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Formulation and Evaluation of Herbal Antidiabetic Chocolate by using Syzygium Cumini and Stevia: A Reasearch

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ABSTRACT:
Chocolate remains a universally consumed product across age groups, though health concerns including obesity, hypertension, coronary artery disease, and diabetes often prompt medical professionals to restrict intake. This study focused on developing a therapeutic chocolate formulation designed to address glycemic control while maintaining consumer appeal. Diabetes mellitus, characterized by impaired glucose regulation, requires innovative dietary interventions. Syzygium cumini (jamun seeds) were prioritized for their antioxidant properties and phenolic compounds, which demonstrate hypoglycemic activity. The formulation incorporated jamun seed powder, dark chocolate, cocca butter, and stevia, with rigorous evaluation of general appearance, dimension, blooming test, drug content determination, and physical stability parameters.

Keyword: Antidiabetic herbal chocolate, Syzygium cumini , Stevia rebaudiana, Sugar Free chocolate , Hypoglycemic effects, Herbal neutraceuticals.

I. INTRODUCTION:

Diabetes also known as diabetes mellitus,it is a group of common endocrine diseases characterised by sustained high blood sugar levels .Diabetes is due to either the pancreas not producing enough of the hormones insulin,or the cells of the body becoming unresponsive to insulin effect and it's classified into three main types are as follow :

- Type 1
- Type 2
- Gestational diabetes

Type 1 Diabetes:

- **Cause**: An autoimmune disease where the body's immune system mistakenly attacks and destroys the insulin -producing cells (beta cells) in the pancreas.
- **Insulin Production**: The pancreas produces little to no insulin, a hormone essential for regulating blood sugar levels.
- **Onset** : Often diagnosed in childhood or adolescence, but can occur at any age.
- **Prevalence**:Accounts for about 5% to 10 % of all diabetes cases.

Type 2 Diabetes:

- **Causes**:The body either doesn't produce enough insulin or the cells become resistant to the effect of insulin , leading to high blood sugar levels.
- **Insulin Resistance**: The body's cells don't respond normally to insulin, preventing glucose from entering the cells for energy.
- **Risk Factors** :Obesity ,lack of physical activity ,family history, and certain ethnicities increases the risk.
- **Onset**: Typically developed in adulthood,but can occur in children and adolescents.
- **Prevalence**: Account's for about 90% to 95% of all diabetes cases.

Gestational Diabetes:

- **Cause**: High blood sugar levels that develops during pregnancy ,often due to hormonal changes that interfere with insulins effetiveness.
- **Onset:** Typically diagnosed during the second or third trimester of pregnancy .
- **Resolution** : Usually resolves after childbirth ,but increses the risk of developing type 2 diabetes later in life.
- **Risk Factor** : Family history of diabetes ,and certain ethnic groups are at higher risk.

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Other Types of Diabetes:

- **Maturity onset diabetes of young (MODY)**
  A rare form of diabetes caused by genetic mutations, often diagnosed in
  Childhood or adolscence.
- **Neonatal Diabetes:**

Neonatal diabetes is a form of diabetes that is diagnosed under the age of six months.

- **Latent autoimmune diabetes in adults (LADA):**

A type of diabetes that shares characteristics of both type 1 and type 2 ,
Often diagnosed in adulthood

Introduction of chocolate :

Fig no : 1 Dark chocolate

Chocolate serves as a versatile culinary medium capable of being engineered for diverse sensory profiles through strategic ingredient blending. This positions it as an optimal nutraceutical delivery system, particularly for pediatric and adolescent demographics. Herbal formulations represent standardized compositions containing processed botanical elements in precise ratios, designed to deliver targeted nutritional interventions for diagnostic, therapeutic, and prophylactic applications. From a functional perspective, cocoa derivatives demonstrate exceptional potential as bioactive compound carriers. As a cocoa-based matrix, chocolate naturally contains elevated concentrations of flavonoid antioxidants and associated phytochemicals. A nutritional powerhouse. Its structural complexity enables precise customization through controlled blending techniques that modulate organoleptic properties. Key bioactive constituents, including flavanols, polyphenols, and theobromine, demonstrate clinically validated therapeutic profiles within this delivery matrix.

