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# HERBAL DIP : DIABETIC CARE A combination of Herbs with Modern technique of extraction of phytochemicals and their medical benefits

By

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## Abstract

*Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels, insulin resistance, and oxidative stress, leading to severe complications such as cardiovascular diseases, nephropathy, and neuropathy. The rising global prevalence of diabetes has fueled interest in natural and functional remedies, particularly herbal formulations that help regulate blood sugar levels without adverse side effects. This study explores the potential of Methi Leaves (Trigonella foenum-graecum), Black Jamun (Syzygium cumini), Cumin (Cuminum cyminum), Garlic (Allium sativum), Betel Leaf (Piper betle), Vilva (Aegle marmelos) and Ashwagandha (Withania somnifera), in developing a functional diabetic herbal drink. These botanicals, known for their anti-diabetic, antimicrobial, and antioxidant properties, have been extensively used in traditional Ayurvedic medicine, modern medicine and are now being validated through modern scientific research.*

*The taxonomy of these medicinal plants spans multiple botanical families, contributing diverse phytochemical properties. Their physio-chemical composition includes polyphenols, flavonoids, alkaloids, tannins, Terpenoids and saponins, which regulate glucose metabolism, improve insulin function and reduce oxidative stress. Additionally, these herbs exhibit antimicrobial activity, preventing infections commonly associated with diabetes, and antioxidant activity, which protects pancreatic  $\beta$ -cells from oxidative damage. Their mechanism of action involves multiple pathways, including inhibition of carbohydrate-digesting enzymes ( $\alpha$ -glucosidase and  $\alpha$ -amylase), enhancement of insulin secretion and receptor sensitivity, suppression of hepatic gluconeogenesis, and regulation of lipid metabolism.*

*To preserve the bioactive compounds and maximize therapeutic efficacy, this study employs a pre-activated Vedic methodology for extraction. This technique involves a sequence of soaking, sun-drying, cold maceration, and fermentation, ensuring the retention and bioavailability of key phytochemicals. Unlike conventional extraction methods that may degrade active compounds, the Vedic approach enhances their potency and effectiveness. By incorporating these seven potent herbs into a carefully formulated diabetic herbal drink, this study aims to present a natural, safe, and effective alternative for managing diabetes. This research underscores the growing potential of herbal-based dietary interventions in complementing modern diabetes therapies, encouraging further exploration and clinical validation of plant-based functional drinks.*

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## INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder that has become a global health concern, affecting millions of individuals worldwide. It is primarily characterized by persistent hyperglycemia, insulin resistance, and oxidative

stress, leading to severe complications such as cardiovascular diseases, nephropathy, neuropathy, and retinopathy. While conventional treatments like insulin therapy and oral hypoglycemic drugs help manage blood glucose levels, they often come with side effects and limitations. This has led to increased interest in natural remedies, particularly herbal



medicine, which has been widely used in Ayurveda, Traditional Chinese Medicine (TCM), and Siddha medicine for centuries. Among various herbal preparations, functional herbal drinks and teas have gained popularity due to their ease of consumption, bioavailability, and ability to support metabolic health.

This research focuses on the anti-diabetic potential of seven medicinal plants, each known for its effectiveness in regulating blood glucose levels, improving insulin function, and reducing oxidative stress. The selected herbs include Black Jamun (*Syzygium cumini*), Cumin (*Cuminum cyminum*), Garlic (*Allium sativum*), Betel Leaf (*Piper betle*), Bael (*Aegle marmelos*), Ashwagandha (*Withania somnifera*), and Methi Leaves (*Trigonella foenum-graecum*). These botanicals contain bioactive compounds such as polyphenols, flavonoids, alkaloids, and essential oils, which contribute to their anti-diabetic, antimicrobial, and antioxidant properties. Black Jamun is widely recognized for its rich anthocyanin content, which enhances insulin secretion and lowers blood sugar levels. Cumin contains thymol and cuminaldehyde, which improve glucose metabolism and reduce oxidative stress. Garlic, known for its allicin and sulfur compounds, has been shown to enhance insulin sensitivity and lower cholesterol levels, further benefiting diabetic patients. Betel Leaf, with its high eugenol and flavonoid content, helps regulate glucose absorption, acts as an antioxidant, and improves insulin function. Bael, a powerful digestive and anti-diabetic herb, is known for its ability to control cholesterol and support pancreatic function. Ashwagandha, an adaptogenic herb, plays a crucial role in reducing stress-induced hyperglycemia and improving insulin sensitivity. Methi Leaves, rich in saponins and fiber, aid in glucose regulation, blood formation, and digestive health.

The incorporation of these herbs into a diabetic care drink or tea offers a natural and holistic approach to diabetes management. Unlike synthetic anti-diabetic drugs, which may cause long-term side effects, these plant-based formulations provide additional benefits, including improved glucose metabolism, reduced inflammation, and enhanced antioxidant protection. Herbal drinks and teas allow for the gradual release of bioactive compounds, ensuring sustained blood sugar control while also offering antimicrobial and immune-boosting properties. The method of preparation plays a crucial role in maximizing the therapeutic potential of these herbs. This study emphasizes the pre-activated Vedic methodology as the preferred extraction technique, as it enhances the bioavailability and potency of active compounds. This ancient method involves soaking, sun-drying, cold maceration, and fermentation, preserving the phytochemical integrity of the herbs. By ensuring optimal extraction of bioactive compounds, this methodology enhances the effectiveness of the herbal formulation.

