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A RESEARCH PAPER ON FORMULATION AND EVALUATION OF AN ANTIDIABETIC NUTRITIOUS FORMULAE CONTAINING COSTUS IGNEUS AND GYMNEMA SYLVESTRE LEAVES FOR EARLY MONTH OF PREGNANCY TIME (GESTATIONAL PERIODS)

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ABSTRACT

Diabetes is a serious worldwide health issue. Because they have fewer adverse effects, herbal formulations are recommended for the management of diabetes. Gymnema sylvestre and Costus igneus are possible natural substitutes for pharmacological methods of blood sugar management, according to a study conducted in Tamil Nadu, India. The most prevalent pregnancy-related illness at the moment is gestational diabetes mellitus. Obesity, poor glucose metabolism, and cardiovascular disease are among the long-term problems that GDM raises the risk of for both the mother and the child. For more than 50 years, it has been known that pregnancy- hyperglycemia that goes away after delivery occurs. The aim of this study was to formulate a antidiabetic nutritious food from Costus igneus leaves and Gymnema sylvestre leaves for early month of pregnancy time. The rise in plasma glucose levels is slowed in the early stages of a typical pregnancy by increased insulin secretion by the pancreatic beta cells. It was shown that the combination of the enhanced insulin tolerance during pregnancy and the insufficiency of pancreatic beta cells leads to hyperclycemia. Costus igneus Nak commonly known as Spiral flag, is a member of Costaceae and a newly introduced plant in India from South and Central America. It is a perennial, upright, spreading plant reaching about two feet tall, with spirally arranged leaves and attractive flowers. In southern India, it usually grows as an ornamental plant and its leaves are used as a dietary supplement in the treatment of diabetes mellitus. Gymnama Sylvester is a herb distributed throughout the world, The leaves of the plant are widely used for treatment of diabetes and as a diuretic in Indian proprietary medicines. Gymnemic acid is the main active chemical constituent isolated for the Gymnema Sylvestre plant.

KEYWORDS : *Gestational Diabetes Mellitus, Costus Igneus, Gymnema Sylvestre*

INTRODUCTION

Gestational diabetes mellitus (GDM) :-

Increased release of diabetogenic chemicals from the placenta and insufficient pancreatic response to insulin resistance are hallmarks of gestational diabetes mellitus (GDM). Currently, the most prevalent pregnancy-related medical problem is gestational diabetes mellitus (GDM), which is characterized as a state of hyperglycemia initially identified during pregnancy. Pregnancy termination by cesarean section, pre-eclampsia, and gestational hypertension are all risks for mothers with GDM. Furthermore, type 2 diabetes develops in both mothers and babies as a result of GDM's increased risk of comorbidities such as cardiovascular disease, obesity, and impaired carbohydrate metabolism.[5] The term the stationary diabetes mellitus reverse to any dysglycaemia that develops or is identified for the first time during pregnancy. Maintaining glycemic control during pregnancy greatly reduces the frequency of adverse outcomes. Increased insulin resistant is observed during the second and third trimesters. GDM is characterized by an increased supply of nutrients to the foetus, resulting in excessive growth. First, GDM raises the risk of pregnancy issues for the fetus (particularly those associated with excessive fetal development and obesity) and the mother (particularly hypertensive disorders of pregnancy). Furthermore, a diagnosis of GDM identifies a subset of mothers and their children who are more likely to develop diabetes, obesity, and early cardiovascular disease in the future.[4]