This research initiative focuses on engineering and optimizing nutrient-dense chocolate formulations. A primary objective involves prototyping and validating a natural confectionery product with dual functionality as a dietary supplement. The medicated chocolate formula remains commonly employed in therapeutic applications, targeting patient health conditions while enhancing adherence rates. Organoleptic characteristics, pH stability, blooming test outcomes, preliminary phytochemical screening, and mixture hardness were systematically evaluated.

Dark chocolate incorporates bioactive compounds including polyphenols and theobroma. Such components demonstrate capacity to modulatcholesterol profiles, reducing low-density lipoprotein (LDL) levels while elevating high-density lipoprotein (HDL) concentrations. Clinically recognized as 'bad cholesterol' and 'good cholesterol' respectively, these biomarkers respond favorably to cocoa-rich formulations. With minimum 70% cocoa content, the potent antioxidant source enables multiple benefits: glycemic regulation support, hemodynamic optimization through improved circulation, blood pressure management, and cardiovascular risk mitigation. Long-term diabetes prevention potential has been additionally observed.

Types of chocolate:

1. **Milk chocolate:** It's best to mix Ecuadorian beans with mostly medium – roastd west african beans . This combination would provide a clean , nutty,somewhat fruity chocolate .It's woth noting that the inclusion of the more acdic Brazilian and Malaysian beans might clash with the intened creamy overtones.
2. **Light milk chocolate:** This product might be prepared from gently roasted Java beans, which have light coour and a mild flavour with pronounced nutty overtones. Because the coating would be many shades lighter than a 100 percent West African bean, this would aid in achieving an acceptable standard of identification for milk chocolate.
3. **White chocolate**: White chocolate, although similar in texture to that of milk and dark chocolate, does not contain any cocoa solids that impart a dark color. It is made of sugar, milk, and cocoa butter, which has been extracted from the cocoa liquor. It is pale ivory

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colored, and lacks many of the compounds found in milk and dark chocolates.

4. **Dark chocolate** : Dark chocolate, also called plain chocolate, is produced using only cocoa butter, with no milk fat included. It is made from chocolate liquor to which some sugar, more cocoa butter and vanilla are added. Dark chocolate can be eaten as is, or used in cooking, for which thicker baking bars, usually with high cocoa percentages ranging from 70% to 100%, are sold. A higher amount of cocoa solids indicates more bitterness. Many brands display the cocoa percentage on their packaging.
5. **Ruby chocolate:** Ruby chocolate is made from the Ruby cocoa bean, resulting in a distinct red color and a different flavor, described as "sweet yet sour". It was created by Barry Callebaut, a Belgian–Swiss cocoa company. The variety was in development from 2004, and was released to the public in 2017.
6. **Semisweet chocolate**: Semisweet chocolate contains at least 35 percent cocoa solids, but there are no official guidelines that govern what can be called "semisweet." Semisweet chocolate falls somewhere between bittersweet chocolate and sweet dark chocolate. This type of chocolate is most commonly used for baking, but it's important to follow the recipe to determine whether it calls for semisweet, bittersweet, or baking chocolate.
7. **Bittersweet chocolate**: Bittersweet chocolate must contain at least 35 percent cocoa according to the FDA, but most bittersweet bars contain 50 percent, with others having as much as 80 percent cocoa. This type of chocolate often has a deeper, more bitter flavor than other types of chocolate.
8. **Unsweetened chocolate:** Unsweetened chocolate is just like its name implies. It's pure chocolate liquor, made of simply of ground cocoa beans. It's also known as baking chocolate, because it's not meant for consumption on its own. Instead, it's best when used in baking or cooking and combined with other ingredients to make it taste better. Contrary to popular belief, pure chocolate doesn't taste very good. However, it lends a deep, rich chocolate flavor to recipes and is the base of most of the other types of chocolate.

Health benefits of dark chocolate :

I. Improved Insulin Sensitivity

Polyphenol in dark chocolate may improve insulin sensitivity, which could help regulate blood sugar level and reduce the risk of type 2 diabetes.

II. Lower Blood Pressure

Studies suggest that dark chocolate consumption may help lower blood pressure in individuals with diabetes.

III. Reduced risk of type 2 diabetes :

Some research indicates that consuming dark chocolate may be linked to lower risk of developing type 2 diabetes.

IV. Antioxidant properties

Dark chocolate contains antioxidant that can help combat oxidative stress and inflammation, which are factors that contribute to various diabetes complications.

V. Stress Reduction

Dark chocolate may help lower stress hormone levels.

