Due to trouble during application by syringe, the structured vehicle is not convenient for parenteral suspension.

Traditional and medicinal uses:-
Traditionally and medicinally jamun seed is used and other parts such as the bark, leaves, and fruits are used in ayurvedic medicine. The bark is acridly used as anti-helminths bark and contains tannins and carbohydrates so is used in the treatment of throat, asthma, thirst, biliousness, blood impurities, and ulcer. Bark has a wound-healing property[41]. Leaves ash is used for gums, and teeth.

Benefits Syzygium cumini seeds as Antidiabetic action:-

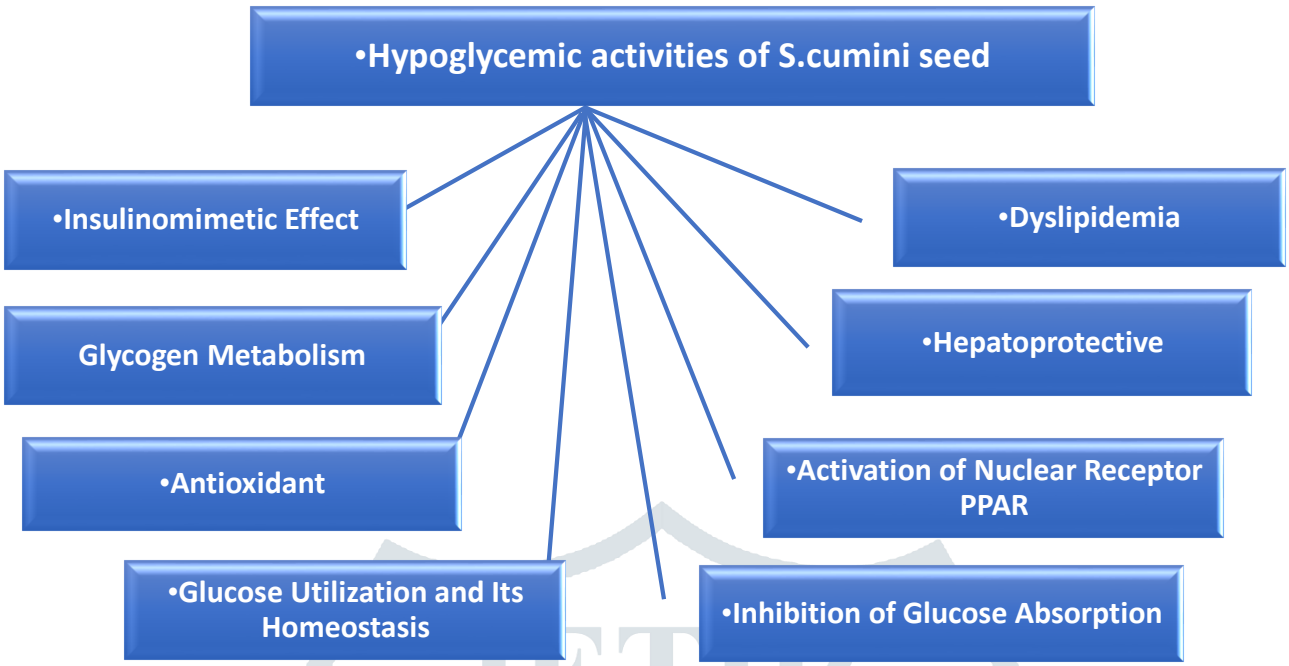

Fig.9:- Benefits of syzygium cumini seeds

Insulin mimetic and Insulinotropic effect:-

The pancreatic beta cell acts as sensors glucose-sensing using the mechanism to regulate glucose homeostasis[45].
Type 2 diabetics patients have either reduced islet number or reduce beta cells amount in the pancreas due to increased beta cell death. S. cumini has phenolic and flavonoids that have antioxidant properties. Flavonoids help to the regeneration of the pancreatic beta cells and stimulate the release of insulin[46].

