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A Review on Antidiabetic Herbal Chocolate Using Guava Leaves and Aegle Marmelos Leaves

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ABSTRACT

Chocolate is a loving food for children whose medicines hate substances. Therefore, the purpose of this study is to produce and design chocolate. The main goal of this study was to develop and evaluate nutritious chocolates and dietary supplements containing antioxidants and antiacetic acid properties [1]. Diabetes is characterized by an implemented ability to properly control blood glucose. Psidium guajava is a synonym, and Guaven leaves have a hi gh mirror of antioxidants and vitamins, which also contributes to lower blood sugar levels [2]. Psidium Guajava Linn. (Guava) is used not only as food, but also as folk medicine in subtropical regions around the world for its pharmacological activities. In particular, GubenBratt extracts have traditionally been used to treat diabetes in East Asia and other countries [3]. Daiebletes has been the main reason for the world's death in recent years in scientific te sting, and currently the largest diabetes is used to help prevent illness from medication, but it is necessary to use diabetes through certain loving foods. Patients are interested in bringing children and older adults to essentially the essential goals of this study, developing and assessing nutritious chocolate s and nutrition. The aim of this study is to develop and evaluate sugarfree antidiabetic chocolate formulations using guabu leaves and eglujam leaves as natural additives.

KEYWORDS : Antidiabetic chocolate, Guava leaves, Aegle marmelos, Phytochemicals, Blood glucose regulation, Medicinal Plants, Prevalence, epidemic mortality.

INTRODUCTION-

Diabetes is a chronic disease that occurs when the pancreas is not producing enough insulin, or when the body is unable to use effectively produced ins ulin. Insulin is a hormone that regulates blood glucose levels. Hyperglycemia, increased blood glucose levels or increased blood glucose are also comm on effects of uncontrolled diabetes, leading to serious damage to many systems in the body, especially nerves and blood vessels, over time. In 2022, 14 % of adults from the age of 18 lived with diabetes. It increased by 7% in 1990. More than half (59%) of 30-

yearold adults did not take diabetes medication in 2022 for diabetic life. Diabetes treatment coverage was lowest in countries with low and medium size d incomes. In 2021, diabetes was the direct cause of 1.6 million deaths, with 47% of all deaths caused by diabetes occurring 70 years ago. 530,000 addit ional deaths of kidney disease are caused by diabetes, and hyperglycemia causes approximately 11% of cardiovascular deaths [1]. Diabetes is one of the leading diseases around the world and the third most common cause of death in the United States. Antidiabetic drugs are used to treat diabetes to contr ol glucose levels in the blood [2]. Around 830 million people worldwide suffer from diabetes, with the majority living in countries with low and mediu m incomes. More than half of diabetics are not treated. The number of people with diabetes and the number of people with untreated diabetes has been steadily increasing over the last few decades. Daebetes has been the main reason for world death in recent years in scientific research, and now the larg est diabetes is used to help prevent illness from medication from medication, but should be used through certain loving foods. Patients are keen to devel op the nutritional value of children, elderly people, research main goals, nutritional value, nutritional value. Diabetes is a chronic disease cause d by metabolic disorders characterized by increased fat in blood sugar levels. Diabetes is growing worldwide, affecting an estimated 9.3% of adults bet ween the ages of 20 and 79. Diabetes is not automated immunity. Dieting is a key consideration for people with diabetes and a major recommendation f or people with both types of diabetes is the limits of sugar and sweets. This is because it can block the high postprandial glucose response insulin produ ced by the placenta. GuabenReves is a carotenoid, polyphenol, VIT c. [3] It was reported that Aegle Jam has a variety of pharmacological activities. Th ey are known for their hypoglycemia (lower blood glucose) properties, which makes them valuable in treating diabetes. Research shows that A. The lea ves of JAM lobes have been shown to lower blood glucose levels in a streptozotocininduced diabetic rat model by increasing insulin secretion from pan creatic beta cells [4]. Aegle Jam Leaves believes they have the hypoglycemic properties that can be created for people with diabetes and those who wan t to regulate their blood glucose levels [5]. Both Guave (Psidium Guajava) and Bael (Aegle Jamelos) are known for their therapeutic potential in the tre atment of diabetes. These leaves have been investigated for their beneficial properties, such as their ability to regulate blood glucose levels, reducing ox idative stress, and improving insulin sensitivity. The combination of these leaves in the chocolate formulation not only provides delicious delights, but also includes the health benefits of these traditional herbs.

Diabetes is a chronic disease caused by metabolic disorders, characterized by a rapid increase in blood glucose levels (hyperglycemia) [14].

Type of diabetes:

- 1. Type: 1 Diabetes: Type 1 diabetes is an autoimmune disease in which the pancreatic immune system attacks and destroys insulin-
- producing beta cells in the pancreas. As a result, people with type -1 diabetes cannot produce insulin and need to take external insulin [15].

