



STEVIA DEMYSTIFIED: A NATURAL CHOICE FOR SUGAR-FREE LIVING

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ABSTRACT:-

Stevia rebaudiana is a south american plant the cultivation of which is increasing worldwide due to its high content of sweet compound. Stevia is produced by cultivation process and it mostly used as a sweetener it made up from stevia leaves and used as replacement for sugar. It contains a number of natural compounds including stevioside and rebaudioside stevia can be more than 300 time sweeter than sucrose from sugarcane and sugar beets. Stevia are mostly used as a sweetener and the diabetic persons are use the stevia sugar free tablet. Stevia have a glycoside, anti-hypertensive, anti-obesity, anti-diabetic, anti-oxidant, anti-cancer, anti-inflammatory and anti-microbial effect and improvement of kidney function. The Sweet Herb of stevia rebaudiana bertonii is fast becoming a major source of high potency sweetener which produces sweet taste but has no calorific value. Stevia natural sweetener is also symbolised as honey plant. Total sweet glycoside concentration as stevioside amongst these stevioside is the major component, besides these is also contains good amount of sterols, triterpenes, flavonoids, tannins and also negligible amount of volatile oil.

Key words:

Stevia leaves, rebaudioside, stevioside, extract, powder, medicinal

INTRODUCTION:-

Stevia are dried roots and leaves of plant *Stevia rebaudiana* Bertoni belonging to family Asteraceae (Compositae). Stevia natural sweetener is also symbolised as honey plant. Due to its high potency sweetening property, in future stevia is likely to be superior to chemical and synthetic sweetener, as well as sugar too. Its real wonder herb which is 300 times sweeter than sugar along with calorie free property. The genus *Stevia* of the Asteraceae family includes 230 species, but only one of them, *Stevia rebaudiana* Bertoni produces sweet steviol glycosides. It was earlier thought that *S. plumbophila* also has this property. Stevia is a tender perennial herb that reaches 30.5–80 cm (1–2.5 feet) in height. The oblong aromatic leaves are 2.5 cm (1 inch) long with a prominent midrib and are arranged oppositely along the stems. The small tubular flowers have five white petals and are borne in terminal clusters; the flowers are usually removed to improve the flavour of the leaves. Germination from seed is difficult, and most plants are grown from cuttings. The plant requires rich well-drained soil and thrives in warm humid climates. A lot of work has been done on the ecology, importance of the plant, its production requirements and the agronomic and management aspects of the plant to be grown as a crop, the current status of understanding of the plant and its potential as an alternate source of sweetening to cane sugar^{17,18} studies showed that Stevia could replace some or all of the sugar (sucrose) in recipes without drastically affecting the visual acceptability or physical characteristics of the food product. Further studies on the safety of Stevia are recommended to determine its potential usefulness as a sugar substitute¹⁹. The paper presents a comprehensive review on its agro techniques, bio product extraction, phytochemical, Biological and toxicological studies done on *S.Rebaudiana*

SYNONYMS:-

- Sweet leaf
- Sugar leaf
- Candy leaf
- Sweet honey leaf
- Meethi Tulsi

BIOLOGICAL SOURCE:-

These are dried roots and leaves of plant *Stevia rebaudiana* Bertoni.

Family: Asteraceae (Compositae)

GEOGRAPHICAL SOURCE:-

It is native of Paraguay (also known as sweet herb of Paraguay) and Brazil. Now cultivated in Canada China, Japan, USA, Mexico, Indonesia, Korea and also to some extent in India

MICROSCOPIC CHARACTERS:-

Leaves colour. - Green

Odour - None

Taste. - Sweet, liquorice-like

- Size.** - 5 cm in length, 3 cm in width
- Shape** -ovate
- Extra features** - Leaves, simple, sessile, petiolate, acuminate,
Crenate faces are glabrous, planted crosswise,
Facing each other pubescent.
- Flower** - white, throats funnel form lobes 5 available in
June to August every year.