Activation of Nuclear receptor:-

PPRy is a group of nuclear receptors that regulate the metabolism of carbohydrate and lipid metabolism by managing homeostasis. Insulin secretion from pancreatic islets was found to be in streptomycin-induced diabetic rates after oral administration of flavonoid-rich extract of s.cumini seeds. Many alpha glucoside and alpha-amylase inhibitors can be used to check the 26 initiation and progression of type- 2 diabetic mellitus and will be important to manage the disease[47].

Antihyperlipidemic Activity:-

Dyslipidemia is a metabolic disorder of lipoprotein with diabetic mellitus and about 40% of diabetic patients are suffering from hyperlipidemia . In diabetic induced hyperlipidemia which is responsible for vascular complications. S.cumini seeds show hyperlipidemic activity it compared to their control[48,49]. This hypolipidemic activity of the seed extract may be due to the presence of either some stimulator of insulin. Aqueous extract of s.cumini seed decreases the level of free fatty acids cholesterol, phospholipids, and TBARS after oral administration in the diabetic brain and restores them to normal value[50].

Antioxidants:-

Oxidative stress is an imbalance between free radical generation and elimination due to the depletion of the antioxidant scavenger system and is characterized by increased lipid peroxidation and a number of chronic complications in diabetics. S.cumini has an alcoholic extract that helps to restore normal levels. Quercetin has antioxidant properties that inhibit lipid peroxidation [51,52].

Hepatoprotective Activity:-

Injury of the liver to exposure of exogenous and endogenous substances coupled with impaired liver function is hepatotoxicity. Methanolic extracts of s.cumini seed can intensify hepatotoxic free radical and antioxidant defense activities by altering liver cytochrome p 450 enzymes. S.cumini and its different parts such as seed, leaves, and bark used to treat liver disorders and also show the hepatoprotective effect[53,54]. 27

Diabetes Mellitus:-

Diabetes Mellitus is a complex group of diseases with varieties of causes. People or human beings with diabetes have high blood glucose levels, also called high blood sugar or hyperglycemia. Diabetes Mellitus is the most common metabolic syndrome. In these ways, the body use digested food for energy. Type-1 diabetes typically occurs in children and young adults, though it can appear at any age, In

the past type-1 diabetes Mellitus and latent autoimmune diabetes in an adult may be slowly developed into many kinds of type-1 Diabetes Mellitus [55]. Type -2 diabetes is the most common form of diabetes caused by a combination of factors.