II. LITERATURE REVIEW :

1)**Mr Ghuge Jagnnath Ramprasad , Miss Kale Vidya Raosaheb (2023)**

Chocolate remains a universally enjoyed product across age groups, though health concerns including obesity, high blood pressure, coronary artery disease, and diabetes necessitate consumption limits. Medical professionals frequently restrict patient intake. This research therefore prioritized developing a medicated chocolate formulation designed to address diabetic prevention while maintaining palatability. Syzygium seeds, recognized for elevated antioxidant concentrations and vitamin content, were leveraged for their blood glucose-regulating properties. A critical insight. One that demands action. The formulation combines Syzygium cumini seed extract, dark chocolate cocoa butter, and stevia, with evaluation parameters encompassing general appearance, dimension, hardness, blooming tests, drug content determination, and physical stability.

As clinical data indicates, diabetes represents a chronic metabolic disorder marked by elevated blood glucose levels. Three primary classifications exist: Type 1, Type 2, and gestational diabetes. Type 1 manifests as an autoimmune condition, while Type 2 arises from insulin

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resistance leading to glucose accumulation. Not merely a temporary condition, gestational diabetes involves placental hormone-induced insulin interference during pregnancy. Strategic alignment between nutritional innovation and therapeutic intervention proves essential given these pathophysiological complexities.

2)S.K .Goyal (2013)

Global utilization of Stevia spans centuries, with applications ranging from a sweetener to medicinal purposes. A comprehensive literature review was conducted to synthesize and quantify existing evidence on Stevia. A thorough search of relevant papers up to 2007 was performed across multiple databases. Notably, the leaves of the Stevia plant possess functional and sensory properties that surpass those of many other high-potency sweeteners. This superiority positions Stevia to become a leading source of high-potency sweeteners for the expanding natural food market. A critical insight. One that demands action.

Diabetic patients, individuals seeking to reduce caloric intake, and children are likely to benefit significantly from Stevia's remarkable sweetening potential. Notably, Stevia is a small perennial shrub. Its leaves have been used for centuries as a bio-sweetener and for various medicinal applications, including blood sugar regulation. The natural herbal sweetener derived from Stevia is a white crystalline compound, characterized by zero calories and a sweetness that exceeds table sugar by 100-300 times. This underscores the potential benefits of Stevia. Particularly in terms of risk mitigation and strategic alignment with health-conscious consumer trends.

3)Syed Raza Shah, Richard Alweis , Maria Shahid -2017

Emerging evidence suggests cocoa polyphenols' antioxidant properties may directly modulate insulin resistance, potentially lowering diabetes risk. Research indicates cocoa could stimulate pancreatic β-cell regeneration, enhance insulin secretion, exert hypoglycemic effects, and improve glucose tolerance. Endothelial function-mediated insulin sensitivity may be further enhanced through cocoa's vasodilatory properties. Sustained cocoa consumption demonstrates potentially greater impact on insulin resistance compared to acute interventions. A critical factor in long-term metabolic health.

To validate these insights, large-scale randomized controlled trials examining cocoa-enriched diets are warranted. Such research would provide enhanced opportunities to assess molecular-level healthcare benefits in reducing diabetic complications.

4)Muniappan Ayyanar, Pandurangan Subash - Babu

Indian medical journal findings indicate Jamun seed and bark demonstrate therapeutic efficacy in human diabetes management, attributed to their rich composition of ellagitannins, 3,6-hexa hydroxyl diphenoyl glucose, isomer 4,6-hexahydroxy diphenoyl glucose, 1- galloylglucose, 3-galloylglucose, gallic acid, and ellagic acid . The fruit's seeds and pulp showcase significant hypoglycemic potential, as evidenced by clinical research . Widely recognized as an adjuvant therapy for type-2 diabetes management, Jamun's anthocyanin-rich pulp and seeds have undergone extensive study for their antidiabetic properties. A botanical approach supported by phytochemical analysis. The marker compound has been clinically validated for anti-diabetic activity. When administered to alloxan-induced diabetic rats, Jamun seed extract demonstrated marked efficacy in reducing blood glucose, blood urea, serum cholesterol, and triglyceride levels. Containing key phytochemicals including glucoside, jamboline, and ellagic acid, the seeds exhibit regulatory effects on starch-to-sugar conversion during glucose overproduction . This mechanism effectively regulates starch conversion processes during glucose overproduction.