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Pathophysiology of GDM

Women who develop gestational diabetes mellitus (GDM) during pregnancy often have underlying health issues even before conceiving, such as issues with the pancreas's β-cells and heightened insulin resistance. In wealthier countries, many women who experience GDM tend to be overweight or obese, which is linked to increased inflammation in the body. During pregnancy, the body undergoes changes that affect how it processes sugar. Pregnancy hormones increase the body's demand for insulin, but at the same time, insulin becomes less effective. This makes it harder for the body to manage sugar levels, leading to high blood sugar, called hyperglycemia. When a mother has high blood sugar, more sugar and nutrients like amino acids pass to the baby through the placenta. This causes the baby to produce too much insulin, a condition known as fetal hyperinsulinemia. This overproduction of insulin in the baby can lead to rapid growth or excess fat accumulation. Over time, the child may develop metabolic issues later in life because of these changes. It's important to know that T2DM refers to type 2 diabetes mellitus, and TNF refers to tumor necrosis factor.[4]

Fig no: 1

Risk factor for GDM

- Advanced age
- Obesity (BMI ≥ 25kgm-2)
- Male fetus
- Genetic factor
- Cigarette smoking
- Multiple pregnancy
- Family history of type 2 diabetes mellitus
- Physical inactive lifestyle before and during pregnancy
- **Epidemiology**

Prevalence

Globally, the reported prevalence of GDM varies greatly, ranging from 1% to over 30%. Comparing the prevalence of GDM across nations and regions is difficult due to a lack of agreement and consistency in screening guidelines and diagnostic standards. With a median of 15.2% (interquartile range 8.8–20.0%), the Middle East and a few North African nations have the highest prevalence of GDM. South-East Asia comes in second with a median of 15.0% (range 9.6–18.3%), followed by the Western Pacific with a median of 10.3% (range 4.5–20.3%), South and Central America with a median of 11.2% (range 7.1–16.6%), sub-Saharan Africa with a median of 10.8% (range 8.5–13.1%), North America and the Caribbean with a median of 7.0% (range 6.5–11.9%). Europe has the lowest prevalence of GDM and the greatest variation in prevalence, with a median of 6.1% and a range of 1.8–31.0 percent.[4]

Role of Hormones in gestational diabetes mellitus (GDM)

When a woman is pregnant, the organ called the placenta creates hormones that enter her bloodstream. These hormones play an important role in maintaining the pregnancy and supporting the baby's growth. The hPGH can cause insulin levels to increase. This might reduce how much glucose the body absorbs and how much glycogen it produces. It might also weaken insulin's ability to prevent the liver from producing glucose. Its effects on human pregnancy remain uncertain. A day or two after giving birth, mothers who have type 1 diabetes often find that their insulin needs return to what they were before pregnancy, or even slightly less. This change happens because the body no longer supports the pregnancy, which affects blood sugar levels and insulin. Understanding this adjustment is important so that mothers can manage their diabetes effectively postpartum.[3]

Costus igneus

Costus igneus commonly known as spiral flag, is a member of Costaceae. It has been proven to possess various pharmacological activities like hypolidemic, diuretic, antioxidant, anti-microbial, anti-cancerous.Studies also find it contains useful substance like carbs and proteins, along with other important compounds like triterpenoids, alkaloids, tannins, saponins, flavonoids and

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steroids. Furthermore, it has small but significant amount of trace minerals.[1] The family Costaceae consist of four genera and approximately 200 species. This plant is rich in caffeic acid, chlorogenic acid, flavonoids, phenolic compound and sesquiterpenes lactone and has antihyperglycemic and antioxidant effects.

Taxonomy

Botanical name – Costus igneus
Kingdom – Plantae
SabKingdom – Viridaeplantae
Phylum – Tracheophyta
Sabphylum – Euphyllophytina
Class - Liliopsida
Sabclass – Commelinidae
Order – Zingiberales
Family – Costaceae
Genus – Costus

Fig. 2 :Costus igneus

Sources

The Insulin plant, known scientifically as Costus igneus, originates from South and Central America. This plant was recently brought to India from America to help treat diabetes, which is why it's often referred to as the 'insulin plant.' In South India, people grow it in gardens mainly for its beauty. Many people use it to help manage diabetes by eating a leaf each day, as this is believed to lower blood sugar levels. In Tamil Nadu, the tribal communities of the Kolli hills have traditionally used Costus igneus leaves for diabetes management. The Costaceae plant family includes four groups and around 200 types of plants. Within this family, the Costus group is the largest, with about 150 species that mostly thrive in tropical climates.[6]