With the increasing burden of diabetes, natural and holistic treatment approaches are gaining attention for their long-term efficacy and safety. The selected seven medicinal plants possess significant anti-diabetic properties, and their synergistic effects offer a comprehensive solution for

managing diabetes naturally. This study aims to scientifically evaluate these herbs in the development of a functional diabetic care drink, validating their role through modern scientific methods while integrating traditional Ayurvedic wisdom. By exploring their taxonomy, physio-chemical composition, antimicrobial and antioxidant activities, and mechanisms of action, this research provides a strong foundation for the development of herbal formulations that can serve as effective alternatives to conventional diabetic treatments.

## Health Benefits of the Diabetic Care Drink

1. **Regulates Blood Glucose Levels**
  - Black Jamun, Methi Leaves, and Cumin help reduce fasting and postprandial blood sugar levels.
  - Anthocyanins in Black Jamun improve insulin sensitivity.
  - Fiber in Methi Leaves slows down carbohydrate digestion, preventing glucose spikes.
  - Essential oils in Cumin and Betel Leaf modulate glucose absorption.
2. **Enhances Insulin Function and Sensitivity**
  - Garlic's sulfur compounds stimulate insulin secretion.
  - Ashwagandha reduces stress-related insulin resistance.
  - Bael aids in pancreatic regeneration for improved insulin production.
3. **Provides Strong Antioxidant Protection**
  - Polyphenols, flavonoids, and tannins in Betel Leaf, Black Jamun, and Cumin reduce oxidative stress.
  - Protects pancreatic  $\beta$ -cells from free radical damage.
  - Helps prevent diabetes-related complications such as neuropathy and cardiovascular diseases.
4. **Lowers Cholesterol and Supports Heart Health**
  - Garlic and Bael reduce LDL (bad cholesterol) and increase HDL (good cholesterol).
  - Methi Leaves help in lipid metabolism and reduce triglyceride levels.
5. **Exhibits Antimicrobial Properties**
  - Betel Leaf, Garlic, and Cumin have strong antibacterial and antifungal properties.
  - Supports gut health and prevents infections, which diabetics are more prone to.
6. **Aids Digestion and Improves Gut Health**
  - Bael and Methi Leaves have natural laxative properties, preventing constipation.
  - Prebiotic fibers support a healthy gut microbiota, improving digestion and metabolism.
7. **Reduces Stress and Balances Hormones**
  - Ashwagandha helps lower cortisol levels, reducing stress-induced blood sugar spikes.
  - Supports adrenal function and enhances overall hormonal balance.

### 8. Natural and Safe Alternative to Synthetic Drugs

- Offers long-term benefits without side effects.
- Integrates Ayurvedic wisdom with modern scientific validation for effective diabetes management.

### 9. Holistic Approach to Diabetes Care

- Improves blood sugar control, insulin function, and metabolic health.
- Protects against long-term diabetes complications with a multi-targeted approach.

Regular consumption of this herbal diabetic care drink, along with a balanced diet and healthy lifestyle, can significantly improve overall well-being and metabolic health.

## MATERIALS AND METHODS:

### Taxonomy of Methi Leaves (*Trigonella foenum-graecum*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Dicotyledons
- Order: Fabales
- Family: Fabaceae
- Genus: *Trigonella*

Native to the Mediterranean region and widely cultivated in Asia and Africa, Methi is commonly used in traditional medicine for its multiple health benefits.

### Physio-Chemical Composition

Methi leaves are rich in several bioactive compounds that contribute to their medicinal benefits:

- **Alkaloids:** Help regulate glucose metabolism and contribute to the anti-diabetic effects of Methi.
- **Flavonoids:** Possess antioxidant properties and help protect against oxidative stress, supporting overall metabolic health.
- **Saponins:** Contribute to cholesterol reduction and improved blood circulation.
- **Tannins:** Aid in improving blood health and regulating glucose levels.
- **Vitamins and Minerals:** Including iron, magnesium, and vitamin C, which are essential for blood formation and overall health.
- **Dietary Fiber:** Important for controlling blood sugar levels and supporting digestive health.

These compounds make Methi leaves a powerful agent for managing diabetes and improving overall health.

### Antimicrobial Activity

Methi leaves demonstrate strong antimicrobial properties, thanks to their content of alkaloids, saponins, and flavonoids. Studies have shown its effectiveness against a variety of bacterial strains, such as *Staphylococcus aureus* and *Escherichia coli*, and fungal pathogens. These antimicrobial properties help in maintaining oral health and preventing infections, particularly useful in managing diabetes-related complications, such as infections and oral health problems like halitosis.

### Antioxidant Activity

The antioxidant capacity of Methi leaves is primarily due to the flavonoids and polyphenolic compounds. These compounds scavenge free radicals, reducing oxidative stress, which is a key factor in the development of diabetes-related complications such as neuropathy and retinopathy. By reducing oxidative damage, Methi supports pancreatic health and enhances insulin secretion.