5). Lokesh Prasad MS,Kalaskar P Gurunath ,SB Chandrasekar ,Umashankar C, Pawar AT (2017)

Since medicinal plants are the most abundant source of bioactive molecules utilized in both traditional and modern medicine, plant-derived substances and herbal medicines have recently gained a lot of attention due to their many potential uses. The use of herbal treatments and interest in them has grown significantly in recent years, even in places with access to modern medicine. In both developed and developing nations, herbal therapy is the most common kind of alternative and traditional medicine. The common interest in medications made from plants due to the perception that they are reliable, safe, and have fewer negative effects. According to a review of the research, traditional plant medicines can help with wound healing and a number of skin-related issues. The practice of traditional medicine has

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been encouraged by the World Health Organization (WHO) and our nation due to its affordability, accessibility, and comprehensiveness, particularly in developing nations. The usage of herbs has been investigated and used for millennia in some European and oriental nations. Great work has been accomplished that is beyond the awareness and reach of the average person. The 21st century's technologically advanced lifestyle is causing human pain to manifest under various names. The answer is found in the basic herbs with numbers.

6)**Manoj Kumar 1,2 ORCID,Baohong Zhang, Jyoti Nishad , Aman Verma ,Vijaty Sheri.**

Researchers have studied the nutritional aspects and applications of jamun seed (JS) in various food matrices to determine the valorization potential of JS. Jamun seeds have been utilized to treat diabetes and digestive problems in Ayurveda since ancient times. Currently, the health-promoting properties of JSs are being confirmed and many bioactive compounds responsible for it, including phenolics, terpenoids, phloroglucinol derivatives, and saponins, have been identified. Intensive research on biological potential is ongoing and the seed extracts, extract fractions, and isolated compounds are being tested for antidiabetic, antioxidant, anti-inflammatory, anticancer, antimicrobial, cardioprotective, hepatoprotective, and neuroprotective properties. Moreover, the jamun seeds have been found to contain nutrients . The seeds have substantial amounts of dietary fiber and appreciable quantities of anthocyanins, chlorophyll, phytosterols, amino acids, vitamin C, vitamin B complexes (thiamine, riboflavin, folic acid), essential minerals and trace elements (calcium, iron, sodium, magnesium, zinc, phosphorus, chromium, vanadium, and potassium), essential oil, albumin, and fats . Fatty acid profiling of the seeds reveals the presence of lauric, myristic, palmitic, stearic, oleic, linolenic, malvalic, and sterculic acids as predominant fatty acids along with β-sitosterol as phytosterol .

7 **) Muhammed Farhan Jahangir Chughtai, Imran Pasha, Tahir Zahoor ,Adnan Khaliq, Samreen Ahsan, (2019)**

Diabetes mellitus is a disease described as hyperglycemia and varying degrees of an insufficient insulin effect. There are approximately 177 million people with diabetes worldwide according to the World Health Organization (W. H. Organization, Citation2016). Traditionally Stevia leaf extract has been used in the treatment of diabetes . It was observed that in both animals and humans Stevia has the ability to increase the insulin effect on cell membranes, increase insulin production, and stabilize glucagon secretion as well as blood sugar levels, and improved glucose tolerance to ingested carbohydrates and lower post-prandial blood sugar levels. It can be stated that Stevia provide a comprehensive set of mechanisms that alter the type II diabetes and its ultimate complications. Thus, SGs or Stevioside of Stevia leaf can be used as a replacement of sugars to support healthy glucose regulation .

8)Binkai Liu, doctoral student1, Geng Zong, professor23, Lu Zhu, research assistant1, Yang Hu, research scientist1, JoAnn E Manson, professor456, Molin Wang, associate professor457, Eric B Rimm, professor145, Frank B Hu, professor145, Qi Sun, associate professor14 (2024)

Dark chocolate, with a higher cocoa content than milk chocolate, may lower the risk of T2D through various mechanisms. It has been suggested that bioactive compounds in cocoa, such as flavan-3-ols and their monomeric form, epicatechin, mitigate risk of T2D by improving insulin sensitivity,protecting pancreatic β cells from oxidative stress, lowering pro-inflammatory cytokines such as tumor necrosis factor-α and IL-6, and improving endothelial function by stimulating the production of nitric oxide, a vasodilator, which may lead to improved glucose metabolism and reduced risk of T2D.575859 Milk and white chocolate intake might not lead to the same metabolic health benefits owing to their higher added sugar content—an established dietary risk factor for cardio metabolic diseases.