Phyconstituents

Phytochemical testing was done on plants from the Kannada district in Karnataka, South India. This testing used different non-water-based solvents to find out what chemicals are in different parts of these plants:[6]

A. Leaves : The methanolic extract from Costus igneus leaves contains a lot of chemicals called secondary metabolites. These chemicals include steroids, phenols, triterpenoids, alkaloids, tannins, flavonoids, glycosides, saponins, carbohydrates, and proteins. This extract has more of these chemicals than other solvent extracts. When we checked the antioxidant properties of these leaves, we found that they are rich in protein and iron. They also have other important components like ascorbic acid (Vitamin C), α tocopherol (Vitamin E), β carotene, terpenoids, steroids, flavonoids, and diosgenin.
B. Stem : The analysis found a terpenoid compound known as lupeol and a steroid compound called stigmasterol.
C. Rhizome : Quercetin and diosgenin. Diosgenin is a kind of steroidal sapogenin.
D. Root : Terpenoid, alkaloids, tannins, etc.

Gymnema Sylvestre

Gymnema Sylvestre is a valuable herb belonging to the family Asclepiadaceae and widely distributed in India, Malaysia, Srilanka, Australia, Indonesia, Japan, Vietnam, tropical Africa and the South Western region of the People's Republic of China. The world "Gymnema" is derived from a Hindu word "Gurmar" meaning "Destroyer of sugar". It is believed to be used in dyspepsia, constipation, jaundice, haemorrhoids, cardiopathy, asthma, bronchitis and leucoderma. Pharmacological activities of this plant such as antidiabetic, antiobesity, hypolidemic, antimicrobial.[2]

Taxonomy of Gymnema sylvestre

Kingdom – plantae
Subkingdom – Tracheobionta
Superdivision – Spermatophyta
Division – Magnoliophyta
Class – Magnoliopsida
Subclass – Asteridae
Order – Gentianales
Family – Asclepiadaceae
Genus – Gymnema
Species – sylvestre

Fig. 3: Gymnema sylvestre

Source

The plant grows in warm regions and can be found in central and southern parts of India, southern China, tropical Africa, Malaysia, and Sri Lanka. It belongs to a group of plants with species like G. sylvestre, G. montanum, G. yunnanense, and G. inodorum. Gymnema sylvestre, in particular, is from India's tropical forests and is useful in managing both type 1 and type 2 diabetes. Researchers have studied this plant to understand its benefits better, focusing on its chemical components and health effects.

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These studies look at its ability to lower blood sugar and its antioxidant properties, among other health benefits. Experiments are conducted in laboratories and on living organisms to gather more information. Scientists use resources like PubMed, Scopus, Google Scholars, Science Direct, and various scientific journals to gather detailed information about the plant compounds and their positive effects.