### Mechanism of Action

Methi leaves help in managing diabetes through the following mechanisms:

- **Blood Glucose Regulation:** Methi leaves help in lowering blood glucose levels by improving insulin sensitivity and supporting better glucose metabolism.
- **Blood Formation:** Rich in iron and other essential nutrients, Methi helps in the formation of red blood cells, thus improving blood health and addressing anemia.
- **Cures Halitosis:** Methi leaves have been traditionally used to cure halitosis (bad breath) due to their antimicrobial and anti-inflammatory properties, promoting better oral hygiene and fresh breath.
- **Cholesterol Control:** Methi helps in lowering LDL cholesterol and triglyceride levels, promoting cardiovascular health.
- **Anti-inflammatory Action:** The anti-inflammatory effects of Methi help reduce systemic inflammation, which plays a role in the development of insulin resistance.

These mechanisms demonstrate Methi leaves' potential as a natural remedy for diabetes, blood health, and oral hygiene.

## Result

Product name		Methi leaves		
Source		<i>Trigonella foenum-graecum</i>		
Parts used		Leaves		
Appearance		Green, dried leaves		
Moisture Content		≤ 10%		
Ash Content		≤ 8%		
Ph		6.0-7.5		
Odour		Characteristic herbaceous odour		
Solubility		Soluble in water,		
Physio	Specification	Batch	Batch	Batch
Specific Gravity @20°C(g/ml)	0.850-0.900	0.873	0.880	0.868
Optical Rotation 20°C(Degrees)	+30 to +45	+35	+38	+36

)				
Refractive index @ 20°C	1.450-1.460	1.455	1.457	1.453
<b>Microbial test</b>	<b>Specification</b>	<b>Batch</b>	<b>Batch</b>	<b>Batch</b>
Aerobic	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life	24 Month			

## Taxonomy

### Taxonomy of Black Jamun (*Synzygium Cuim*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Eudicots
- Order: Myrtales
- Family: Myrtaceae
- Genus: Syzygium

Black Jamun is an evergreen tropical tree native to the Indian subcontinent and is widely cultivated in tropical and subtropical regions.

### Physio-Chemical Composition

Black Jamun is rich in bioactive compounds, including:

- **Anthocyanins:** Responsible for its deep purple color and antioxidant properties.
- **Flavonoids:** Contribute to its anti-inflammatory and anti-diabetic effects.
- **Tannins:** Provide antimicrobial and astringent properties.
- **Ellagic Acid and Gallic Acid:** Exhibit strong antioxidant potential.
- **Alkaloids:** Play a role in reducing blood sugar levels. These compounds contribute to its therapeutic effects, making it beneficial for diabetes management.

### Antimicrobial Activity

Black Jamun exhibits significant antimicrobial properties due to the presence of tannins and flavonoids. Studies have demonstrated its effectiveness against bacterial strains such as *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. These antimicrobial properties make it a potential natural remedy for controlling infections and improving gut health.

### Antioxidant Activity

The fruit and seeds of Black Jamun contain high levels of antioxidants that help in reducing oxidative stress, which is a contributing factor to diabetes complications. The presence of polyphenols and anthocyanins enhances free radical scavenging activity, protecting pancreatic  $\beta$ -cells from

oxidative damage. This antioxidant potential plays a crucial role in preventing cellular damage and promoting overall health.

### Mechanism of Action

Black Jamun aids in diabetes management through multiple mechanisms:

- **Enhances Insulin Secretion:** Stimulates pancreatic  $\beta$ -cells to produce more insulin.
- **Reduces Glucose Absorption:** Inhibits carbohydrate-digesting enzymes, slowing down glucose release into the bloodstream.
- **Improves Glucose Uptake:** Enhances cellular glucose uptake, promoting better glycemic control.
- **Protects Against Oxidative Stress:** Reduces inflammation and prevents cellular damage in diabetic patients.
- **Controls Blood Sugar Levels:** Helps in maintaining blood sugar within a healthy range, preventing sudden spikes.
- **Reduces Glucose in Blood and Urine:** Aids in lowering excess glucose levels, reducing the risk of glycosuria. These mechanisms contribute to its effectiveness as a natural antidiabetic agent.

## Result

Product name	Black Jamun			
Source	<i>Synzygium cuimi</i>			
Parts used	Seeds,Fruits			
Appearance	Dark purple to black fruit,powdered seed			
Moisture Content	$\leq 10\%$			
Ash Content	$\leq 7\%$			
Ph	4.5 - 6.5			
Odour	Characteristic fruity aroma			
Solubility	Soluble in water, partially soluble in alcohol			
Physio	Specification	Batch	Batch	Batch
Specific Gravity @ 20°C(g/ml)	0.900-1.100	0.980	1.010	1.010
Optical Rotation 20°C(Degrees )	-10 to +10	-5	-3	-4
Refractive index @ 20°C	1.350-1.400	1.365	1.372	1.368

Microbial test	Specification	Batch No: CBTFG001	Batch No: CBTFG002	Batch No: CBTFG003
Aerobic	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

### Taxonomy of Cumin (*Cuminum cyminum*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Eudicots
- Order: Apiales,
- Family: Apiaceae,
- Genus: *Cuminum*.

