International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

Formulation and Evaluation of Antidiabetic Chocolate by using Guava Leaves

Rutuja Ganeshrao Jogdand [1], Nita P. Nimbekar[2], Shweta Jalindar Ingole[3]

[1,2,3]SSS Indira College of Pharmacy, Vishnupuri, Nanded

Abstract:

The chocolate is product which love every age person to eat but due to health issues like obesity, high blood pressure, coronary artery disease, diabetes etc. doctor restrict patient to take chocolate. So, objective of present research was to formulate the chocolate keeping note of health issues to prevent the Diabetes and make patient convenient to eat chocolate i.e.prepare an antidiabetic chocolate by using guava leaves. Psidium Guajava is synonyms Guava leaves have high levels of antioxidants and vitamins which also helps to lower blood sugar levels. Chocolate formulation contained Guava leaves powder, dark chocolate, cocca butter, coffee, honey and evaluated parameters are general appearance, dimension, hardness, blooming test, drug content determination, physical stability etc.

Keyword: Anti Diabetes, Chocolate, Guava leaves

1. INTRODUCTION :

One important lifestyle element that may impact the development of chronic illnesses like diabetes is dietary modifications. [1,] When hyperglycemia occurs during a fast or after meals, it is referred to as diabetes. Diabetes mellitus (DM) is characterized by persistent hyperglycemia, which is linked to end organ damage, malfunction, and failure in the heart, blood vessels, kidney, retina, and nerves. [2]

Diabetes comes in three main forms: Type I, Type 2, and Gestational Diabetes.

• Diabetes type 1 is an autoimmune condition.

• When blood sugar levels rise due to the body's resistance to insulin, type 2 diabetes develops.

• Pregnancy-related elevated blood sugar is known as gestational diabetes.

This kind of diabetes is brought on by hormones that the placenta produces that block insulin. The chemical components of guava leaves (Psidium Guajava), which are members of the Myrtaceae family, include linoleic acid, carotenoids, polyphenols, and vitamin C. It is used to treat rheumatism, ulcers, fever, diarrhea, diabetes, inflammation, and high blood pressure. Additionally, it supports liver function, enhances blood circulation, and lowers blood sugar levels. Seventy percent or more of dark chocolate is high in coca, which is a potent antioxidant that helps control blood sugar, improve blood pressure and flow, lower heart disease, and enhance brain function. Additionally, it lowers long-term diabetes risk. [3]

When it comes to children, one of the most crucial aspects is medication compliance. One of the most challenging responsibilities is giving children medications repeatedly, which can occasionally result in non-adherence to medicine. [11]

Around the world, chocolate is consumed by individuals of all ages and from all walks of life. This food's ability to evoke pleasant feelings and sensory pleasure is primarily responsible for its popularity. Consumer perceptions now reflect growing awareness of the connection between a healthy diet and overall wellbeing. Customers view functional foods as belonging to the particular food group to which they belong. Additionally, confections like functional chocolate that offer practical advantages for health and wellbeing are becoming a major trend in industrialized nations. [13]

Aim & Objective :

Aim : Formulation and Evaluation of Antidiabetic Chocolate by using Guava Leaves.

Objectives:

- To create dark chocolate with a lower fat content
- The formulation of chocolate will lower the body's elevated fat levels.
- Blood glucose levels will be kept within normal ranges.
- To create antidiabetic chocolate for people with diabetes of all ages.
- To lower the long-term risk of diabetes and regulate blood sugar levels.
- Overdosing on medication to achieve antidiabetic effects. [4]

CHOCOLATE:

Due to the several uses that sugar gives food, including sweetness, bulkiness, and textural qualities, sugar-free products have become increasingly rare. Consumers today are worried about the high sugar content, calories, and cariogenicity of confections, which is why "light" and "sugar-free" products are becoming more and more popular. Making chocolates without sugar is very difficult since all of the sugar must be substituted. [5]

People with diabetes may find the use of sweeteners in place of sugar in dark chocolate to be an appealing alternative because it is unlikely that this formulation will cause blood glucose levels to rise. An investigation into the intake of chocolates sweetened with sucrose, fructose, and isomalt by individuals with type 2 diabetes.

Assessing the blood glucose response to sugar-free dark chocolate may show that this kind of chocolate is a healthy food option for diabetics, supporting the possible vascular advantages of dark chocolate consumption without impairing blood glucose regulation.

Because of its versatility and sophistication, chocolate may be made into a wide variety of flavors and consistencies. Chocolate acts as a water-resistant media for moisture-sensitive active ingredients, showing resistance to hydrolysis and microbiological growth. Chocolate is an excellent vehicle for delivering these active ingredients in a number of ways.

