

## A 'SWEET SHRUB' STEVIA: MORE THAN A SWEETENER

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<p><b>*For Correspondence:</b> University Institute of Pharmacy, C.S.J.M. University, Kanpur (U.P.) India. Email: anju_niper@yahoo.co.in &amp; ajaympgupta@yahoo.com Tel : +91-9415510866</p>	<p><b>ABSTRACT</b> The sweet shrub Stevia is well recognized worldwide as hypocaloric bio-sweetener due to its two major thermostable phytoconstituents stevioside and rebaudioside. The commercialization of Stevia rebaudiana (Bert.) Bertoni as sugar substitute is rapidly increasing due to increase calorie consciousness among the people, while calories do play important role in normal physiology. Recent researches on this traditional medicinal plant revealed many of its pharmacological properties and hence Stevia should be known as medicinal plant as it to be and used beyond its sweetening property.</p> <p><b>KEY WORDS:</b> Stevia, sweetener, stevioside, rebaudioside, calorie consciousness, traditional medicinal plant</p>
<p><b>Received: 27.01.2014</b> <b>Accepted: 22.03.2014</b></p>	
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<p><b>Website:</b> www.drugresearch.in</p>	
<p><b>Quick Response Code:</b></p> 	

**INTRODUCTION**

Stevia is one of worldwide known natural sweetener also called as "Sweet Weed", "Sweet Leaf/Meethi Patti", "Sweet Herbs" and "Honey Leaf", which is estimated to be 300 times sweeter than cane sugar while dry leaves of this plant are 30 times sweeter than sugar (Mehta et al., 2012). In ancient Indian traditional Ayurvedic system of medicine, *Stevia rebaudiana* has a long history of use by tribal people (Sairkar et al., 2009) though some authors relate its history with indigenous peoples in Paraguay and Brazil for example Ahmed et al. 2011 as well as database file for Stevia but fact is that the Guarani Indians were the key role player before the Europeans first learned about stevia in the sixteenth century. In the 1930's and 1940's stevia was introduced in UK and Russia as a sugar substitute and Japan has been using it extensively since early 1970 (Rao et al., 2014). Indian system of medicine and/or Indians are

mostly found to be associated directly or indirectly with the medicinal uses of most herbs since from the history of illness and development of healthcare system; the Ayurveda is such an ancient science of life. Ayurveda means "science of life" and it is the oldest and holistic medical system available on the planet today (Gupta and Mishra, 2006).

**BOTANICAL SUMMARY**

Stevia is a small perennial branched bushy shrub that belongs to the family aster or chrysanthemum family; over 200 species of stevia have been found around the world. *Stevia rebaudiana* Bertoni is the botanical name of stevia; it is one of 154 members of the genus Stevia and is the only species at present, which possesses the ability to sweeten. The leaves of the stevia shrub contain specific substances (glycosides), which produce a sweet taste but have no caloric value (Shivanna et al., 2013). The seeds of stevia show very less vigour and propagation and do not allow the production of

homogenous population which leads to variability in sweetening level and composition (Miyagawa et al., 1986). The mature plant grows up to 65-centimetres (26 inches) to as tall as 180 cm (72 inches) when cultivated or growing naturally in fertile soil. It is a short day plant and flowering from January to March in the southern hemisphere. It prefers a sandy soil, requiring a warm sunny position. The suitable natural climate is semihumid subtropical with temperature extremes from 15 to 40°C (Ahmed et al., 2011 and Mehta et al., 2012).



**Plate 1 – *Stevia rebaudiana***

#### **HISTORICAL PERSPECTIVE**

Stevia (Family-Asteraceae) was botanically classified by Dr. Moisés Santiago Bertoni in 1899 by name *Eupatorium rebaudianum*, but later its name changed to *Stevia rebaudiana* (Bertoni) Bertoni in honour of Paraguayan chemist Dr. Rebaudi in year 1905. Then in 1909 its sweet principle was isolated which was purified as stevioside in 1931, the main sweet component in the form of an extremely sweet, white crystalline compound. The chemical structure of stevioside was established in 1952 as a diterpene glycoside. Then in the year 1970s, another important compound rebaudioside-A was isolated, with a sweetening potency even higher than stevioside (Lemus-Mondaca et al., 2012) i.e. about 250 to 400 times than the sucrose with a smaller residual flavor (Rao et al., 2014). England used it as a sweetener during World War II when it was cut off from sugarcane supplies from the Caribbean, conversely, interest faded when sugar again became available. Japan used stevia in replace of saccharin after it was banned in the 1970. Stevia sweeteners have been consumed in Japan in large amount than in any other country. In Europe it was not permitted in market or for other use due to the lack of proper reports or documentation.