It is native to the Mediterranean region and India and is cultivated globally for its seeds, which are widely used in culinary and medicinal applications.

### Physio-Chemical Composition

Cumin contains a variety of bioactive compounds beneficial for diabetes management:

- **Cuminaldehyde:** Exhibits hypoglycemic properties and regulates blood sugar levels.
- **Flavonoids:** Possess antioxidant and anti-inflammatory properties.
- **Terpenes and Polyphenols:** Contribute to antimicrobial and free radical- scavenging activities.
- **Alkaloids:** Help regulate insulin function and glucose metabolism.
- **Essential Oils (Thymol, Carvacrol, and Limonene):** Enhance digestion and metabolic processes.

These compounds contribute to cumin's medicinal potential, making it a valuable natural remedy for diabetes management.

### Antimicrobial Activity

Cumin has significant antimicrobial properties due to the presence of bioactive essential oils and flavonoids. Studies have shown its effectiveness against pathogenic bacteria, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. This antimicrobial effect supports gut health, which plays a crucial role in metabolic regulation and diabetes control.

### Antioxidant Activity

Cumin exhibits strong antioxidant properties, primarily due to the presence of flavonoids and polyphenols. These compounds help reduce oxidative stress, which is a major contributor to diabetes complications. By scavenging free radicals, cumin protects pancreatic  $\beta$ -cells from oxidative damage, improving overall glycemic control.

### Mechanism of Action

Cumin contributes to diabetes management through various mechanisms:

- **Enhances Insulin Secretion:** Stimulates pancreatic  $\beta$ -cells for increased insulin production.
- **Improves Insulin Sensitivity:** Helps cells utilize glucose more efficiently.
- **Reduces Blood Sugar Levels:** Inhibits key enzymes responsible for carbohydrate digestion.
- **Protects Against Oxidative Stress:** Lowers inflammation and cellular damage in diabetic patients.
- **Regulates Lipid Metabolism:** Reduces cholesterol levels, which are often elevated in diabetes.
- **Lowers Glucose in Blood and Urine:** Aids in controlling hyperglycemia and glycosuria.

These mechanisms highlight cumin's potential as a natural alternative for diabetes treatment.

### Result

Product name		Cumin		
Source		<i>Cuminum cyminum</i>		
Parts used		Seeds		
Appearance		Brownish- green dried seeds		
Moisture Content		$\leq 10\%$		
Ash Content		$\leq 8\%$		
Ph		6.0 - 7.5		
Odour		Characteristic spicy aroma		
Solubility		Soluble in alcohol and oil, partially soluble in water		
Physio	Specification	Batch	Batch	Batch
Specific Gravity @20°C(g/ml)	0.850-0.950	0.890	0.910	0.932
Optical Rotation 20°C(Degrees)	+10 to +30	+18	+20	+22



Refractive index @ 20°C	1.460-1.480	1.465	1.470	1.468
Microbial test	Specification	Batch	Batch	Batch
Aerobic	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life	24 Month			

### Taxonomy of Garlic (*Allium sativum*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Monocots
- Order: Asparagales
- Family: Amaryllidaceae
- Genus: *Allium*.

It is native to Central Asia and has been cultivated worldwide for both culinary and medicinal applications.

### Physio-Chemical Composition

Garlic contains a variety of bioactive compounds beneficial for diabetes management:

- **Allicin:** A sulfur-containing compound known for its hypoglycemic properties.
- **Flavonoids:** Provide antioxidant and anti-inflammatory benefits.
- **S-allyl cysteine & S-allyl mercaptocysteine:** Improve insulin sensitivity and protect pancreatic cells.
- **Polysaccharides:** Aid in blood sugar regulation.
- **Essential Oils (Diallyl Disulfide & Diallyl Trisulfide):** Contribute to its antimicrobial and metabolic-enhancing properties.

These compounds play a crucial role in its medicinal applications, making garlic a valuable natural agent for diabetes control.

### Antimicrobial Activity

Garlic has strong antimicrobial properties due to its sulfur compounds and essential oils. Studies have shown its effectiveness against bacterial strains such as *Staphylococcus aureus*, *Escherichia coli*, and *Helicobacter pylori*. Its antimicrobial potential contributes to improved gut health, which is essential for maintaining metabolic balance in diabetic patients.

### Antioxidant Activity

Garlic is a potent antioxidant due to the presence of organosulfur compounds and flavonoids. These compounds neutralize free radicals, reducing oxidative stress—a major contributor to diabetes complications. Garlic protects pancreatic  $\beta$ -cells from oxidative damage, thereby enhancing overall insulin function.

### Mechanism of Action

Garlic contributes to diabetes management through various mechanisms:

- **Enhances Insulin Secretion:** Stimulates pancreatic  $\beta$ -cells for increased insulin production.
- **Improves Insulin Sensitivity:** Helps cells utilize glucose more efficiently.
- **Reduces Blood Sugar Levels:** Lowers fasting glucose levels and postprandial blood sugar spikes.
- **Protects Against Oxidative Stress:** Reduces inflammation and prevents cellular damage.
- **Regulates Lipid Metabolism:** Reduces cholesterol and triglyceride levels, which are often elevated in diabetes.
- **Lowers Glucose in Blood and Urine:** Aids in controlling hyperglycemia and glycosuria.