2. Type: 2 Diabetes: Type 2 diabetes occurs when the body becomes resistant to insulin or when the pancreas does not produce enough insulin. This for m of diabetes occurs more frequently in adults, but increases obesity rates make it more noticeable in children [16].

3. Gestational diabetes: Gestational diabetes occurs during pregnancy and usually disappears after birth. However, it increases the risk of developing lat er in life in both mother and child type-2-disaccharides [17].

4. Other specific types: There are other less common forms, such as genetic mutations that affect the production or effectiveness of insulin, pancreatic d isease, drug-induced diabetes and diabetes, diabetes, and other specific disease-related diseases [18].

Plant Profile :

1) Guabene Leaves: Plants are the major natural source of numerous bioactive compounds. Although several diseases have been cured since ancient tim es, various plant preparations in civil medicine are used, and the cosmetic, pharmaceutical and nutritional industry is now increasingly respectful of pla nt preparation and pure plant chemical attention [6].



(FIG-1 Guava Leaves)

Botanical Classification of Guava Leaves :

(Table No- 1 Guava Leaves Botanical Classification Table)[10].

Parameter	Details
Biological Name	Psidium Guajava
Family	Myrtaceae
Kingdom	Plantae
Order	Myrtales
Genus	Psidium
Species	Psidium Guajava

Pharmacology: Guben leaves are antidiabetic. This is because it has the ability to lower blood glucose levels by regulating blood glucose levels, reduci ng inflammation, improving liver function and improving insulin production and sensitivity.

Chemical Constituents: Guava leaves have been reported to contain flavonoids, sesquiterpenes, triterpenoids, coumarins, alkaloids, and tannins[11]. 2) Aegle Marmelos Leaves:

Aegle Jam, also known as Bael, has been proven to have antiabectivety activity in several studies. This includes leaves, root bark and plant fruits.



(FIG-2 Aegle Marmelos Leaves) Botanical

Classification Of Aegle Marmelos Leaves:

Parameter	Details
Scientific name	Aegle Marmelos
Family	Rutaceae
Kingdom	Plantae
Order	Sapindales
Species	Aegle Marmelos

(Table No-2 Botanical Classification Of Aegle Marmelos Leaves) [12]

Pharmacology:Aegle Mammelos, also known as Bael, has many pharmacological activities, including antibiotics, antiinflammatory and antidiabetic properties.

Chemical Constituents:

Bael's fruits, bark, leaves, seeds and roots contain bioactive compounds such as coumarin, xanthooxol, command agents, gravity, and jam. These compounds can provide antidiabetic, antihe, anticatalytic, antibiotic, immunogenic, and insecticidal activity [13].



(FIG-3 Aegle Marmelos Activity Flow Chart)

Medicinal Plants Used:

1. Guava Leaves (Psidium guajava)

Phytochemical Constituents: Flavonoids (quercetin), tannins, carotenoids, saponins.

Antidiabetic Properties:

- Inhibits α-glucosidase and α-amylase enzymes, slowing carbohydrate digestion.
- Enhances insulin sensitivity and promotes glucose uptake.
- Possesses antioxidant and anti-inflammatory properties that protect pancreatic β-cells.
- 2. Aegle marmelos Leaves (Bael)

Phytochemical Constituents: Alkaloids, coumarins, flavonoids, terpenoids.

Antidiabetic Properties:

- Stimulates insulin secretion from pancreatic β-cells.
- Regenerates islet cells and restores normal blood glucose levels in diabetic models.
- Exhibits antioxidant activities, reducing oxidative stress in diabetic conditions.

Review Litrature:

Herbal chocolates containing traditional medicinal plants such as Guavenblätter (Psidium Guajava) and Aegle Jammelos (Bael) are innovative research fields. These plants are known for their medical properties and can improve health benefits by adding chocolate while also maintaining the joyful factor Here we find a review of the potential uses, benefits, and research findings of including these herbal ingredients in chocolate.

1. Guven's LeafScience Name: Psidium guajavaGuavenblätter has been traditionally used in a variety of cultures due to the benefits of medical care. Th ey include bioactive connections such as flavonoids, phenolic acids, and tannins, which contribute to their health-promoting properties.

Health Benefits: Antidiabetic Effects: Studies show that Guav leaves help regulate blood glucose levels. This could be a valuable addition to chocolate, which is intended to promote healthy blood glucose regulation.

¢Antidiabetic effects: Studies have shown that Guav leaves help regulate blood glucose levels, which has shown to be useful for people with - 2 diabetes. This could be a valuable addition to chocolate, which is intended to promote healthy blood glucose regulation.

Antiinflammatory: Guabu leaf connection reduces inflammation and is likely useful for diseases such as arthritis and other inflammatory diseases.