Classification of Diabetes:-

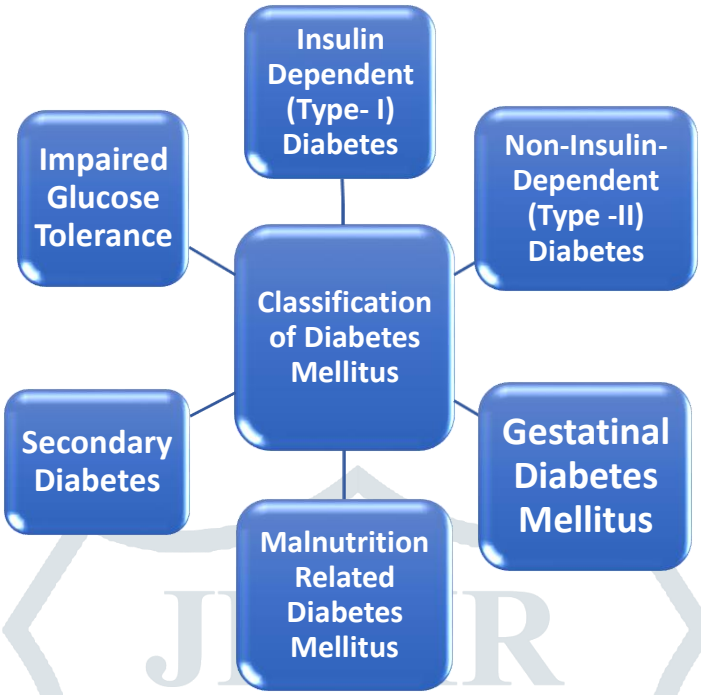

Fig.10:- Classification of diabetes mellitus

Risk Factor of T2DM:-

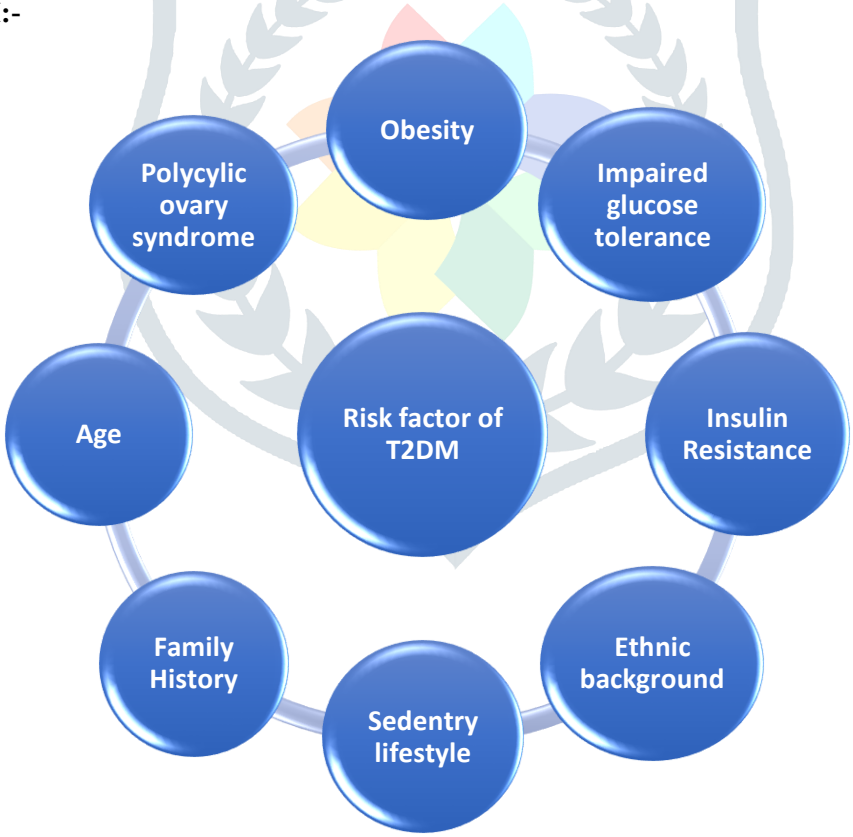

Fig.11:- Risk factors of T2DM

Anti- Diabetic Activity of Jamun:-

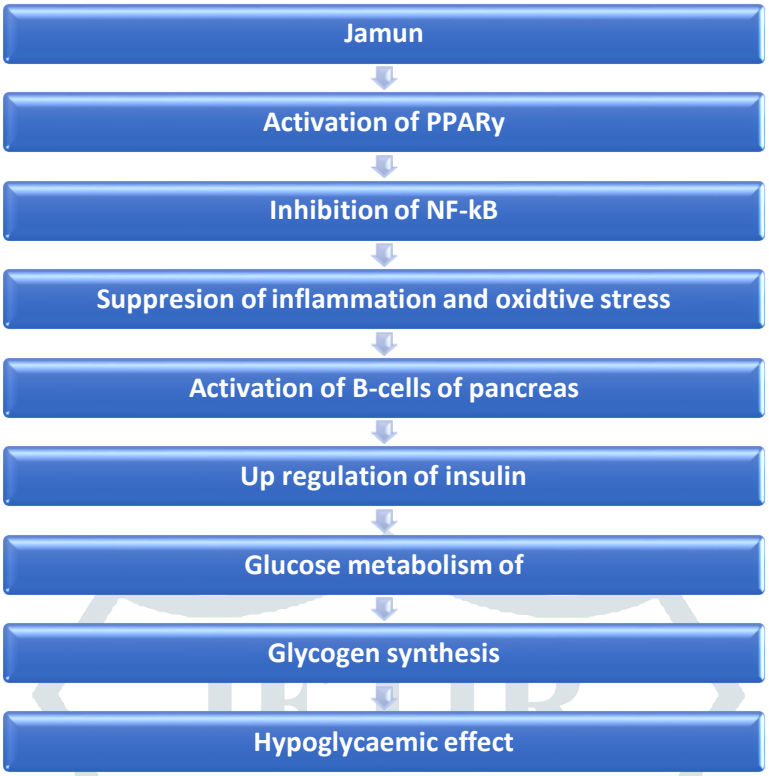

Fig.12:- Anti diabetic activity of jamun

Anti diabetic action of The hypoglycemic action through stimulation of surviving beta cells of islets of Langerhans to release more insulin. According to the study glucose -6-phosphate content in the liver indicates g an overall increasing glucose influx thus it is having an overall effect in increasing glucose utilization. It may be acting as of a hypoglycemic agent by increasing insulin content .Syzygium cumini seed decreased the level of glycosylated