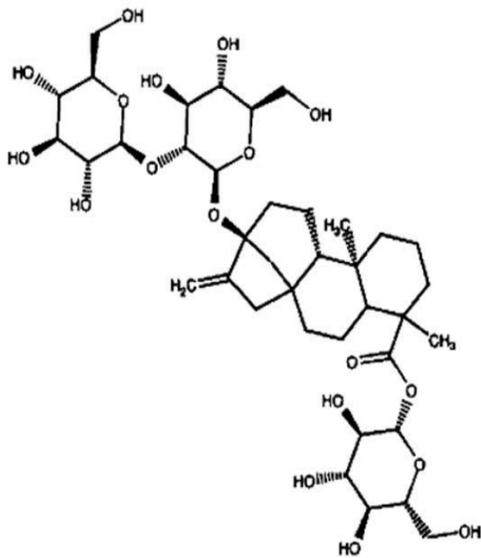
Stevia is an erect, cauline, perennial, herbaceous plant about 50-100 cm in height. Dry weight of single plant about 70 gram.



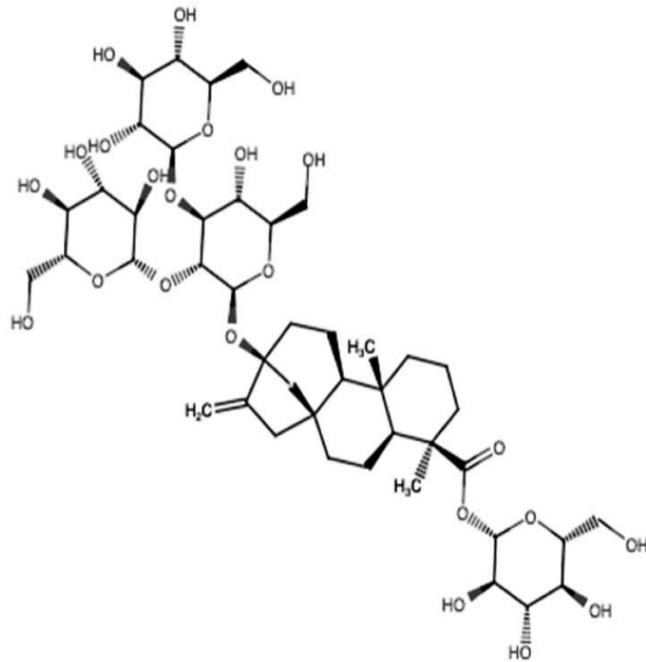
CHEMICAL CONSTITUENTS:-

Total sweet glycoside concentration as Stevioside (5-10 percent) Rebaudioside-A (2-4 per cent), Rebaudioside-C (1-2 percent) Dulcoside- A (0.4-0.7 per cent), Amongst these stevioside is the major component, besides these it also contains good amount of sterols, triterpenes, flavonoids, tannins and also negligible amount of volatile oil.

Structure -



Stevioside



Rebaudioside A

HISTORY:-

What is Stevia?

Stevia is a small shrub native to the region of South America where the borders of Paraguay, Argentina, and Brazil meet. The scientific name for stevia is *Stevia rebaudiana* Bertoni and it is a member of the largest family of plants, Asteraceae which is also called the “sunflower family”. There are 240 close relatives of stevia and they are all herbs or shrubs originating from the tropical and semi-tropical areas of North, Central and South America.

Discovery of the Sweetness

In 1901, the discovery of the stevia plant’s sweetness was attributed to an Italian-Swiss botanist, Dr. Moises S. Bertoni. However, researchers believe the use of the stevia plant to sweeten medicines and foods by indigenous people dates prior to the 16th century. The sweetness of the stevia plant is due to the production of sweet compounds, also known as steviol glycosides, in the plant’s leaves. In 1931, French researchers, M. Bridel and R. Lavielle first identified the individual glycosides noting their sweetening power which is 50-450 times as sweet as sucrose. There are at least 60 known steviol glycosides in the stevia leaf with Stevioside and Rebaudioside A being the most prevalent.

Cultivation

Stevia is a semi-humid subtropical plant that can be grown easily like any other vegetable crop. India’s agro-technologists are actively involved in the cultivation and study of various parameters like mean

height, weight of leaves, growth per day, total biomass yield and stevioside content in the plant. The crop could be transplanted in February or March and seed collected in the late summer. Flowering under these conditions should occur between 54-104th day following transplanting, depending on the day length sensitivity of the cultivars used for seed production. Leaf yield increased with increasing density up to 83,000 and 111,000 plants/ha for the first year of production. The concentration of stevioside in the leaves of Stevia increases when the plants are grown under long days. It is harvested just prior to flowering when steviol Glycoside content in the leaves is maximum. Weight of one thousand seeds of Stevia usually ranges between 0.15 and 0.30 g and depending on plant density it yields up to 8.1 kg/ha. Seed viability and yield are affected by growing conditions during pollination. Excessive rainfall during pollination can affect both seed yield and germination.