The dried and fermented seeds of Theobroma cacao, cocoa beans, and cocoa butter are commonly used to make chocolate.

Depending on how much cocoa is used in their recipe, chocolates are classified as dark, milk, or white. Typically found in chocolates, cocoa powder is made from cocoa beans and is said to offer anticariogenic properties. The glucosyltransferase enzyme (GTFB, GTFC, and GTFD) is produced by the microbe Streptococcus mutans, which is the main cause of tooth decay. This enzyme sticks to teeth and causes decay.

Theobromine, a key component with two important properties—anti-glucosyltransferase action and anti-microbial activity—is abundant in cocoa beans and their husks. [11]

Chocolate is a very complex and adaptable food that may be combined to produce a wide variety of flavors and textures. Additionally, because chocolate is an anhydrous media, it resists the growth of microorganisms and the hydrolysis of active ingredients that are sensitive to water. In many ways, chocolate works well as a delivery system for active ingredients.

"The sensation of flavor perceived in the mouth upon contact with a substance" is the definition of taste. According to the Oxford Dictionary (2007), a palatable meal or drug is one that is "pleasant to taste."

The tongue's taste papillae include modified epithelial cells, which are the main taste-related cells. These cells are organized in taste buds (Llorens et al., 2004). Sweet, salty, sour, and bitter are the four fundamental taste modalities. Adults and children have different taste perceptions (Mennella et al., 2005).

According to Lawless et al. (1985), children and infants have a taste for sweet foods, which diminishes to adult levels in late adolescence (Liem et al., 2002).

However, resistance to bitterness is exhibited from a very young age, therefore bitter flavors are likely to make food less palatable. Aversive bittering substances have in fact been suggested as a way to stop young toddlers from ingesting toxins. [12]

Chocolate Types:
The following are the different kinds of chocolate that are utilized in chocolate preparation:

1] Sweet Chocolate - Cocoa butter should make up 18% and cocoa solids should make up 12% of its minimum 30% total cocoa solids content.

2] Milk chocolate - it should contain not less than 25% cocoa solid and a minimum quantity od 12-14% of milk solids. Typically, a blend of medium-roasted West African beans and Ecuadorian beans is commonly used.

3] White chocolate – it should contain not less than 20% cocoa butter and not less than 14% milk solid.

4] Bittersweet chocolate – This type is employed for creating highly flavoured, sweet cream centres with a bitter coating.

The health advantages of chocolate :

The nutritional and pharmacological qualities of dark chocolates are enhanced by the presence of different percentages of polyphenols. The following is a list of chocolate's many health advantages.

Cardiovascular diseases –

Foods high in flavanols are known to have strong cardioprotective properties that lower the risk of a number of cardiovascular conditions. Therefore, the fact that cocoa contains flavan-3-ols indicates that it may be somewhat useful in the treatment of cardiovascular illnesses. Due to its ability to thicken and harden arteries while regaining their elasticity, dark chocolate in particular helps prevent and treat atherosclerosis. The characteristics of cocoa products can help avoid cardio-metabolic problems, which are thought to put a strain on the heart.

Hypoglycaemic action –

Dark chocolate provides protection against type 2 diabetes mellitus and aids in the preservation of healthy blood vessels in diabetics. Dark chocolate contains flavonoids, which can make diabetics more insulin resistant. Dark chocolate's low glycaemic index also lessens the possibility of unexpected rises in blood sugar levels.

Magnesium deficiency –

Many people throughout the world eat cocoa, which is regarded as one of the foods high in magnesium. According to a rat trial, cocoa products may be used to treat chronic magnesium insufficiency in rats. However, further research is needed to fully understand how cocoa affects people.

Diuretic action –

As a diuretic, theobromine, which is present in cocoa, helps the body eliminate extra water and salt, which helps alleviate oedema. This characteristic helps control high blood pressure.

Anticancer action –

Studies are being conducted to determine the precise pharmacological substance that may be responsible for the possible cancer-fighting benefits of dark chocolate.

Antioxidant action –

It is well known that dark chocolate contains a significant amount of antioxidants that protect cells from oxidative damage. Free radicals have the potential to cause cancer and hasten the aging process, but dark chocolate may help prevent them.

Vitamins and minerals –A wealth of vitamins and minerals can be found in dark chocolate, including vitamin K, calcium, magnesium, manganese, phosphorus, iron, copper, potassium, zinc, selenium, and the B-vitamin complex (B1, B2, B3, and B9). The presence of potassium and copper helps to prevent cardiovascular diseases.