AIM AND OBJECTIVES:

Aim: Formulation and Evaluation of herbal Antidiabetic Chocolate by using Syzygium Cumini and stevia extract.

Objectives:

a) To formulate antidiabetic chocolate for a person who suffers from the diabetic disease.
b) To regulate blood sugar level and reduce long term risk of diabetes.
c) To reduce reliance on medicated drugs by providing an alternative antidiabetic option.
d) Improving insulin sensitivity.
e) To provide palatable and convinient option for individual for suffering with diabetes.

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f) To formulate dark chocolate that reduce fat activity.

PLAN OF WORK :

1) Literature review
2) Selection and procurement of drug
3) Collection of material
4) Selection of method
5) Extraction of material
6) Drug authentication
7) Evaluation
8) Experimental result and discussion
9) Conclusion

DRUG PROFILE :

The plant selected for preparation of herbal antidiabetic chocolate is Syzygium Cumini seeds and Stevia leaves.

1. Syzygium Cumini (Jamun):

Syzygium cumini, commonly known as Malabar plum, Java plum,black plum, jamun, jaman, jambul, or jambolan,is an evergreen tropical tree in the flowering plant family Myrtaceae, and favored for its fruit, timber, and ornamental value. It is native to the Indian subcontinent and Southeast Asia. It can reach heights of up to 30 m (100 ft) and can live more than 100 years.A fast growing plant, it is considered an invasive species in many world regions. The jamun trees starts flowering in March -April . The fragrant flowers of Jamun are small ,nearly 5 mm in diameter. This is followed by the fruits which appears in May -June and resembles a large berry.

Fig no 2 .Jamun

Scientific classification:

Synonym: Java plum,Malabar plum, Jamun

Biological source: The biological source of Syzygium cumini is a tree

Specifically Syzygium cumini (L) Skeels, which is also known as Eugenia Jambolana Lam / Syzygium jambolanum DC.

Family: Myrtaceae

Genus : Syzygium

Species : S. cumini

Binomial name : Syzygium cumini (L) Skeels

Chemical constituents: Chemical Constituents : Jamun mainly contains polyphenols, flavonoids, phenolic, anthocyanins, gallic acids, tannins, phenols, alkaloids, ellagic acid, glycoside, isoquercetin, kaempferol, myricetin, tannins, flavonols, flavone, and vitamins.

- Jamun includes an essential glycoside called Jambolin, which inhibits starch from being converted into sugar and so aids in blood sugar regulation The leaves of the Jamun the jamblang plant contain several phytochemicals , including phytochemicals, flavonoids, and phenolic compounds such as sitosterol, betulinic acid, crategolic acid, quercetin, myricetin, and kaempferol . These flavonoids-, antioxidants-, and polyphenols-rich Jamun leaves possess anti-inflammatory, anticancer, and hypoglycemic potentials

Use:

a. It is a suitable source of iron and ascorbic acid, and it can even help with heart and liver problems.
b. The dried and powdered seed of the Jamun is frequently used in India to manage diabetes.
c. It has been used in treating kidney problems, diabetes, indigestion, and diarrhea. Hence, it's antioxidant, anti-inflammatory, anticancer, antidiabetic, antibacterial, antifungal, and radioprotective properties.
d. For years, Jamun seed powder has been used as a natural way to maintain a healthy blood sugar level, as well as treat cardiovascular and gastrointestinal problems.

2. Stevia (Madhuparni)

Stevia rebaudiana is a plant of the genus stevia in the family Asteraceae. Itis commonly known as candyleaf ,sweetleaf or sugarleaf . It may beregular plant which develops toheight of 30 to 60 cm (1 to 2 feet). Stevia is spreading in the leaves ,from which the extract is commonly known as stevia and can be produced as a sweetener product sold under various product names.