In India cultivation is done from April to June or August to September if there are heavy rains Distance between two plants is maintained 25-30 cm and in between two rows 45-50 cm. Exposure sunlight upto 40°C is essential, Whole plant is dried in shade for 3-4 days. Then the leaves are separated from the plant. Which are used for preparation of powder. Depending upon the number of plucking the leaves (3 to times in a year) 2000 to 4000 kg dried leaves, can be collected per h

Marketed preparation:-

Here are some well-known marketed stevia formulations available in the market:

1. **Truvia** – A blend of stevia extract (Reb A) and erythritol, used as a sugar substitute in both cooking and beverages.
2. **Stevia in the Raw** – A stevia-based sweetener that includes dextrose, sold as a sugar alternative in packets or bulk.
3. **Pure Via** – A stevia-based sweetener combined with erythritol, marketed for use in beverages and food.
4. **Sweet Leaf Stevia** – A range of stevia products, including liquid drops, packets, and stevia blends, with no added calories or sugars.
5. **Better Stevia** – A line of stevia products by Now Foods, offering liquid drops, powders, and stevia blends with natural sweeteners.
6. **Stevita** – Pure stevia extract in various forms, including liquid, powder, and tablets.
7. **Zevia** – A brand that uses stevia to sweeten sodas and other beverages.
8. **Kirkland Signature Stevia** – A stevia powder blend, often available at wholesale stores like Costco.
9. **Natura Stevia** – A stevia product available in both liquid and powdered forms for baking and sweetening drinks.

These formulations are available in different forms such as powder, liquid, tablets, or blends with other sweeteners to improve taste and texture

DIFFERENT FORMS:-

1.Green stevia drops

This is a liquid form of stevia, but it is not refined. Approximately 1 Tablespoon of this is the equivalent of 1 cup of sugar. It has a stronger aftertaste than the refined powder with a more “licorice-y” taste.

These typically come in convenient packets that make it easy to take with and add to favorite beverages while on the run.



Fig. Stevia drops

2. Stevia leaves

Stevia is a low-growing shrub native to Paraguay. For centuries, the Guarani Indians used stevia leaves as a sweetener, tonic, digestive aid, and even as a topical poultice to help in healing wounds.

For its primary use as a sweetener, stevia has earned the common names sweet leaf and sugar leaf among South American natives. Apart from South America, stevia is now also grown in Asia (most notably in Japan, India, and China) and in North America.



Fig. Stevia leaves

3. Stevia power

Dry newly harvested stevia leaves to prolong its shelf life or to prepare own ready-to-use stevia powder. To make powdered stevia, the plant's leaves should be sun-dried for approximately 12 hours. The dried leaves are then crushed with the aid of a coffee grinder or with a mortar and pestle to create homemade stevia powder.

Most stevia powder varieties found in health stores are chemically processed from stevia leaves. The process involves boiling the leaves in distilled water and then heat-drying the extract to make a powdered form of stevia. When prepared this way, the stevia powder has an off-white color. It becomes very concentrated that it is about a hundred times sweeter than the naturally prepared stevia powder.



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3. stevia liquid extract

Another form of stevia available in the market is the stevia liquid extract. Most of those readily available in stores are processed using food-grade alcohol. However, there are also those which are alcohol-free. There are a number of commercial brands of stevia liquid to choose from. Some are packaged clear and unflavored while others are flavored with a tinge of vanilla, raspberry, or chocolate, to name a few. Stevia liquid extract is often marketed as a baking essential or as a more convenient and versatile option to using either fresh leaves or powdered stevia



Fig. Stevia extract

4. Stevia tablet

Sweet Stevia Sugar-Free Tablet is a natural sweetener made from 100% herbal, natural calorie-free sugar substance extracted from the leaves of the stevia plant. It contains zero calories and is 200 times sweeter than sugar in the same concentration. The tablets come in a dispenser and can be used in cooking, baking, and beverages as a substitute for sugar. So Sweet Stevia Sugar-Free Tablet is ideal for

individuals who need to restrict sugar intake due to health concerns such as diabetes or those who are trying to maintain a healthy weight. It is a convenient and tasty way to sweeten foods and drinks without the negative effects of consuming regular sugar.