CNS action – Dark chocolate may help treat a number of illnesses affecting the central nervous system, including mood swings, since it improves blood flow to the brain. The phenylethylamine found in dark chocolate elevates the patient's mood by inducing the release of endorphins

In oral hygiene –By fortifying tooth enamel, theobromine, which is present in dark chocolate, helps prevent dental cavities and promotes good oral hygiene.

Neuroprotective action-Numerous researchers' experimental findings indicate that dark chocolate, which is high in polyphenols, has neuroprotective, neuromodulatory, and neurorescue properties that effectively prevent neurodegenerative diseases. [11]

SWEETENER : [7]

HONEY :

Bees use nectar to make honey, a naturally occurring material. Using herbal medicines, dietary supplements, and other natural items like honey are examples of alternate approaches to diabetes treatment. The medicinal applications of honey have drawn more attention in recent years. This is mostly because there are more evidence-based studies showing honey's positive health effects in treating a variety of illnesses, including diabetes mellitus. [8]

Nearly all natural honey contains phenolic acids such ellagic, caffeic, p-coumaric, and ferulic acids, as well as flavonoids like apigenin, pinocembrin, kaempferol, quercetin, galangin, chrysin, and hesperetin. Ascorbic acid, tocopherols, peptides, reduced glutathione (GSH), catalase (CAT), superoxide dismutase (SOD), and products of the Millard reaction.

The majority of those compounds have an antioxidant activity that is synergistic. The drawback is that honey elevates blood sugar levels more quickly than sugar since it has a higher glycemic index. This is due to the fact that it contains more fructose and no trace minerals. Honey has the advantage of having somewhat more calories than sugar, but because it is sweeter, less may be needed.[9]

MATERIAL :

Ingredients: coffee, dark chocolate, honey, distilled water, gauva leaf powder, and cocoa butter.
Equipments: Measuring cylinder, Beaker, Mortar pestle, Conical flask, Funnel, Chocolate mould, Petri dish.

Preservative :

In order to increase shelf life and provide possible health advantages, herbal preservatives in anti-diabetic chocolate frequently use natural extracts with antioxidant and anti-diabetic qualities. Herbs including cinnamon, liquorice powder, guava leaves, and rosemary extract are frequently utilized. The taste and health of people, particularly those with diabetes, can be improved by using these herbs in a functional food product. [10]

METHOD OF PREPARATION :

1. Gauva leaves should be gathered and cleaned with water to get rid of any dirt.
2. Let it dry naturally for four to five days.
3. Use a grinder to reduce size to powder.
4. Pass Gauva powder through sieves
5. Melt the dark chocolate and the cocoa butter in a water bath, then stir in the gauva powder and the remaining ingredients.
6. Pour the mixture into a chocolate mold, then freeze it for eight to ten hours [3].

7. FORMULATION TABLE:

Table 1: Formulation Table

Sr.No.	Ingredients	Quantity Given	Quantity Taken	Use

1.	Guava Leaves Powder	100gm	10gm	Antidiabetic
2.	Dark Chocolate	100gm	100gm	Antidiabetic
3.	Honey	q.s.	q.s.	Sweetening Agent
4 .	Coffe	10gm	1gm	Flavouring Agent
5.	Butter	50gm	5gm	Shine

Fig.2 Melt and add all ingredients

Fig.3 Mix it properly

Chocolate :

Physical properties of chocolate :

The melting point of cocoa butter normally ranges from 34 to 38°C. As a result, chocolate stays solid at 25°C but melts when it comes into touch with the mouth's warmth. To maintain this temperature constancy, refrigeration is necessary. Avoid overheating cocoa butter as this may cause polymorphism, which could lead to less stable chocolate. Cocoa butter has an acid value of 1.68, a saponification value

of 191.214, and a refractive index of 1.44. The pH range of processed cocoa powder is 6.8 to 8.1, while that of natural cocoa powder is between 3.5 and 5.8.

Chemistry of Chocolate :

About 300 volatile chemicals, including aliphatic esters, polyphenols, aromatic carbonyls, and theobromine, are found in chocolate, which is made up of cocoa. Amines, alkaloids, fatty acids, polyphenols (particularly flavonoids), tyramine, trigonelline, magnesium, phenylethylamine, and N-acylethanolamines are among the pharmacologically active substances found in cocoa seeds.

Alkaloids

About 2-3% of theobromine, a major alkaloid, is present in raw cocoa beans, along with 4% methylxanthines, 0.2% caffeine, and trace amounts of theophylline. These alkaloids are primarily responsible for cocoa's bitter flavor.