¢Antibials: Guavenblatte extracts have antibacterial properties that can improve the nutritional value of chocolate by supporting the immune system.Gu

abene leaves can be treated with powder and mixed with chocolate to improve antioxidant content and promote health benefits related to sugar regulatio n, anti-inflammatory effects, and digestive health.

2. Aegle Jammelos (Bael) of herbal chocolateScientific name: Aegle JammelosBael Fruits, especially their leaves, are known for their many medical be nefits. This plant was used for its therapeutic benefits in traditional healthcare systems such as Ayurveda and Siddha. Active connections include alkalo ids, flavonoids, essential oils and tannins.

Health Benefits:

¢Antidiabetic Effects: Bael's leaves and fruits help lower blood sugar levels and help in diabetes management. This makes Bael an excellent option for using diabetes friendly chocolate formulations.

¢Antidiabetic effects: Bael's leaves and fruits help lower blood sugar levels and help in diabetes management. This makes Bael an excellent option for using diabetes friendly chocolate formulations. It has been reported that immune supplementation has an immunomodulatory effect and may improve th e body's defense against infection.Bael leaf powder or extract can be attached to chocolate to improve health benefits, particularly in digestion and bloo d glucose regulation. It can be used in a variety of chocolate forms, such as dark chocolate and white chocolate, adding unique health promotion propert ies.

Overall Prevalence of Diabetes (% of Population Ages 20 to 79) in World:



(FIG-4 Mapping Diabetes Rates by Country in 2021)

Despite advancements in healthcare lengthening life expectancy across the world, there are still many diseases that are hard to beat . One of these growing and costly diseases is diabetes, but each country is being hit differently.

One of the leading causes of death and disability globally, over half a billion people are living with diabetes today. The World Bank's IDF Diabetes Atlas reveals that diabetes was responsible for 6.7 million deaths in 2021 alone.

Rank	*	Country	% of Diabetic Population Aged 20-79
1		🖪 Pakistan	30.8
2		🖙 French Polynesia	25.2
3		🗲 Kuwait	24.9
4		🛤 Nauru	23.4
5		ӣ New Caledonia	23.4
6		🖾 Marshall Islands	23.0
7		➡ Mauritius	22.6
8		🛤 Kiribati	22.1
9		= Egypt	20.9
10		🛋 American Samoa	20.3

Worlds Top 10 Countries % of Diabetic Population Aged 20-79

Mortality Rate :



- 284,049 deaths, 139,651 deaths in men, and 144,398 deaths in women.
- The age-standardized death rate due to diabetes was estimated at 20.9 deaths per 100,000 population.
- Age-standardized deaths rates from diabetes vary across countries from a high in Guyana (82.6 deaths per 100,000 population) to a low in Canada (7.2 deaths per 100,000 population).

The countries with the highest age-standardized death rates due to diabetes are:

• Guyana

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- Mexico
- Trinidad and Tobago
- Haiti

- Grenada
- Guatemala
- Jamaica

Advantages of Herbal Chocolate:

1.Improved Palatability and Taste Masking

- Many herbal extracts have a bitter or unpleasant taste, which reduces patient adherence.
- Chocolate masks bitterness effectively, making it easier to consume herbs like guava and bael leaves without altering the sensory experience.

2. Appealing to All Age Groups

• Chocolate is widely accepted across all demographics, including children, adults, and the elderly. This makes it a versatile delivery method, especially for those who are non-compliant with traditional herbal preparations.

3. Portable and Convenient:

Herbal chocolate is easy to store, transport, and consume—no preparation needed.Suitable for on-the-go consumption, especially for
patients with busy lifestyles.

4. Dual Functionality: Medicinal + Nutritional

• Besides delivering antidiabetic herbs, chocolate offers nutritional value: iron, magnesium, and antioxidants. It acts as a nutraceutical, combining food and medicine in a single form.

5. Encourages Innovation and Consumer Interest:

• The fusion of traditional medicine with a modern, enjoyable format like chocolate can drive consumer curiosity, increase acceptance, and enhance market potential. Supports the trend toward functional foods and wellness-focused eating.

Challenges:

1. Standardization of Herbal Extracts

- The concentration of active phytochemicals (e.g., flavonoids, alkaloids) in guava and bael leaves can vary with season, location, and processing.
- Lack of standardization affects dose consistency, safety, and therapeutic efficacy.

2. Limited Clinical Validation

- Most antidiabetic effects of guava and bael are demonstrated in in vitrooranimal studies.
- There is a lack of large-scale, randomized human clinical trials confirming the efficacy and safety of these herbs when delivered via chocolate.

3. Stability of Active Compounds

- Heat during chocolate processing (e.g., conching or tempering) may degrade heat-sensitive bioactives.
- Long-term stability and retention of herbal properties in the chocolate matrix need careful formulation and shelf-life testing.