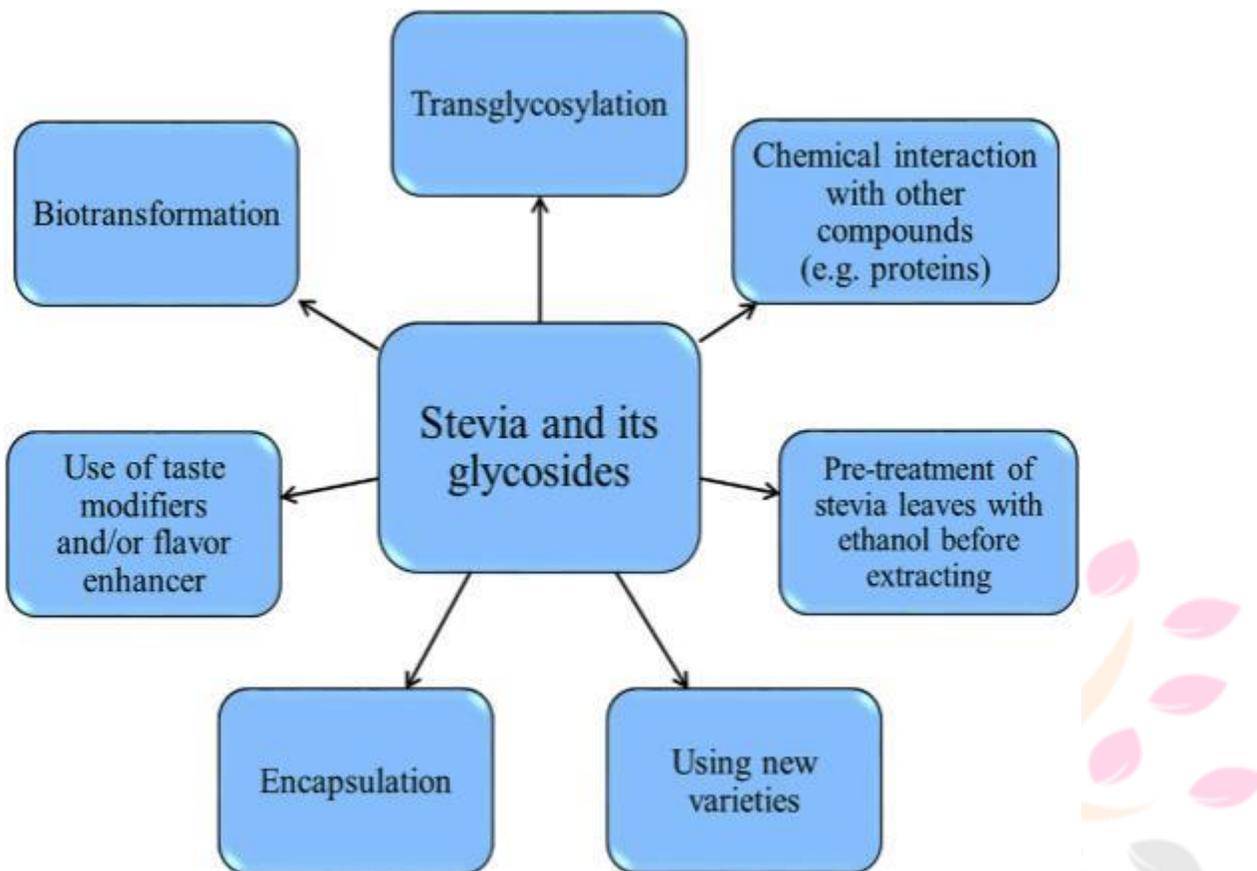


Fig. Stevia tablet

Extraction of Stevia

The sweetness found in the stevia leaves is released by steeping its dried leaves in water, filtering and separating the liquid from the leaves and stems, and further purifying the plant extract with either water or food grade alcohol. The result is a naturally sourced, high intensity sweetener which does not impact blood glucose levels. For decades, high purity stevia extracts have been approved for use in foods and beverages in Japan. Over the last 10-15 years, positive safety opinions from global food safety authorities, including the World Health Organization/Joint Expert Committee on Food Additives, the European Food Safety Authority, and the U.S. Food and Drug Administration, have opened the market for this new and exciting sweetener.