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Fig no .3 Stevia rebaudiana

Scientific Classification
Biological name: Stevia rebaudiana
Synonyms : Candyleaf, Madhuparni
Biological source : Stevia is a natural sweetener, obtained from the leaves of stevia rebaudiana .
Family : Asteraceae
Kingdom : Plantae
Genus : Stevia
Species: S . rebaudiana

Chemical Constituents :

- Stevia leaves contain a variety of chemical compound ,but the most notable are the steviol glycosides, especially stevioside and rebaudioside A, which are responsible for their sweet .These glycosides are diterpenes and are much sweeter than sucrose . Additionally , stevia leaves also contain other connections such as flavonoids , alkaloids and amino acids.
- Stevioside and rebaudioside ,which have 200-300 times more sweeter than sugar

Use:

- It has antioxidant and anti -inflammatory properties. It can be used for treatment of oxidative stress-linked tissue pathologies.
- Stevia helps regulate blood sugar levels and is a possible option for People with diabetes.

- Weight Management:

Stevia is a zero -calorie sweetener that helps you manage your weight by reducing your total calorie intake .

- Some people take stevia for medical purposes such as weight loss to stimulate heart rate and water retention, such as lowering blood pressure , treating diabetes ,heartburn, and high uric acid level in blood.used in India to manage diabetes
- It has been used in treating kidney problems, diabetes, indigestion, and diarrhea. Hence, it's antioxidant, anti-inflammatory, anticancer, antidiabetic, antibacterial, antifungal, and radioprotective properties.
- For years, Jamun seed powder has been used as a natural way to maintain a healthy blood sugar level, as well as treat cardiovascular and gastrointestinal problems

EXCIPIENTS PROFILE :

A. Emulsifier:

- **Cocoa butter**

Coccoa butter helps t blend the various ingredients toghether , creating a smooth and cohesive chocolate.
Coccoa butter helps to solidify the chocolate , allowing it to maintain its shape.

B. Flavouring agent :

- **Coffee**

Coffee can give a unique and complex flavour to chocolate, complimenting the traditional cocoa taste.
Coffee can act as a both excipient and a flavour enhancer,adding depth and potentially offering health benefits.

C. Chocolate Base :

- **Dark chocolate**

Dark chocolate plays a crucible role in herbal chocolate formulation by providing a base for incorporating medicinal herbs,enhancing the taste and texture ,and ptentially contributing to the overall health benefits to the final product.

D. Herbal Extract :

They seve as a functional food , offering potential health benefits beyond the traditional enjoyment of chocolate.
They can be used as a delivery system for nutrients and bioactive compounds.

AUTHENTICATION LETTER OF PLANT MATERIALS:

i. Authentication letter of Syzygium cumini (Jamun)

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LOKNETE DR. BALASAHEB VIKHE PATIL
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PRAVARA RURAL EDUCATION SOCIETY'S
PADMASHRI VIKHE PATIL COLLEGE OF ARTS, SCIENCE AND COMMERCE,
PRAVARANAGAR A/P- LONI KD. TAL-RAHATA, DIST-AHILYANAGAR (MS)
Estd. 1971 POST GRADUATE DEPARTMENT OF BOTANY AND RESEARCH CENTRE

Authentication Certificate

This is to certify that the plant specimen collected by **Ms. Landge Kalyani Changdeo, MS. Gagare Aditi Raju, Ms. Nimse Gauri Vinayak and Mr. Perane Aditya Bhausaheb,** Students of **Final Year** B. Pharmacy of **Mrs. Saraswati Wani College of Pharmacy At. Ganegaon,** Po. Guha, Tal Rahuri Dist. Ahilyanagar is *Syzygium cumini* **(L.) Skeels., belongs to family Myrtaceae with local name Jamun/Jambul.**

Identified by

Dr. S. P. Giri
Research Guide
Dept. of Botany and Research Centre
PVP College, Loni

Verified by

Dr. A. S. Wabale
Research Guide, Vice Principal and Head
Dept. of Botany and Research Centre
PVP College, Loni

Date: 17th Feb. 2025
Place: Pravaranagar
Ref. No./PVPC/Bot./2024-25/383-1

P. V. P. College, Pravaranagar
BOTANY

Fig no .13 : Authentication letter of syzygium cumini

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ii. Authentication letter of Stevia:

LOKNETE DR. BALASAHEB VIKHE PATIL
(PADMA BHUSHAN AWARDEE)
PRAVARA RURAL EDUCATION SOCIETY'S
PADMASHRI VIKHE PATIL COLLEGE OF ARTS, SCIENCE AND COMMERCE,
PRAVARANAGAR A/P-LONI KD. TAL-RAHATA, DIST-AHILYANAGAR (MS)
POST GRADUATE DEPARTMENT OF BOTANY AND RESEARCH CENTRE
Estd. 1971