4. Taste Compatibility

- Incorporating herbal extracts into chocolate can alter taste, texture, and aroma.
- High concentrations may lead to bitterness or herbal aftertaste, impacting consumer acceptability.

5. Regulatory and Safety Concerns

- Herbal chocolate may fall into a grey area between food and medicine in many countries.
- It requires proper labelling, toxicology testing, and regulatory approval as a nutraceutical or functional food product.

6. Cost and Scalability

- Extracting high-quality, standardized herbal compounds and integrating them into chocolate can increase production costs.
- Ensuring scalability for mass production while maintaining quality is a technical and economic challenge.

7. Consumer Awareness

- Despite the appeal of chocolate, many consumers may be unaware of its therapeutic benefits when combined with herbs.
- Educational and marketing efforts are needed to increase awareness and trust in such products.

Future Direction:

1. Development of Standardized Extracts

- Invest in phytochemical profiling and quantification of active compounds (like quercetin in guava, marmelosin in bael).
- Use of advanced extraction techniques (supercritical fluid, cold extraction) to retain bioactivity.

2. Clinical Trials and Efficacy Studies

Conduct well-designed human clinical trials to confirm glycemic control, safety, and patient compliance.

• Evaluate long-term benefits in prediabetic and diabetic populations.

3.Diversification of Product Forms

- Expand beyond bars to include sugar-free chocolate drinks, spreads, or supplements.
- Tailor formulations for specific populations (e.g., high-fiber for obese diabetics, high-antioxidant for elderly).

4. Regulatory Harmonization

- Work with food and drug authorities to develop clear guidelines for herbal-infused functional foods.
- Ensure transparent labeling for dosage, ingredients, and claims.

5. Consumer Education and Awareness Campaigns

- Promote health benefits through evidence-based marketing, nutritional workshops, and product demonstrations.
- Leverage social media, influencers, and clinical endorsements to build trust.

Aim And Objectives:

For research or projects using herb chocolate with guabu leaves and eglu jam, goals and goals usually focus on examining the possibility of including th ese herbs in the chocolate to improve health benefits. We will develop functional herbal chocolates, including guabene leaves (Psidium guajava) and A egle Jamelos (Bael), which have improved health benefits, particularly targeting blood glucose regulation, digestibility and antioxidant properties, and e valuate their sensory attributes, stability and effectiveness. Preparation of Gauava leaves and Aegle Jammelos herbal chocolate benefits the elderly and children. This herbal chocolate is suitable for those who are afraid to take the medicine. This project is created with this goal in mind.

Objectives:

1) Prescription anti-labeled chocolate suitable for people of all ages.

- 2) Regulate blood glucose levels and reduce the long-term risk of diabetes.
- 3) Reducing reliance on medication by providing alternative antidiabetic options.
- 4) Create a chocolate mixture with guabu leaves and aegle jam leaf powder powder and use anti-standards.
- 5) To assess the sensory properties of herbal chocolate, including taste, aroma, texture, and appearance, to ensure consumer acceptance.
- 6) Optimize the language to balance taste, health benefits, product stability and ultimately provide diabetes-friendly enjoyment.

7) Overcoming medical medication hospitalization to gain the activity of diabetic patients.

Material And Methods:

- 1. Raw Materials
 - Cocoa Butter (for smooth texture and consistency)
 - Butter for shine
 - Stevia Sweetning Agent •Coffee for flavouring agent
- 2. Herbal Ingredients:
 - Guava Leaves (Psidium guajava) Fresh or dried leaves, powdered form.
 - Aegle Marmelos (Bael) Fresh or dried leaves Bael .
 - Solvents for Extraction:
 - Distilled Water (for aqueous extraction of the plant materials)

Conclusion:

3.

Based on the research conducted, we can draw the conclusion that the naturally active ingredients of Guav Leaf Powder and Eegle Jams leave excellent inhibition of diabetic activity compared to commercially available antidiabetic chocolate. Herbal ingredients such as gua brif powder and Aegle Jamme los Leaf Powder have been successfully formulated in chocolate. These ingredients contain active ingredients such as flavonoids and phenolic compoun ds known for their antidiabetic properties. The current research work has improved herbal chocolate by using guabu leaves and Aegle Jamelos leaves p owders. Including dark chocolate in the wording is beneficial to improve insulin sensitivity and blood glucose regulation. This reduces the risk of type 2 diabetes and improves glucose metabolism. Guaben is extracted as a safe and effective option for treating diabetes. Further research and clinical research can provide additional insight into effectiveness and long-term impact on diabetes management. Despite promising benefits, antidiabetic herbal chocolate faces formulation, regulatory, and research hurdles. However, with advancements in extraction technology, clinical research, and consumer education, it has strong potential as a safe, effective, and enjoyable nutraceutical product for managing diabetes.

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