#### **ORNAMENTAL STEVIA**

Stevia which is categorized as a shrub is suitable for ground decorator. Edible Garden or Ingredients Garden concept emphasizes every plant can be grown as food, medicine as well as decorate the garden or home. For

that reason, stevia is an interesting ornamental plant (Lemus-Mondaca et al., 2012). The leaves are oval shaped while the stem is soft. It has small white flowers resembling a daisy. The flowers are pentamerous, small and white with a pale purple throat. They are composite surrounded by an involucre of epicalyx. The capitula are in loose, irregular, sympodial cymes. The tiny white florets are borne in small corymbs of 2–6 florets, arranged in loose panicles. This plant can also be reproduced using seed, but seeds germination rate is very low, as already described above, but the rhizome has slightly branching roots. Thus breeding is often done using stem cutting, such method of breeding is also accepted for a population of uniform plants with better chemical composition (Tamura et al., 1984).



**Plate 2 – Flowering *Stevia rebaudiana***

#### **PHYSIOLOGY OF CALORIE**

Calories are a measure of energy and are commonly used to describe the energy content of foods. Human body is able to store the excess calories/energy as glycogen or fat to use at a later time for many different functions, including movement, thought, growth etc or for emergency. Some fat storage is essential to allow the body to have energy reserves, protect internal organs, insulate the body and protect nerves (Alexander and Elliott, 1987). Pregnancy, lactation etc. are other important physiological changes where one should not cut down the calories. The lack of calories via dieting may cause a metabolic melee in the brain resulting in fierce mood swings, loss of sense of proportion and decrease BMI much below the recommended level, result in infertility, insomnia, liver and kidney failure (Pantalone and Faiman, 2012). The use of diet pills, which is very common for the Size Zero aspirants, results in incontinence, and bowel and bladder disorders. Eventually, various cardiovascular complications could develop and heart may stop functioning.

#### **CALORIE CONCIOUSNESS**

The calorie consciousness tremendously increased the numbers of direct consumers and commercialization of

stevia. With increased consumer interest in reducing sugar intake, food products made with sweeteners rather than the sugar have become popular. The food industry has responded to this demand and as a consequence, there has been a fast growing increase in diet foods and beverages available to consumers in many markets of the world. In India, the use of artificial sweeteners in food products has not been very common so far when compared with the majority of western countries. However, over the past decade, there has been a steady increase in many Indian retail foods that are labeled as 'diet' and /or 'light'. Contrary to the situation on the late 1980s when only people with health problems (e.g. diabetes or high blood cholesterol) used to buy these products, many Indians have now started to consume low calorie foods and are eating less sugar and fat as part of their main diet (Sharma and Chattopadhyaya, 2007).

### TOXICOLOGY

The great interest in stevia as a non-caloric, natural sweetener has fueled many studies on it-including toxicological ones. The main sweet chemical, stevioside, has been found to be nontoxic in acute toxicity studies with rats, rabbits, guinea pigs, and birds. The natural stevia leaf also has been found to be nontoxic and has no mutagenic activity (Rajab et al., 2009). Studies conflict as to the effect of stevia leaf on fertility; as majority of clinical studies show stevia leaf to have no effect on fertility in both males and females, but in one study, however, a water extract of the leaf was shown to reduce testosterone levels and sperm count in male rats (Filho et al., 1989 and Melis, 1999). Similar is the case with its risk towards genotoxicity (Nunes et al., 2007).

### BAN BY FDA

In 2012, FDA posted a note on their website regarding crude Stevia plant: "FDA has not permitted the use of whole-leaf Stevia or crude Stevia extracts because these substances have not been approved for use as a food additive. FDA does not consider their use in food to be GRAS (Generally recognized as safe a FDA designation) in light of reports in the literature that raise concerns about the use of these substances. Among these concerns are control of blood sugar and effects on the reproductive, cardiovascular, and renal systems. Therefore, stevia leaves and leaf extracts are commonly found in most health food stores, however; they may only be sold in the United States as dietary/herbal supplements, not as food additives or sweeteners.

### CONCLUSION

It could be now concluded that considering stevia just as a sweetener or commercializing it as diet food and diet beverages for healthy individuals seems to be neither justifiable nor ethical, as it has many medicinal

properties and pharmacological activities – Antioxidant activity (Shukla et al., 2012; Shivanna et al., 2013 and Rao et al., 2014); Anti-inflammatory activity (Yingkun et al., 2013); anti-inflammatory and immunomodulatory activity (Boonkaewwan et al., 2006); Immunomodulatory activity (Boonkaewwan et al., 2008 and Sehar et al., 2008); Antimicrobial activity (Gamboa et al., 2012); Antibacterial activity (Preethi et al., 2011); Antihypertensive (Ferri et al., 2006 and Chan et al., 2000); Diuretic effect (Melis, 1995); Anti-hyperglycemic effect (Gregersen et al., 2004); Anti-diabetic activity (Misra et al., 2011 and Shivanna et al., 2013); Antiviral activity (Takahashi et al., 2001 and Kedik et al., 2009); Anticancer activity (Paul et al., 2012 and Rajesh et al., 2010); Gastroprotective activity (Shiozaki et al., 2006). Therefore, by performing some more clinical and pharmaceutical research

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**Cite this article as:**

Singh, A., Agrawal, N. and Gupta, A.K. (2014). A sweet shrub stevia: More than a sweetener. *Indian J. Drugs*, 2(1), 1-4.