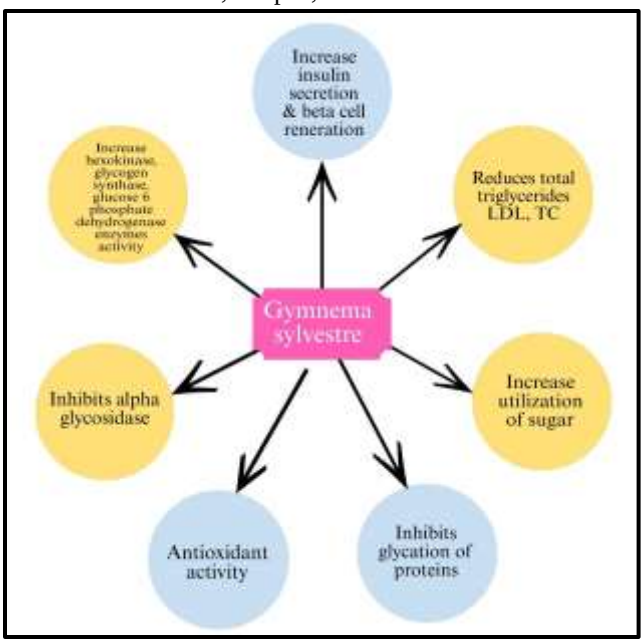

Fig no:4

Phytoconstituents

The water-based extract from the leaves has chemicals called triterpene saponins, which are part of the oleanane and dammarane classifications. The primary chemicals found are gymnemic acids and gymnema saponins, and these belong to the oleanane saponins group. Another key chemical is gymnemasides, which is in the dammarane saponin group. Additionally, the plant contains a variety of substances such as anthraquinone, flavones, hentriacontane, pentatriacontane, phytin, resins, tartaric acid, formic acid, butyric acid, lupeol, and β-amyrin-related glycosides. It also includes stigmasterol, calcium oxalate, and a polypeptide known as gurmarin. The extract contains some alkaloids, too. Most of these active ingredients, also called secondary metabolites, are located in the leaves.

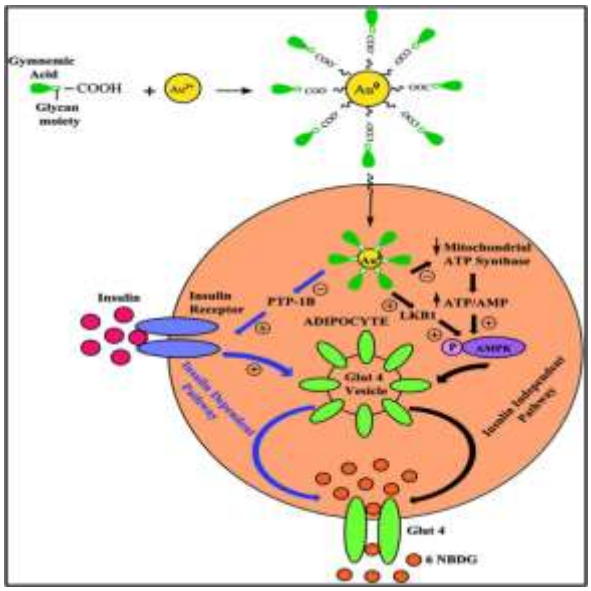

Fig no:5

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• Ingredients and their uses

Sr No	Ingredients	Uses
1	Costus igneus	Known for their anti-diabetic properties, helping regulate blood sugar levels.
2	Gymnema sylvestre	Used to reduce sugar cravings and support healthy blood sugar levels.
3	Ragi flour	Rich in fiber and calcium, supporting digestive health and bone strength.
4	Bajra flour	High in fiber and nutrients, aiding digestion and providing sustained energy
5	Wheat flour	Provides carbohydrates, fiber, and nutrients for energy and digestive health.
6	Udad dal flour	Rich in protein, fiber, and nutrients, supporting digestive health and muscle strength.
7	Brown rice flour	Gluten-free, rich in fiber, and nutrients, supporting digestive health and energy.
8	Ghee	Nourishes digestive system, provides energy, and supports absorption of vitamins.
9	Pink salt	Supports digestive health, provides essential minerals, and regulates fluid balance.
10	Carom seeds	Aids digestion, relieves bloating, and supports respiratory health.
11	Cumin seeds	Supports digestion, boosts immunity, and aids nutrient absorption
12	Fenugreek	Supports blood sugar management, digestive health, and hormonal balance.
13	White sesame	Rich in calcium, vitamin E, and healthy fats, supporting bone and skin health.
14	Black sesame	Rich in antioxidants, calcium, and healthy fats, supporting bone and heart health.
15	Coriander powder	Supports digestion, reduces inflammation, and provides antioxidant benefits.
`16	Aamchur powder	Adds flavor, supports digestion, and provides antioxidant benefits.
17	Red chilli powder	Adds flavor, boosts metabolism, and provides antioxidant benefits