Extraction of Stevia glycosides are besides the known extraction methods, new methods for glycoside-based extraction from Stevia were developed and it was found that water was very effective for extracting glycosides at selected pH and temperatures. It was also reported that a multi-stage membrane process was successfully able to concentrate the glycoside sweeteners. The bitter-tasting components were washed out from the sweetener concentrate in the nano filtration process. It has been demonstrated that a membrane-based separation process for refining glycoside-based sweeteners could be viable and needs to be investigated further. The extraction process of Stevia involves several steps to isolate the sweet compounds, known as steviol glycosides, from the *Stevia rebaudiana* plant. Here's an overview of the extraction process:



STEVIA EXTRACTION PROCESS:-

1. **Harvesting** - Stevia leaves are harvested from the Stevia rebaudiana plant.
2. **Drying** - The harvested leaves are dried to remove excess moisture.
3. **Grinding** - The dried leaves are ground into a fine powder.
4. **Extraction** - The powdered Stevia leaves are extracted with a solvent, such as methanol, ethanol, or water, to release the steviol glycosides.
5. **Filtration** - The extracted mixture is filtered to remove impurities and insoluble particles.
6. **Concentration** - The filtered extract is concentrated through evaporation or distillation to increase the steviol glycoside content.
7. **Purification** - The concentrated extract is purified using techniques like crystallization, chromatography, or enzymatic treatment to isolate the desired steviol glycosides.
8. **Drying** - The purified steviol glycosides are dried to remove any remaining moisture.
9. **Packaging** - The final Stevia extract is packaged and ready for use as a natural sweetener.

Methods of Extraction:-

There are several methods of extraction used to obtain Stevia extract, including:

1. **Solvent extraction** - This is the most common method, which uses a solvent like methanol or ethanol to extract the steviol glycosides.
2. **Water extraction** - This method uses water as the solvent and is considered a more natural and environmentally friendly option.
3. **Enzyme-assisted extraction** - This method uses enzymes to break down the cell walls of the Stevia leaves and release the steviol glycosides.
4. **Supercritical fluid extraction** - This method uses high pressure and temperature to extract the steviol glycosides using a solvent like carbon dioxide.

QUALITY CONTROL:-

To ensure the quality of the Stevia extract, manufacturers must follow good manufacturing practices (GMPs) and adhere to international standards for quality control. This includes testing for:

1. **Purity** - The Stevia extract must contain a minimum of 95% steviol glycosides.
2. **Heavy metals** - The extract must be free from heavy metals like lead, mercury, and arsenic.
3. **Microbiological contaminants** - The extract must be free from microbiological contaminants like bacteria, yeast, and mold.
4. **Residual solvents** - The extract must contain minimal residual solvents.

Type of Extraction

1. Plant tissue halogenation
2. Serial exhaustive extraction
3. Soxhlet extraction
4. Maceration
5. Decoction
6. Infusion
7. Digestion
8. Percolation
9. Sonication