hemoglobin ,increased the body weight and hemoglobin, restored. Syzygium cumini seed contains ferule acid which shows the antidiabetic.

Pathophysiology:-

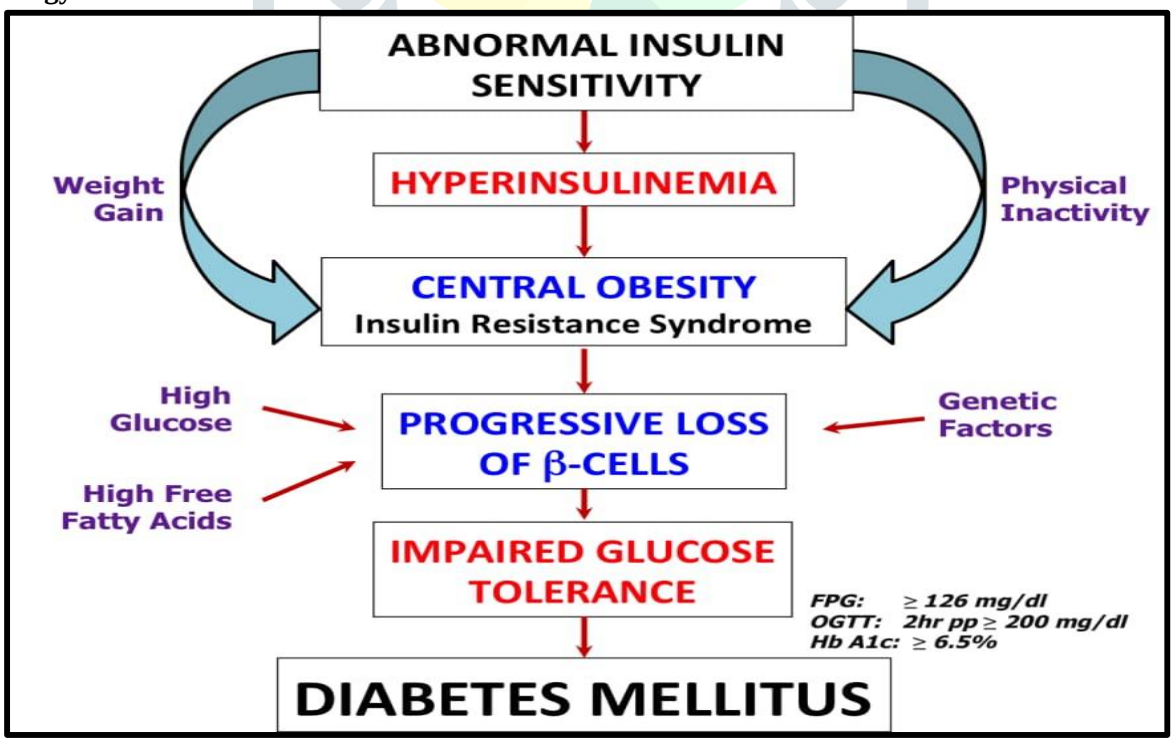

Fig.13:- pathophysiology of diabetes mellitus

Insulin is the principal hormone that regulates the reuptake of glucose from the blood into most cells of the body. Liver, muscle, and adipose tissue. Deficiency of insulin or the insensitivity of its receptors plays an central role in all form of diabetes Mellitus. Body obtain glucose from 3 main places, the intestinal absorption of foods, the breakdown of glycogen, the storage forms glucose found in the liver, and gluconeogenesis . The generation of glucose from non-carbohydrates components in the body. Insulin play an important role in