These mechanisms highlight garlic's effectiveness as a natural alternative for diabetes treatment.

### Result

Product name	Garlic			
Source	<i>Allium sativum</i>			
Parts used	Bulb			
Appearance	White dried or powdered bulb			
Moisture Content	$\leq 10\%$			
Ash Content	$\leq 6\%$			
Ph	5.5 – 7.0			
Odour	Pungent, Characteristic garlic smell			
Solubility	Soluble in water and oil			
Physio	Specification	Batch	Batch	Batch
Specific Gravity @ 20°C(g/ml)	0.950-1.050	1.010	1.020	1.015
Optical Rotation	-5 to +5	-2	0	+1
Refractive index @ 20°C	1.375-1.400	1.380	1.385	1.382

Microbial test	Specification	Batch	Batch	Batch
Aerobic	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life	24 Month			

### Taxonomy of Betel Leaf (*Piper betle*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Magnoliids
- Order: Piperales
- Family: Piperaceae
- Genus: *Piper*

Native to Southeast Asia, it is widely cultivated for its medicinal and cultural significance.

### Physio-Chemical Composition

Betel leaf contains a variety of bioactive compounds beneficial for diabetes management:

- **Eugenol:** Exhibits anti-diabetic properties by reducing blood glucose levels.
- **Polyphenols:** Possess strong antioxidant properties, reducing oxidative stress.
- **Flavonoids:** Provide anti-inflammatory benefits and support insulin function.
- **Tannins:** Help regulate carbohydrate metabolism and glucose absorption.
- **Alkaloids:** Contribute to antimicrobial and free radical-scavenging activities.

These compounds play a crucial role in the medicinal applications of betel leaf, making it a valuable natural agent for diabetes control.

### Antimicrobial Activity

Betel leaf exhibits strong antimicrobial properties due to the presence of bioactive essential oils, tannins, and polyphenols. Studies have shown its effectiveness against bacterial and fungal strains such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. These antimicrobial properties contribute to improved gut health, which plays a key role in diabetes management.

### Antioxidant Activity

Betel leaf is a potent antioxidant, primarily due to the presence of flavonoids and polyphenols. These compounds help reduce oxidative stress, a major contributor to diabetes-

related complications. By scavenging free radicals, betel leaf protects pancreatic  $\beta$ -cells from oxidative damage, thereby improving insulin secretion and glucose metabolism.

### Mechanism of Action

Betel leaf contributes to diabetes management through various mechanisms:

- **Lowers Blood Glucose Levels:** Reduces fasting and postprandial blood sugar levels.
- **Enhances Insulin Sensitivity:** Helps cells utilize glucose more efficiently.
- **Protects Against Oxidative Stress:** Reduces inflammation and prevents cellular damage.
- **Inhibits Alpha-Glucosidase Enzyme:** Slows carbohydrate digestion, preventing glucose spikes.
- **Regulates Lipid Metabolism:** Helps in lowering cholesterol levels.
- **Prevents Free Radical Damage:** Protects vital organs from diabetes-induced complications.

These mechanisms highlight betel leaf's effectiveness as a natural alternative for diabetes treatment.

### Result

Product name	Betel leaf			
Source	<i>Piper betle</i>			
Parts used	Leaves			
Appearance	Dark green, glossy leaves			
Moisture Content	$\leq 12\%$			
Ash Content	$\leq 5\%$			
Ph	6.0-7.0			
Odour	Characteristic pungent aroma			
Solubility	Soluble in water and alcohol			
Physio	Specification	Batch	Batch	Batch
Specific Gravity @ 20°C(g/ml)	0.850-0.900	0.873	0.880	0.868
Optical Rotation 20°C(Degrees)	+30 to +45	+35	+38	+36
Refractive index @ 20°C	1.450-1.460	1.455	1.457	1.453
Microbial test	Specification	Batch	Batch	Batch
Aerobic	<10000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml

Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life	24 Month			

### Taxonomy of Vilva (*Aegle marmelos*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Dicotyledons
- Order: Sapindales
- Family: Rutaceae
- Genus: *Aegle*.

It is primarily found in India, Sri Lanka, and Southeast Asia. Bael has been traditionally used in Ayurvedic and folk medicine due to its multiple medicinal properties.

### Physio-Chemical Composition

Bael is rich in several bioactive compounds beneficial for managing diabetes and related complications:

- **Alkaloids:** Contribute to its anti-diabetic properties and help control blood sugar.
- **Flavonoids:** Possess potent antioxidant properties, helping protect against oxidative stress.
- **Coumarins:** Contribute to its anti-inflammatory and antimicrobial activities.
- **Tannins:** Play a role in controlling cholesterol and improving digestion.
- **Vitamins and Minerals:** Including Vitamin C and calcium, which support overall health.
- **Fibers:** Essential for regulating bowel movements and promoting digestive health.