Authentication Certificate

This is to certify that the plant specimen collected by **Ms. Landge Kalyani Changdeo, MS. Gagare Aditi Raju, Ms. Nimse Gauri Vinayak and Mr. Perane Aditya Bhausaheb,** Students of **Final Year** B. Pharmacy of **Mrs. Saraswati Wani College of Pharmacy At. Ganegaon**, Po. Guha, Tal Rahuri Dist. Ahilyanagar is ***Stevia rebaudiana*** **(Bertoni) Bertoni, belongs to family Asteraceae with local name Sugarleaf or Madhuparni.**

Identified by

Dr. S. P. Giri
Research Guide
Dept. of Botany and Research Centre
PVP College, Loni

Verified by

Dr. A. S. Wabale
Research Guide, Vice Principal and Head
Dept. of Botany and Research Centre
PVP College, Loni

Date: 17th Feb. 2025
Place: Pravaranagar
Ref. No./PVPC/Bot./2024-25/383-2

P.V.P. College Pravaranagar BOTANY

Fig no .14 : Authentication letter of Stevia

MATERIAL AND METHOD

MATERIAL

Material:

Syzygium cumini extract ,Cocca butter, Dark chocolate, coffee, stevia ,
Methanol and distilled water

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Equipment :
Measuring cylinder, Beaker ,Morter pestle ,Conical flask , Funnel , Chocolate
Mould, Petri dish, Spatula , Soxhlet appratus.

Instrument:
Water bath, Refrigerator, Sieves ,grinder**.**

METHOD
Formulation of herbal chocolate:
Formulation Table:

Sr no	Ingredients	F1	F2	F3
1	Dark chocolate	33gm	33gm	33gm
2	Syzygium cumini extract	10ml	7ml	8 ml
3	Stevia extract	1 ml	1ml	2ml
4	Coccoa Butter	5gm	8gm	5gm
5	Coffee	1gm	1gm	2 gm

Formula No 1 : Fail
In this formulation Dark chocolate is not melted in water bath , so they melt by direct heat method .Due to this reason the formulation is not stable at room temperature or during storage , it could lead to change in texture ,taste or even degradation of herbal extract.

Formula no: 2 Fail
In this formulation due to overheating can cause the cocoa butter in chocolate to melt and then recrystallize on the surface ,formed white patches and also this cocoa particle clump together, resulting in a less smooth, more lumpy texture.

Formula no :3 Pass
In this above formulation contain better balance of ingredients, including the herbal extract , excipients , and chocolate components resulting in a more cohesive and palatable product. F3 demonstrates good stability, ensuring that the product maintains its quality and effectiveness over time . The formulation process in F3 might have yielded a smoother , a more appealing texture.

METHOD:
1. Measuring Ingredients: All the ingredients are measurd accurately.
2 .Selecting parts of the plant to be extracted.
3. Drying the plant part in shade.
4. Powdering the dried plant parts to a coarse powder.
5. The preapared powder was filled into the thimble and subjected to Soxhlet extraction using methanol as a solvent.
6Melting the chocolate base: A water bath was heated to approximately 50c and the chocolate base was melted in a porcelein dish untill it was Free - flowing.
7. Melt coccoa butter in another beaker , then add these butter and Plant extract , other ingredient chocolate mix well.
8.The final mixture containing the herbal extracts was poured into moulds' and placed in freezer to set overnight.

Fig no .9 Weighing Fig no . 10 Melting

Fig no. 11 Filling to mould Fig no 12. Prepared

EXPERIMENTAL WORK :
1. Preparation of syzygium cumini seed extract
- The plant material was collected locally, identified ,authenticated .

The collected seeds were washed with distilled water for approximately 15 minutes.
- The washed seeds were throughly dried in an oven at 60C for 2-3 days to remove moisture and reduce to fine powder.
- Dried 100 grams of powder from S.cumini was filled to soxhlet extraction using methanol was concentrated as solvent.
- The extract was cooled and filtered and were kept in vaccum dryer until used.

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Fig no .4 Extraction by Soxhlet apparatus

2. Preparation method of stevia leaf extraction :

- Stevia leaves are collected locally , identified and authenticated and dried in shade and further griended and passed through a sieve number 80 to form a coarse powder for extraction.
- Then 100gm of stevia placed in an extraction thimble.
- The thimble was placed in the soxhlet extractor using methanol as a solvent.
- The extract was cooled and filter.