balancing glucose level in body . Insulin can be inhibited the breakdown of glycogen or gluconeogenesis. It can be stimulated the transport of glucose into fats and muscle cells, and it also stimulates the transport of glucose into fats . Insulin are released into the blood by beta cells found in the Langerhans in the pancreas, in response to the rising level of blood glucose. body's cells to absorb glucose from of the blood for used as fuels, for conversion to other needed molecules. Lower blood glucose levels result in decreased insulin released from the beta cells and in the breakdown of glycogen to glucose. This process is mainly controlled by the hormone, glucagon, which act opposite manner to insulin[56].

Conclusion:-

Diabetes Mellitus patients in India are increasing day by day probably due to changes in lifestyle change in food patients that is from of traditional fiber-rich diet to surgery fast food diet. Hence there tends to use traditional indigenous plants widely used in India as a treatment for diabetes mellitus. Syzygium cumini seeds show anti-diabetic action and they have no side effect . Syzygium cumini can help the patient to take a new lease on life. S. cumini finds use as a medicine in various treatment and recommended that further phytochemical and clinical research should be done on this traditional medicinal plant . Pharmacological work can be carried out with Syzygium cumini seeds. Syzygium cumini seeds show the insulin mimetic and insulinotropic effect. It acts as an antidiabetic drug either by stimulation of insulin release from beta cells or by lowering glucose absorption of the intestine, hepatic glucose production , and boosting the sensitivity of insulin by enhancement of peripheral glucose uptake and utilization. Identified proteins from s.cumini seeds definitely have the panorama of action and opens the door for more extensive research to demonstrate their role as an antidiabetic agent and any other different beneficial aspects.

References:-

1.Martinez, S,B. and J Del Valle, M.1981. Storage stability and sensory quality of duhat syzygium cumini Linn. anthocyannis and food colorant .UP Home Eco. J; , 9(1).

2.Baliga, MS; Bhat, H.P, Baliga, BRV, Wilson , R . and Palatty, P.L ,2014.Phytochemistry, traditional uses and pharmacology of Eugenia jambolana Lam.(black pulm):A review. Fd. Res. Int. J. Fruit Sci ;14, 147-156

3. Joshi, S.G .2001.Medicinal plant ,New Delhi, Oxford and IBH publishing co.

4.Kumar A, Ilavarasan R , Jayachandran T, Deecaraman M, aravindhan P, padmanabhan N and krishan,2014. MRV:Anti- diabetic activity of syzygium cumini and its isolated compound againts streptozotocin- induced diabetic rats. Journal of Medicinal plants Research; 246-249.

5.Jadhav VM, Kamble SS and Kadam VJ,2009. Herbal medicine : syzygium cumini : a review .Journal of pharmacy Research ; 2(8): 1212-1219.

6.Baliga MS, Bhat HP, Baliga BRV , et al. 2011. Phytochemistry ,traditional uses and pharmacology of Eugenia jambolana Lam. (black plum).: A review .Food Res Int;44: 1776-1789.

7.Baliga MS, Bhat HP, Baliga BRV, Wilson R, Palatty PL, 2011.Phytochemical traditional uses and pharmacological of Eugenia jambolana Lam.(black plum): A review . Food Research International;44(7): 1776-1789.

8.Islam M, Hussain K, Latif A, Hashmi FK, saeed H, Bukhari NI .et al, 2015. Evaluation of extracts of seeds of syzygium cumini L. for hepatoprotective activity using CCL4-induced stressed rats. pakustan veterinary Journal.;35(12):2457-2464.

9. Veeram anjali et al (2017) and changdeo Amol et al . (2017).

10. Shrikant Baslingappa Swami , Nayan singh J. Thakor , Meghatai M, patil , Parag M. Haldankar,2012. Jamun (syzygium cumini).A review of Its food and medicinal uses , food and Nutritional sciences ,3, 1100-1117.