These compounds make Bael an effective herbal remedy for various conditions, including diabetes, digestive disorders, and high cholesterol.

### Antimicrobial Activity

Bael exhibits strong antimicrobial properties, attributed to the presence of alkaloids, flavonoids, and coumarins. Studies show it is effective against a variety of bacterial and fungal pathogens such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. These properties contribute to Bael's role in maintaining a healthy gut microbiota, which plays an important role in managing diabetes and enhancing overall well-being.

### Antioxidant Activity

Bael's antioxidant capacity is primarily due to its flavonoids and polyphenols. These compounds help scavenge free radicals, thus reducing oxidative stress—one of the primary factors contributing to diabetic complications. By protecting

pancreatic  $\beta$ -cells from oxidative damage, Bael improves insulin secretion and glucose metabolism.

### Mechanism of Action

Bael supports diabetes management through the following mechanisms:

- **Regulation of Blood Glucose Levels:** Bael enhances insulin sensitivity, thereby lowering blood glucose levels and preventing postprandial spikes.
- **Cholesterol Control:** The presence of tannins and other bioactive compounds helps in lowering LDL cholesterol levels and improving lipid profiles.
- **Laxative Effects:** Bael acts as a mild laxative, which aids in regulating bowel movements and improving digestion, thus supporting overall health.
- **Anti-inflammatory Properties:** Bael reduces inflammation, which plays a significant role in managing diabetes and preventing complications such as neuropathy.
- **Free Radical Scavenging:** Its antioxidant activity protects organs from damage caused by free radicals, thus mitigating long-term complications of diabetes, such as heart disease.

These combined actions highlight Bael's potential as a multi-faceted agent for managing diabetes and improving overall metabolic health.

### Result

Product name	Vilva			
Source	<i>Aegle marmelos</i>			
Parts used	Fruit, Leaves			
Appearance	Green fruit, dried or powdered leaves			
Moisture Content	$\leq 10\%$			
Ash Content	$\leq 6\%$			
Ph	5.5 - 7.0			
Odour	Characteristic herbal aroma			
Solubility	Soluble in water, partially soluble in alcohol			
Physio	Specification	Batch	Batch	Batch
Specific Gravity @ 20°C (g/ml)	0.900-0.1.080	0.950	0.970	0.960
Optical Rotation	-5 to +5	-3	-2	-1
Refractive index @ 20°C	1.360-1.400	1.365	1.372	1.368
Microbial test	Specification	Batch	Batch	Batch



Aerobic	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life	24 Month			

## Taxonomy of Ashwagandha (*Withania somnifera*)

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Dicotyledons
- Order: Solanales
- Family: Solanaceae
- Genus: *Withania*.

It is widely cultivated in India, the Middle East, and parts of Africa. Known for its wide range of medicinal properties, Ashwagandha is a staple in Ayurvedic medicine.

## Physio-Chemical Composition

Ashwagandha contains a variety of bioactive compounds that contribute to its medicinal properties:

- **Withanolides:** Steroidal lactones that have anti-inflammatory, anti-cancer, and anti-diabetic properties.
- **Alkaloids:** Help in reducing stress and improving metabolic health.
- **Flavonoids:** Possess potent antioxidant properties and help improve insulin sensitivity.
- **Saponins:** Contribute to its anti-inflammatory and cholesterol-lowering effects.
- **Vitamins and Minerals:** Including iron, calcium, and vitamin C, which support overall health and wellness.

These bioactive compounds make Ashwagandha a powerful natural remedy for managing diabetes and related health conditions.

## Antimicrobial Activity

Ashwagandha exhibits broad-spectrum antimicrobial properties due to the presence of withanolides and other bioactive compounds. Studies have shown its effectiveness against various bacterial and fungal strains, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. Its antimicrobial properties support gut health, which is essential for regulating blood sugar and overall metabolic function.

## Antioxidant Activity

Ashwagandha is a potent antioxidant, primarily due to its withanolides and flavonoids. These compounds scavenge free radicals, which can contribute to cellular damage and

exacerbate diabetic complications. By reducing oxidative stress, Ashwagandha helps protect pancreatic  $\beta$ -cells, improving insulin secretion and glucose metabolism.

## Mechanism of Action

Ashwagandha helps in diabetes management through several mechanisms:

- **Blood Glucose Regulation:** It enhances insulin sensitivity, lowers blood glucose levels, and helps in the proper utilization of glucose by cells.
- **Improved Insulin Sensitivity:** Ashwagandha increases the number of insulin receptors on cells, making them more responsive to insulin.
- **Anti-inflammatory Effects:** Withanolides help reduce inflammation, which plays a significant role in insulin resistance and diabetes complications.
- **Antioxidant Action:** The antioxidants in Ashwagandha protect the pancreas from oxidative stress, improving insulin secretion and reducing the risk of complications like diabetic nephropathy and retinopathy.
- **Stress Reduction:** As an adaptogen, Ashwagandha reduces cortisol levels, helping regulate blood sugar levels and improve overall metabolic health.
- **Cholesterol Control:** It helps in reducing LDL cholesterol and triglyceride levels, supporting cardiovascular health, which is often compromised in diabetic patients.