Table no:1: Ingredients and their uses

Procedure

1. First of all for preparation of Antidiabetic nutritious food we take Costus igneus and Gymnema sylvester.
2. Then clean with distilled water and then dried for 2 to 3 days.
3. After sun drying for 2 to 3 days make it in fine powder it using sieve (
4. After that take Wheat flour ,Ragi flour, Basmati rice flour Bajra flour and mixed the all flour finely.
5. Then keep water for boiling then add small amount of ghee, cumin, Costu igneus, Gymnema sylvestre and pinch of pink salt as per need.
6. Now slowly at the all floor in it and by continuously mixture produced bring to boil transparent and then cool it.
7. Then make dough of it then make the shapes of it as per needed.
8. After that baked the snacks in the microwave and heat it till crunchy.

- Procedure for masala / spices
  1. Take one bowl and to it add chilli powder, pink salt, coriander powder, cumin powder, pinch of fenugreek powder, drug, amchur powder then mix it well.
  2. After that take the snacks and the masala sprinkled on it as you want in quantity.
  3. Then filled it in packet and label it and stored in dry place.

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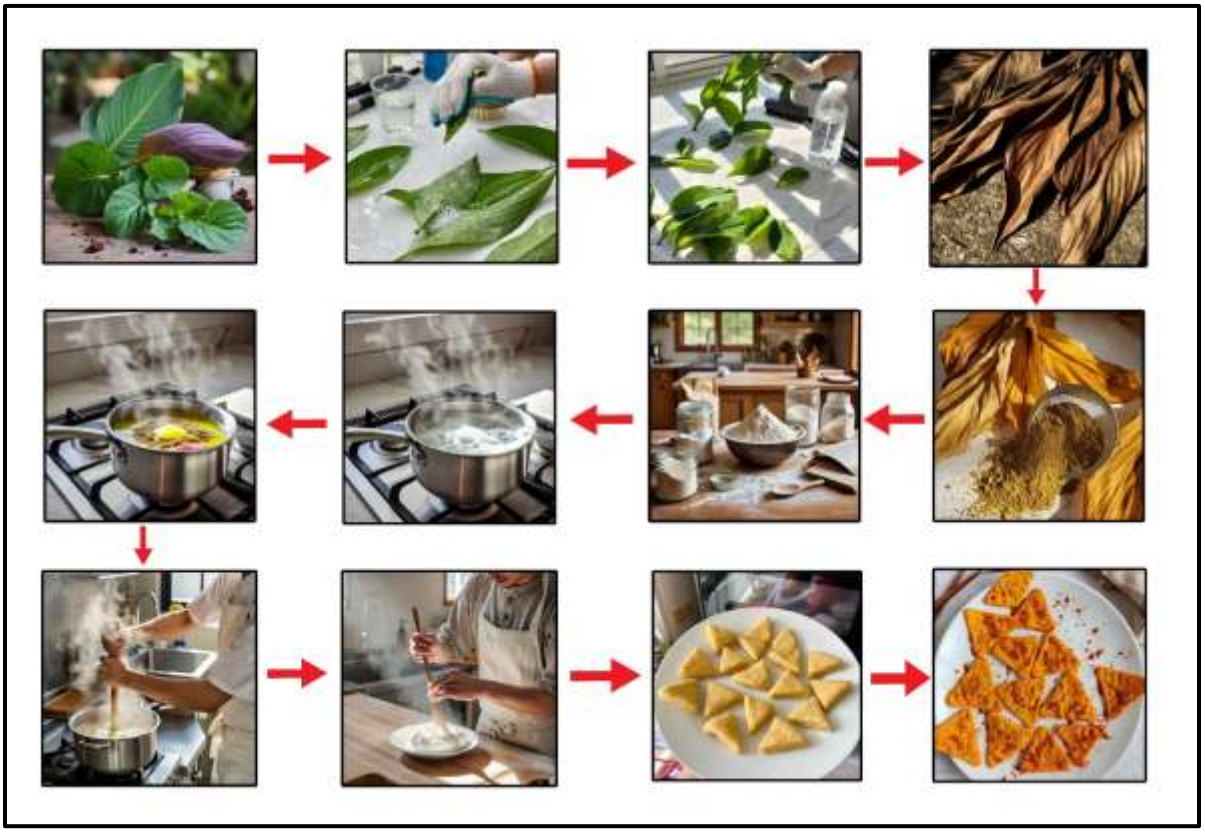