11.Wasswa M , Tumuhimbise GA , Acham H,2019. Chemical characterisation of pulp ,seed powder and a ready -to - drink juice produced from syzygium cumini fruit.

12. Adedapo AA , Ogunmiluyi IO,2020. The use of Natural products in the Management of Diabetes . The current Trends. Journal of drugs Delivery and Therapeutics; 10(1): 153-162. 37.

13.Shrikanta A, Kumar A, Govinda swamy V,2015.Resveratrol content and antioxidant properties of underutilizes fruits. Journal of food science and technology; 52(1): 383-390.

14.Joseph SV, Edirisinghe I, Burton - Freeman BM,2014. Berries: anti-inflammatory effects in human. Journal of agriculture and food chemistry; 62(18) : 3886-3903.

15.Pandey M, Khan A,2002. Hypoglycemic effect of defatted seeds and water soluble fiber from the seeds of syzygium cumini (Linn) skeels in alloxan diabetic rats.

16. Yogeshwari P, Sriram D. Curr. Med. Chem .2005; 12(6): 657-666.

17. Jouad H, Haloui M, Rhiouani H, El Hilaly J, Eddouks M,2001. Ethno botanical survey of medicinal plants used for the treatment of diabetes, cardiac and renal diseases in the North centre region pf Morocco (Fes- Boulemane). Journal of Ethnopharmacology ; 77 (2-3) 175- 182.

18.Sidhana S, Singh VB , Meena BL , BEniwal S, singh K , Kumar D et al,2017.Effect of syzyguim cumini (jamun) seed powder on gycemic control : A Double - blind rando mixed controlled trial. Journal of Medical society;31(3): 185.

19. Joshi M , Upreti S,2017. Therapeutic influence of jamun (syzygium cumini) : A review . Journal of pharmacognosy and phytochemistry ; 8(3): 1056-1059.

20. Achrekar S, kaklij GS , Pote MS , Kelkae SM ,1991. Hypoglycemic activity of Eugenia jambolana and Ficus benghalensis: mechanism of action . In Vivo (Athens, Greece); 5 (2): 143-147.

21. Das S, Das A, dharani N,2019.Application of jamun (syzygium cumini Linn) seed extract on cotton fabric for antibacterial activity .Indian Journal of Fibre and Textile Research (IJFTR); 44 (3): 365-368.

22. Aquil F, Munagala R, Jeyabalan J, Joshi T, Gupta RC, Singh IP,2014. The Indian Blackberry (jamun), Antioxidant capacity, and cancer protection. In caner. Academic Press, 101- 113.