These mechanisms make Ashwagandha a valuable addition to natural therapies for diabetes.

## Result

Product name	Ashwagandha			
Source	<i>Withania somnifera</i>			
Parts used	Roots, Leaves			
Appearance	Brownish powder(root),green leaves			
Moisture Content	≤ 8%			
Ash Content	≤ 6%			
Ph	5.5- 7.0			
Odour	Characteristic earthy aroma			
Solubility	Soluble in water and alcohol			
Physio	Specification	Batch	Batch	Batch
Specific Gravity @20°C(g/ml)	0.900-1.050	0.920	0.940	0.930
Optical Rotation	-5 to +5	-2	-1	0
Refractive index @ 20°C	1.360-1.365	1.365	1.370	1.368

Microbial test	Specification	Batch	Batch	Batch
Aerobic	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life		24 Month		

## METHODOLOGY

### 1. Preactivated Vedic Methodology for Extraction

The formulation of the diabetic care drink involves the Preactivated Vedic Methodology, an advanced extraction technique that enhances bioactive compound availability while eliminating potential contaminants such as pesticides and microbial agents. This method ensures the retention of therapeutic properties in the seven key herbal ingredients: Methi Leaves (*Trigonella foenum-graecum*), Black Jamun (*Syzygium cuimi*), Cumin (*Cuminum cyminum*), Garlic (*Allium sativum*), Betel Leaves (*Piper betle*), Vilva (*Aegle marmelos*), and Ashwagandha (*Withania somnifera*).

### 2. Selection and Sourcing of Raw Materials

The ingredients were carefully selected based on their organic nature, ensuring they are free from chemical additives and synthetic preservatives. The plant parts used include:

- Methi Leaves – Fresh leaves
- Black Jamun – Seeds and pulp
- Cumin – Seeds
- Garlic – Bulbs
- Betel Leaves – Fresh leaves
- Vilva – Leaves and fruit pulp
- Ashwagandha – Roots

All materials were procured from certified organic farms to maintain authenticity and potency.

### 3. Preliminary Treatment and Cleaning

Each raw material underwent a rigorous cleaning process using deionized water to remove surface impurities. To eliminate potential microbial and pesticide residues, the ingredients were subjected to a controlled thermal activation process under Preactivated Vedic Methodology, ensuring minimal loss of bioactive compounds.

### 4. Preactivated Extraction Process

The Preactivated Vedic Methodology follows a unique extraction sequence to activate bioactive components effectively:

- Thermal Pre-Activation: The cleaned ingredients

were exposed to a controlled heat treatment (below 70°C) to enhance the bioavailability of active compounds while preserving antioxidant activity.

- Hydrothermal Extraction: Ingredients were subjected to steam-based extraction to break down fibrous material and release essential phytochemicals.
- Cold Maceration: Aqueous and hydroalcoholic extractions were performed at a sub-ambient temperature to preserve thermolabile constituents.
- Enzymatic Activation: Specific natural enzymatic treatments were used to enhance the breakdown of complex bioactive molecules into bioavailable forms.

### 5. Filtration and Concentration

Following extraction, the obtained solution was filtered using a multi-stage membrane filtration system to remove residual plant fibers and non-essential compounds. The filtrate was then concentrated using a low-temperature vacuum evaporation process to prevent degradation of heat-sensitive bioactives.

### 6. Formulation and Blending

The concentrated extracts of all seven components were blended in specific proportions to achieve an optimized formulation targeting diabetic care. The mixture was stabilized with natural bio-enhancers.

### 7. Standardization and Quality Control

The final formulation underwent standardization by evaluating key phytochemical markers, pH balance, and microbial contamination tests. High- Performance Liquid Chromatography (HPLC) and Gas Chromatography-Mass Spectrometry (GC-MS) were used to assess the presence and concentration of active compounds like flavonoids, alkaloids, tannins, and saponins.

### 8. Packaging and Storage

The diabetic care drink was then packed in sterilized, amber-colored glass bottles to prevent photodegradation of sensitive compounds. The storage conditions were maintained at 4°C to ensure stability over time without the need for synthetic preservatives.

The Preactivated Vedic Methodology effectively enhances the therapeutic potential of herbal ingredients while ensuring safety and purity. The developed diabetic care drink maintains high bioavailability of active compounds, offering a natural and potent solution for diabetes management.

## TEST AND RESULT

The physical analysis of the Diabetic care drink has shown the following properties:

Product name	Diabetic care drink
Source	Methi leaves, Black jamun, Cumin, Garlic, Betal leaf, Vilva, Ashwagandha
Parts used	Leaves, Seeds, Fruits