Process of Extraction :-

Powdered sample



Put the sample in thimble



Place the thimble in the extractor



Fill the solvent in round bottom flask



Heat the Soxhlet extraction unit



**Reflux the solvent
(Extract)**

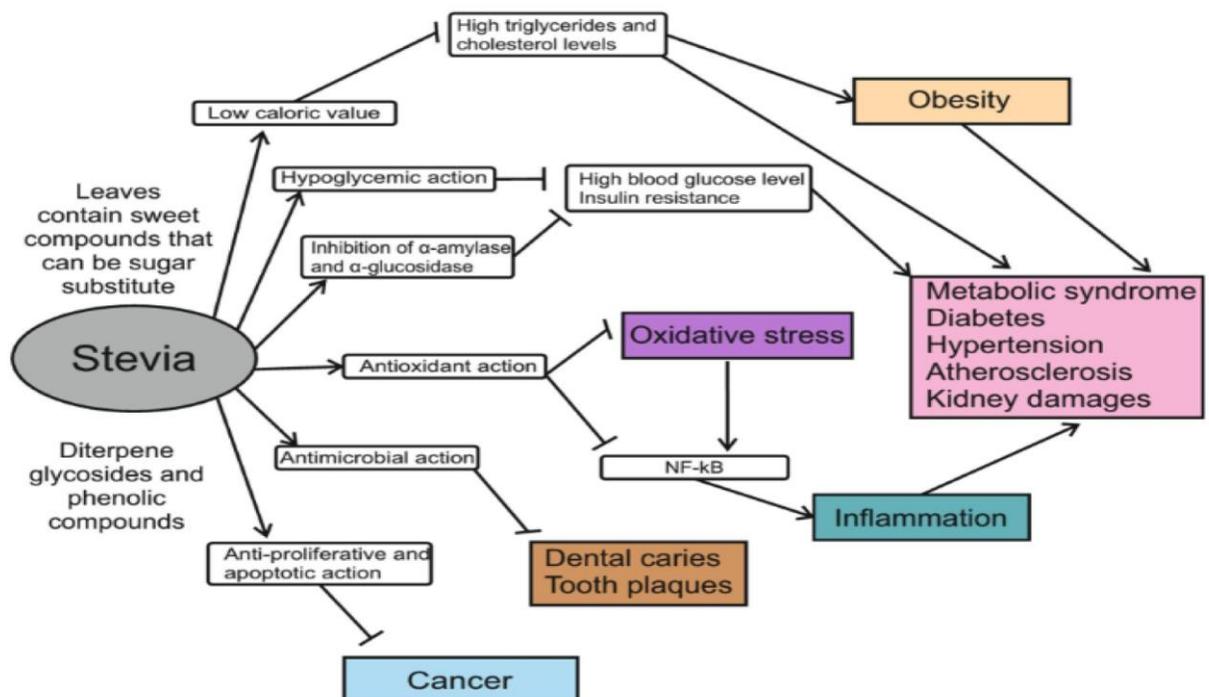
Formulation - formulation table

Ingredient	Amount [g]
Stevia extract	0.5
Sucrose, fine powder	763.1
Ascorbic acid, fine powder	2.0
Citric acid anhydrous powder	55.0
Lemon flavor	8.0
Trisodium citrate anhydrous powder	6.0
Tricalcium phosphate	5.0
β-Carotene 1% CWS from DNP AG, Kaiseraugst, Switzerland	0.4
Total amount	840

HEALTH BENEFIT OF STEVIA:-

The properties of Stevia have been studied for over 100 years. Both earlier and current studies not only confirm the safety of Stevia leaf preparations but also find more and more benefits of its consumption for human health. Next, we will summarize current data on the established and potential pharmacological effects of Stevia extracts and its individual components in various medical models. Stevia (*Stevia rebaudiana* Bertoni) has many health benefits, including:

- Weight loss: Stevia can help with weight loss by reducing appetite and lowering the amount of calories consumed. It's a popular sweetener for people on keto and other low-carb diets.
- Blood sugar: Stevia can help lower blood glucose levels and is safe for people with diabetes.
- Dental health: Stevia can help prevent cavities because it doesn't contain carbohydrates and doesn't produce acid that wears down tooth enamel.
- Cholesterol: Stevia can help reduce bad LDL cholesterol and triglyceride levels, while increasing HDL cholesterol levels.
- Anti-inflammatory: Stevia contains bioactive compounds that have anti-inflammatory properties.
- Antimicrobial: Stevia contains bioactive compounds that have antimicrobial properties.
- Antioxidant: Stevia contains bioactive compounds that have antioxidant properties.
- Anti-caries: Stevia has anti-caries properties.
- Anti-tumor: Stevia has anti-tumor properties.
- Anti-hypertensive: Stevia has anti-hypertensive properties.
- Anti-diabetic: Stevia has anti-diabetic properties.
- Anti-obesity: Stevia has anti-obesity properties. Stevia is also stable at high temperatures, making it a popular choice for baked goods.



CONCLUSION:-

This study provides an updated information on the potential role of stevia in different health conditions, its phytochemicals, industrial applications, and safety. Moreover, recent evidence about the amphiphilic nature and self-assembly behaviour of steviol glycosides have also been discussed. Stevia is a sweet and nutrient-rich plant that has been commercially cultivated in many countries. It has been used in food, beverages, and medicine, and still its benefits and use remains controversial due to conflicting studies. Besides its use in food and drug industry, studies have shown promising health benefits of stevia against diabetes, obesity, hypertension, cancer, dental caries, oxidative stress and as antimicrobial. However, most of the studies were either conducted in vitro and animals or underpowered, making it impossible to make conclusive statements about its health benefits. Therefore, more long-term human studies with large sample sizes are warranted to determine the potential role of stevia in different health conditions, its physiological mechanisms and the key active ingredients.

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