23. The Wealth of India, Vol-x, CSIR,New Delhi, 1982,100-104.
24.Patel soncharan , Shrumugarajan T.S ., Somasundaram. and Maity Niladri, 2010.Protective effect of syzygium cumini seeds against doxorubicin induced cardiotoxicity in rats international 38 Journal of pharmacy and Life,(2):23.
25. Oliver .B, 1880, Oral hypoglycemic plant in west Africa , J. Ethnopharmacol,2: 119-127.
26. http://en. Wikipedia.org/wiki/jambool. 27. The ayurvedic pharmacopoeia of India. Part-1 ,1st edition ,Vol-2 , The controller of publication, Delhi, 1999,54-57.
28. Modi DC, patel , JK shah BN and Nayak BS, 2010. Pharmacognostic studies of the seeds of syzygium cumini Linn; Pharma science monitor. An international Journal of pharmaceutical sciences;1(1):20-26.
29. Prof . P.V.Sharma dravya guna vigyan Vol.2 ChaukhambhaBharti academy , Varanasi P.659-661.
30. Prof . P.V. Sharma , Dhanwantri Nighantu commentary , chaukhambha Orientalia , varanasi .P.P. 120-121
31. A Ayurvedic pharmacopiea of India .New Delhi: Ministry of Health and Family Welfare 1919;54-59.
32.Litrature review shobhaben Pratap bhai patel school of pharmacy and technology management, mumbai.
33.Shorti DS, Kelkar M, Deshmukh VK, Aiman R, 1962. Investigation of hypoglycermic properties of vincaroseaand Eugenia jambolina, Indian Med ;3:51-62.
34. Shahnawaz M , Sheikh SA . Physicochemical characteristics of jamun fruits, Journal of Holi culture and forest.
35.AOAC.Association of official Analytical chemist. Official methods of analysis, 18th edition, Washington DC, 2005.
36. AOAC official method of analysis of Association of Analytical chemists international 17th Edition , Horowitz ,Maryland,2000.
37. Anuradha V, praveena A, sanjayan KP,2013.Nutritive analysis of fresh and dry fruits of morindatinctoria. Int. J Curr. Microbiol .App . Sci;2(3): 65-74.
38. Hussian I , saleem M , Iqubal Y, Khalil SJ, 2006. Comparison of vitamin C content in commercial 39 tea brands and fresh tea leaves. Journal of the chemical society of Pakistan;28: 421-425.
39 https://www.pharmacytimess.com/2022/08/liquid-dosage-forms-pharmaceutical.html
40 https://pharmaeducation.net/formulation-of-suspensions
41. Brain KR, Turner TD. The practical evaluation of phytopharmaceuticals, right - science technical, 1st Ed , Bristol Britain , 1975, 144.
42. Jain Sk. Dictionary of Indian Folk medicine and ethanobotany. Deep publications New Delhi. 1991.
43.Nadkarni KM. Indian matria medica. Popular prakashan, Bombay. 1976.
44.Sagrawat H, Mann As, Kharya MD,2006.Pharmacological potential of eujenia jambolana; a review. pharmacognocy magazine;2(6): 105-96.
45. MacDonald PE, Joseph JW, Rorsman P, 2005. Glucose-sensing mechanism in pancreatic beta cells. Philosophical transactions of the Royal society B; 360(1464):2211-2225.
46. Marchetti P, Bugliani M, Boggi U, Masini M, Maesellu L, 2012.The pancreaatic beta cells in human type 2 diabetics. advances in experimental medicine and biology;771: 288-399.
47. Sharma B, Ramachandran B, Subramannian S, 2008. Protective effect of Eugenia jambolana seed kernel om tissue antioxidant in streptozotocin - induced diabetic rats. Food and chemical Toxicology ; 46(7): 2376-2383.
48.Betteridge J. Lipid disorders in diabetic mellitus. Text Book of Diabetes, Edn.2 Blackwell science, London. 1997-1-55.
49.Krauss RM, 2004.Lipids and lipoproteins in patients with type 2 diabetes. Diabetes care; 27(6): 1496-1504.
50.Kudchodkar BJ ,Lee MJ , Lee SM Di Marco NM, Lacko AG ,1998.Effect of dietary protein on cholesterol homeostasis in diabetic rats. Journal of lipid research;29(10): 1272-1287.
51.Rice EC , Miller N, paganaga G,1997. Antioxidant properties of phenolic compounds .Trends in plant science ;2(4):152-159.
52. Elangovan V, Shohami E, Gati I, Kohen R,2000. Increased hepatic lipid soluble antioxidant capacity as compared to other organs of streptozotocin - induced diabetic rats: a cyclic voltammetry study. Free radical research:32(2):125-134.
53. Baliga MS, Bhat HP , Baliga BRV , Wilson R, Palatty PL,2011.Phytochemistry traditional uses 40 and pharmacology of Eugenia jambolana Lam. (black plum): A review. Food Research International ;2011-10.
54.Kumar KSV, palaksha MN, Venkatesh K, Kumar YS, Naik RR,2013.Antioxidant and hepatoprotective effect of methanolic extrct of organum majorana in ccl4 induced liver in rats. Would Journal of pharmacy and Pharmaceutical sciences;2(6):5898-5912.
55. Wild S, Regolic G, A., Sicre R, King H. " Global Prevalence of diabetes for the year 2000 and projection for 2030". Diabetes potential of medicinal Plants. Acts pol pharma, vol .113- 118.
56.Scheen J.A " Drugs treatment of non-insulin dependant diabetes Mellitues in the 1990 's". Achivements and future development . VOl .54: 1997 355-368.