Fig no:6

Errors

1. **Uneven layer:-** we observed inconsistencies in the layering of the product, which affected it's texture and appearance. To address this, we refined our processing technique to ensure uniform layering.
2. **Sogginess:-** The product exhibited sogginess due to moisture imbalance. We adjusted the moisture content and drying process to achieve the desired texture.
3. **Overheating**:- Overheating during processing affected the products nutritional value and texture. We optimized the temperature control and processing time to prevent overheating.

• Evaluation test

1. **Dissolution test**

Costus igneus in water
(Insoluble)

Gymnema sylvestre in water
(Insoluble)

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Costus igneus in alcohol (Insoluble).

Gymnema sylvestre in alcohol (Insoluble)

2.Glucometer Reading :

1. **Postprandial Glucose**

2. **After having snacks**

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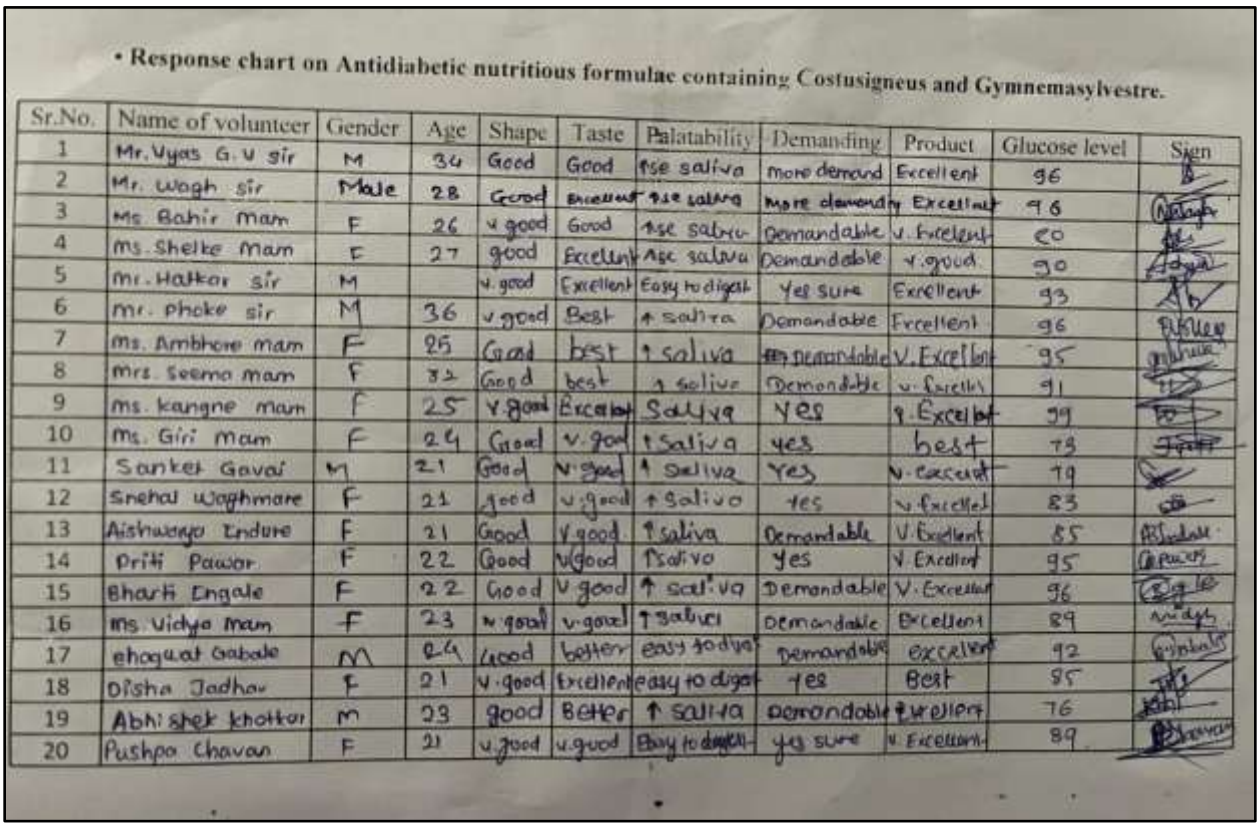
3.Response chart