Fig no .5 Size reduction

Fig no 6. Sieving

Fig no. 7 Extraction of stevia Fig no .8 Extract of stevia

EVALUATION TEST OF CHOCOLATE:

1) **Color**: Observe the chocolate color by visualization.
2) **Texture**: Evaluate the texture of the chocolate by checking its softness and brittleness.
3) **Mouthfeel**: Place chocolate in mouth and feel it.
4) **Taste of chocolate**: Slightly bitter
5) **Blooming test:**

Fat Bloom-

When the thin layer of fat crystals was form on the surface of chocolate formulation. This will cause the chocolate to lose its brightness and a soft white layer will appear , giving the finished article an unattractive look. Fat bloom is caused by the recrystallization of fat and or a immigration of a filling fat to the chocolate layer. Storage at a constant temperature will delay the appearance of fat bloom.

Sugar bloom:

Sugar bloom is a rough a irregular layer on top of chocolate formulationThis is caused by condensation (when chocolate is taken out from refrigerator. This dampness or moisture will sissolve the sugar in the chocolate, when the water vaporizes, sugar recrystallizes into rough irregular crystals on surface.This results into unpleasant look.

6) Physical stability:

Stability testing of herbal chocolate involves evaluating its quality and Characteristics time under different storage conditions. Here's a general Outlines for stability testing timing:

Storage Condition and Testing Intervals.
Room Temperature (25 -28^{o}C) for 30 min
Step : Place a sample on a plate at ambient room temperature.

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Observe for 30 min :
Any signs of softening blooming (white film) or sweating.
Texture and snap when broken.

Elevated Temperature Storage (40 ^{o}C) for 30 min
Step : Place a chocolate sample in elevated temperature the for 30 min
Observe every 5 min for 30 min :
Does it melt , deform or develop oil sepration.
Refrigerator Storage (5 ^{o}C) For 30 min
Step : Place a chocolate sample in the refrigerator for 30 min
Observe for 30 min

7)pH
To measure the pH of herbal chocolate using pH paper. Dip a pH paper strip into the sample, making sure to throughly wet the paper

III. RESULT AND DISCUSSION :

1) Organoleptic properties

Parameters	Result
Colour	Brown
Odour	Chocolaty
Taste	Slightely bitter
Mouth Feel	Smooth and pleasant
Appearance	Glossy

Table no : 4 Organoleptic property

2) Blooming Test

Test	Result
Fat bloom	No
Sugar bloom	No

3) pH
The pH of chocolate formulation was done by using pH paper and the result was found to be 7

4) Stability Testing

Parameter	Initial	Room Temp (25-28^{o}C)for 30 min	Refrigerator (5^{o}C)for 30min	Elevated (40^{o}C)30 min
Appearance	Glossy	No change	Glossy	Slight dull
Texture	Firm	Slightly soft	Firm	Becomes soft
Odour	Chocolaty	No change	No change	Slightly off
Taste	Acceptable	Slightly bitter	No change	Bitter
pH	7	Slightly change	Stable	Slightly dropped off

Table no :7 Stability Testing

Antidiabetic Chocolate was formulated and evaluated by using Syzygium Cumini seed and Stevia leaves extract. The formulated herbal antidiabetic chocolate was subjected to a series of quality and stability tests to evaluate its suitability as functional food product.The chocolate exhibited a uniform brown colour with a smooth and glosy surface, indicating proper cocoa butter and absence of fat or sugar bloom. The texture was firm and non -sticky ,which is desirable for ease of handling and consumption.

IV. CONCLUSION:

In herbal antidiabetic chocolate formulations offer a promising approach to managing diabetes by delivering beneficial herbal extracts in a palatable and convinient form. In essence , F3 likely represents a successful optimization of the formulation process, addressing the issues encountered in F1 and F2, resulting in a palatable , effective , and stable herbal chocolate product.The development of high quality sugar -free chocolate requires the use of most appropriate ingredients that can completely replace sugar without adversly affecting rheological , physical and sensory properties. Sugar -free chocolate sweetened with alternatives like stevia and insulin have demonstrated lower blood glucose levels and compared to conventional dark chocolate.Incorporating herbal extracts, such as those from syzygium cumini can further enhance antidiabeticproperty of the chocolate formulation.

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