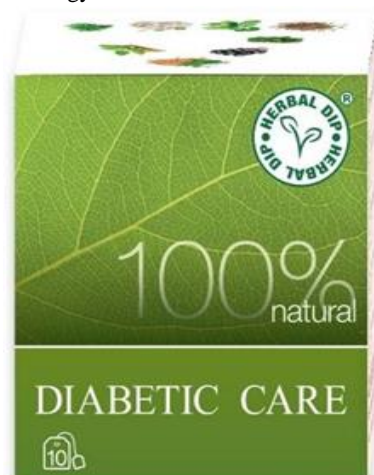
Appearance	Brownish green fine powder			
Moisture Content	≤ 8%			
Ash Content	≤ 6%			
Ph	5.5 - 7.5			
Odour	Characteristic herbal and earthy aroma			
Solubility	Soluble in water, partially soluble in alcohol			
<b>Physio properties</b>	<b>Specification</b>	<b>Batch</b>	<b>Batch</b>	<b>Batch</b>
Specific Gravity @20°C(g/ml)	0.900-1.100	0.970	1.010	1.000
Optical Rotation @ 20°C(Degrees)	-10 to +10	-4	-2	-3
Refractive index @ 20°C	1.350-1.400	1.365	1.372	1.368
Microbial test	Specification	Batch	Batch	Batch
		No: CBTFG001	No: CBTFG002	No: CBTFG003
Aerobic total plate count	<100000CFU/ml	<100CFU/ml	<100CFU/ml	<100CFU/ml
Yeast and mold	<1000CFU/ml	<10CFU/ml	<10CFU/ml	<10CFU/ml
E. coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Staphylococcus sp	Negative	Negative	Negative	Negative
Shelf life	24 Month			

#### Herbal Dip Composition With Medical Benefits

S.no	herapeutic Usage	Material Description	Botanical Name	Medical Benefits
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1	Diabetic	Methi leaf	<i>Trigonella foenum-gracum</i>	Cures diabetes, Blood formation, Cures halitosis.
		Black Jamun	<i>Synzygium cuimi</i>	Blood sugar control under level, downs blood and urine, Increases insulin
		Cumin	<i>Cuminum cyminum</i>	Controls glucose level, antiaging properties
		Garlic	<i>Allvim</i>	Reduce inflammation, Reduce the risk
	Care		sativum	of diabetes Reduce Blood Pressure
		Betal Leaf	Piper betle	Reduce glucose level in blood, Anti-diabetic, antimicrobial, antioxidant, free radicals
		Vilva (bilva, bael)	Aegle Marmelos	Richness in laxatives, anti-diabetic properties, control cholesterol
		Ashwagandha	Withania somnifera	Release more insulin, anti-inflammatory property, reduce triglycerides

This Data represents the properties of the combined formulation of the diabetic care drink using the Preactivated Vedic Methodology.



DIABETIC CARE DRINK

## CONCLUSION

Herbal drinks or teas made from plants such as Methi (*Trigonella foenum-graecum*), Black Jamun (*Syzygium cumini*), Cumin (*Cuminum cyminum*), Garlic (*Allium sativum*), Betel Leaf (*Piper betle*), Vilva (*Aegle marmelos*), and Ashwagandha (*Withania somnifera*) have gained recognition as potential natural remedies for managing diabetes due to their rich bioactive compounds, antioxidant properties, and multifaceted mechanisms of action.

Methi leaves, for example, contain flavonoids, polyphenols, and dietary fibers, which play a key role in regulating glucose levels, enhancing insulin sensitivity, and providing antioxidant and antimicrobial benefits. These properties not only help in blood glucose management but also prevent infections associated with

diabetes, offering a dual benefit. Similarly, Black Jamun is rich in anthocyanins, tannins, and flavonoids, enhancing insulin secretion, glucose absorption regulation, and offering protection against oxidative damage. Its antimicrobial properties further aid in the prevention of infections, which is particularly beneficial for diabetic individuals.

Cumin offers similar benefits through its ability to enhance insulin secretion and regulate blood sugar levels while protecting against oxidative stress. Additionally, its antimicrobial properties contribute to gut health, supporting overall metabolic regulation. Garlic, known for its cardiovascular benefits, also helps improve insulin secretion and glucose metabolism, while protecting the pancreas from oxidative stress and aiding in lipid regulation. Its antimicrobial and antioxidant properties further enhance its therapeutic potential for diabetic care.

Betel leaf, with its active compounds such as eugenol, polyphenols, and flavonoids, improves insulin sensitivity and glucose metabolism while offering antioxidant and antimicrobial protection. Bael, rich in flavonoids, alkaloids, tannins, and coumarins, helps regulate blood glucose levels, improve insulin sensitivity, and support digestive and cholesterol health, making it an effective remedy for diabetes management. Ashwagandha, with its composition of withanolides, alkaloids, flavonoids, and saponins, reduces inflammation, protects against oxidative stress, and enhances insulin sensitivity, making it another powerful tool in diabetes care.

When combined into herbal teas or drinks, these plants provide a synergistic effect, targeting various aspects of diabetes management, including blood glucose regulation, insulin sensitivity, and prevention of complications like infections and cardiovascular issues. The antioxidant and antimicrobial properties of these herbs also provide additional protection for individuals with diabetes.

While the potential of these herbs is evident, further research is needed to standardize formulations and optimize dosages for maximum therapeutic benefit. Clinical trials will be essential in confirming their efficacy, safety, and interactions with conventional diabetes treatments. With scientific

validation, these herbal drinks can serve as effective natural alternatives or adjuncts to standard diabetes therapies, offering a holistic, safe, and natural solution for managing diabetes and enhancing overall metabolic health.

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