Chart no:1



• Response chart on Antidiabetic nutritious formulae containing Costusigneus and Gymnemasylvestre.

Sr.No.	Name of volunteer	Gender	Age	Shape	Taste	Palatability	Demanding	Product	Glucose level	Sign
1	Mr. Vyas G.V sir	M	34	Good	Good	Use saliva	more demand	Excellent	96	
2	Mr. Wagh sir	Male	28	Good	Excellent	Use saliva	More demandy	Excellent	96	
3	Ms. Bahir mam	F	26	v.good	Good	Use saliva	Demandable	v. Excellent	80	
4	Ms. Shelke mam	F	27	good	Excellent	Use saliva	Demandable	v.good	90	
5	Mr. Hatkar sir	M		v.good	Excellent	Easy to digest	Yes sure	Excellent	93	
6	Mr. Phoke sir	M	36	v.good	Best	↑ saliva	Demandable	Excellent	96	
7	Ms. Ambhore mam	F	25	Good	best	↑ saliva	Demandable	V. Excellent	95	
8	Mrs. Seema mam	F	32	Good	best	↑ saliva	Demandable	v. Excellent	91	
9	Ms. kangne mam	F	25	V.good	Excellent	Saliva	Yes	V. Excellent	99	
10	Ms. Giri mam	F	24	Good	v.good	↑ saliva	yes	best	79	
11	Sanket Gavai	M	21	Good	V.good	↑ saliva	Yes	V. excellent	79	
12	Snehal Waghmare	F	21	good	v.good	↑ saliva	yes	V. Excellent	83	
13	Aishwarya Endure	F	21	Good	V.good	↑ saliva	Demandable	V. Excellent	85	
14	Priti Pawar	F	22	Good	V.good	↑ saliva	yes	V. Excellent	95	
15	Bharti Engale	F	22	Good	V.good	↑ saliva	Demandable	V. Excellent	96	
16	Ms. Vidya mam	F	23	V.good	v.good	↑ saliva	Demandable	Excellent	89	
17	Bhagwat Gabale	M	24	Good	better	easy to dige	Demandable	excellent	92	
18	Disha Jadhav	F	21	V.good	Excellent	easy to digest	Yes	Best	85	
19	Abhishek khottar	M	23	good	Better	↑ saliva	Demandable	Excellent	76	
20	Pushpa Chavan	F	21	v.good	v.good	Easy to digest	yes sure	V. Excellent	89	

CONCLUSION

The formulation and evaluation of an antidiabetic nutritious formula containing Costus igneus and Gymnema sylvestre leaves showed promising results in managing blood glucose levels in early pregnancy. The combination of these herbal ingredients demonstrated potential benefits in reducing fasting and postprandial glucose levels, making it a valuable adjunct therapy for gestational diabetes management.

Key Findings

• The formula exhibited significant antidiabetic activity, with a notable reduction in blood glucose levels.
• The nutritional content of the formula supported overall health and well-being during early pregnancy.
• The study suggests that this formula could be a useful addition to conventional gestational diabetes management.

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