Polyphenols

Cocoa seeds contain around 15% of polyphenols, which give chocolate its fruity flavor and astringent feel. There are three main types of polyphenols: proanthocyanidins (58 65%), anthocyanins, and catechins (29–38%). [19] Flavones and polyphenolic acid are examples of other minor polyphenols. These polyphenols contribute to cocoa's protective benefits against heart conditions.

Proteins - Cocoa comprises around 10-16% protein.

Carbohydrates :

-Around 12% of cocoa beans are made up of polysaccharides including starch, pectin, cellulose, and mucilage, while 2-4% are free sugars like glucose, fructose, sucrose, galactose, mannitol, inositol, and arabinose.

Minerals -Minerals such as potassium, phosphorus, copper, zinc, iron, magnesium have been found in cocoa.[11]

EVALUTION TEST :

1. **Color** : Observe color by visualization.
2. **Texture** : Evaluate the texture of the chocolate Checking its soft ness and brittle ness of chocolate
3. **Mouth feel**: Place chocolate in mouth and feel it.
4. **Taste of chocolate**: Taste the chocolate.
5. **Hardness** : The chocolate bars were tested for hardness using a material testing machine (TIRA test 27,025; TIRA GmbH, Germany) with a 200 N load cell (De Clercq et al., 2017). The chocolate bar

was penetrated by the cylindrical probe, which had a diameter of 5 mm and was traveling at a speed of 2 mm/s. Five millimeters was the penetration distance. The hardness was defined as the maximum load. The tests were conducted at a temperature of 20 ± 1°C in an air-conditioned environment. Evaluations of hardness were conducted both immediately following manufacturing and 2, 6, 10, 18, and 26 weeks later. [4]

6. **Blooming Test**

Fat Bloom - when a thin coating of fat crystals forms on the chocolate's surface. As a result, the chocolate will become less glossy and develop a delicate white coating, making the final product appear unappetizing. The migration of a filling fat to the chocolate layer or the recrystallization of fat are the two main causes of fat bloom. Maintaining a consistent temperature during storage will postpone the onset of fat bloom.

Sugar Bloom This layer, which sits on top of the chocolate formulation, is rough and uneven. When chocolate is removed from the refrigerator, condensation occurs, which is the reason of this. The chocolate's sugar will be dissolved by this moisture. Sugar recrystallizes form rough, asymmetrical crystals on the surface after the water evaporates. This creates an ugly appearance

.

7. **Pysical Stability** - A sample of chocolate was stored in a closed container at 28°C for a month in order to assess its physical stability. A month later, the chocolate test sample was examined for both drug degradation and physical appearance.

8. **Melting Point** - The remaining heat from the chocolate will cause it to melt. Don't rely solely on appearance when making chocolate in the microwave. Using an instant-read thermometer to check the temperature of the chocolate while it melts and gently stirring it are the only ways to determine whether it is completely melted. Stir the chocolate that is melting with a rubber spatula. [3]

9. **Weight Variation** - USP states that five formulations are chosen at random from each batch and weighed separately in order to assess weight variation. The standard deviation and average weight are then computed and established. [11]

10. **Disintegration Test** - The disintegration test for chocolate is carried out using a disintegration tester device at 37±0.5°C, 60 rpm, and a pH 6.8 buffer for 20 minutes, in compliance with USP guidelines. [11]

OBSERVATION :

Table .2 Observation table

Sr. No.	Parameter	Result
1.	Color	Dark brown color

2.	Texture	Bitter with chalky texture
3.	Mouth feel	Soft
4.	Taste of chocolate	Sweet
5.	Hardness	11.46
6.	Melting point	88F

RESULT AND DISCUSSION:

Guava leaves were used in the formulation and evaluation of an antidiabetic chocolate. According to Ayurveda, a vast array of botanicals have the ability to prevent diabetes. Many more have not yet been investigated and established, and just a few number have been scientifically validated.

CONCLUSION :

In order to create high-quality sugar-free chocolate, the best ingredients must be used, ones that can fully substitute sugar without compromising the product's rheological, physical, or sensory qualities. Sugar has numerous functional qualities that make it helpful as a bulking agent, texture adjuster, mouthfeel modulator, taste enhancer, and preservative in addition to being added to chocolate to increase sweetness. Comprehending these elements would result in the creation of sugar-free chocolates that satisfy the predetermined standards for quality and healthfulness set by the world's consumers. A significant portion of people can keep good health, which is a valuable asset for our day-to-day existence, even though the removal is not 100%. [4]

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