NEW HORIZON

Stevia: A Promising Herbal Sweeteners

Ekta Arora, Vijay Khajuria, Sachin Kumar*, Z. Gillani, Shamyia Sadiq, VR. Tandon

We live in an age of modern convenience and great advancement but mankind's ongoing battle with health disorders shows no signs of diminishing. These are the results of the fast urban artificial lifestyle, changing diet patterns, lack of exercise, stress etc which are responsible for making many in developing countries susceptible to obesity related health problems like diabetes, dyslipidemia, heart disease, hypertension, stroke etc. The most alarming of them is Diabetes. The World Health Organization (WHO) has commented that there is ' an apparent epidemic of diabetes which is strongly related to lifestyle and economic change' . India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the " diabetes capital of the world. Besides, the so called " Asian Indian Phenotype " and genetic factors, the primary driver of the epidemic of diabetes is the rapid epidemiological transition associated with changes in dietary patterns and decreased physical activity. Consumption of sugar sweetened beverages may be one of the dietary causes of metabolic disorders such as diabetes. So, either one can stop sugar altogether and deprive oneself of the sweet goodies in life or give in to the use of low calorie sugar substitutes like Saccharin, Sucralose & Aspartame which are nothing but artificial. Moreover, recently it has been indicated that artificially sweetened beverage use on long-term basis can cause weight gain and recent epidemiological study found a relationship between aspartame and an increased frequency of brain tumors in humans raising health concerns (1).Thus, substituting sugar with low calorie, natural sweetener may be an efficacious weight management strategy (2).

Stevia is a natural and healthy alternative to sugar and artificial sweeteners. Stevia a perennial shrub, belongs to the family asteraceae, genus stevia and species rebaudiana. It is extensively grown in places like Brazil, Central America and Israel but is native to Paraguay. For centuries this herbal sweetener has been used in native cultures to counteract the bitter taste of various plant based medicines and beverages. S.Rebaudiana was rediscovered by Europeans in Paraguay in 1888 by Dr. M. S Bertoni (3). It contains sweet tasting glycosides, mainly Stevioside in addition to Rebaudiosides A, B, C, D and E. Stevioside, obtained in the form of a white crystalline compound is 100 to 300 times sweeter than table sugar (3, 4).According to new tentative specifications prepared at 63rd meeting in 2004 of JECFA , published in FNP52 and ADD12 (2004); Steviol glycosides are functionally designated as sweetener not as a food additive. It is often recommended for inclusion in weight loss diets and diabetic foods. Studies have suggested it to be safe in diabetics, phenylketonurian (PKU) patients as compared to other sweeteners (3). Apart from its use as a non calorie sweetener, it possesses flavor enhancing properties which add to the attractiveness of using steviol glycosides in foods and beverages.Besides sweetness, stevioside along with related compounds , which include rebaudioside A (second most abundant component of Stevia rebaudiana leaf), steviol and isosteviol may also offer other therapeutic benefits, as they have anti-hyperglycemic, anti-hypertensive, anti- inflammatory, anti- tumor, anti-diarrhoeal, diuretic and immunomodulatory actions. As steviol can interact with drug transporters its role as a drug modulator is proposed (4).

Anti-Hyperglycemic Effect: Stevioside reduces postprandial blood glucose levels in type 2 diabetic patients indicating beneficial effects on the glucose metabolism. It also stimulates insulin secretion via direct action on beta cells . So, Stevioside may be advantageous in the treatment of type 2 diabetics (3).

Anti-Oxidant Effects: Stevioside is a potential source of natural anti oxidants. Isosteviol, a derivative of Stevioside inhibits angiotensin-II-induced cell proliferation and endothelin -1 secretion while attenuation of reactive oxygen species generation (3,5).

Anti-Hypertensive Effect : Evaluation of two long term studies indicates that stevia may be effective in lowering blood pressure in hypertensive patients. Although the hypotensive effect was not better than other antihypertensive drugs, it appears comparable with almost all the active drugs. It has been found that stevioside

From the Department of Pharmacolgy, Therapeutics & Toxicology & *ADRM Centre GMC, Jammu (J&K) - India
Correspondence to : Dr. Vijay Khajuria, Asst Prof., Deptt. of Pharmacolgy, Therapeutics & Toxicology, GMC, Jammu (J&K)-India

Table.1 Superiority of Stevia over Artificial Sweeteners (3,9,10)

Stevia	Artificial Sweeteners
Appetite Regulator or suppressor (It resets the appestat mechanism found in the brain thereby promoting a feeling of satisfaction)	Appetite Stimulator (These are low energy food, so body recognizes complete absence of their potential energy and sends signals which stimulates appetite)
Assists in weight management or weight loss (It reduces craving for sweets and fatty foods)	Lead to weight gain (It increases carbohydrate cravings, stimulate food storage & weight gain)
Studies have not shown any major concerns for safety.	Use of artificial sweeteners are associated with a large number of side effects.
Ideal for cooking and baking as it is heat stable upto 200^0C. It is non fermentable.	Aspartame – Not ideal for cooking and baking when heated above 30^0 C. {It releases methanol which is further broke down into formaldehyde (a known carcinogen) , formic acid & DKP (diketopiperazine causes brain tumors) }.
Energy value: 2.7 kcal/g	Aspartame Energy value: 4 kcal/g
More intense sweetener	Less intense sweetener
Cheaper	Costly
It is safe and useful in management of diabetes.	Safety of artificial sweeteners in diabetes is not established.

causes vasorelaxation via inhibition of Ca2+ influx into the blood vessels (3,6). It is of interest to know that their effects on plasma glucose levels and blood pressure are only observed when these parameters are higher than normal (7).

Anti-inflammatory & Immunomodulatory activity: It has been found that Stevioside attenuates synthesis of inflammatory mediators in LPS- stimulated THP-1 cells by interfering with the Ikappa B kinases(IKKbeta) and NF- kappa B signaling pathway (3).

Digestive supplement and Universal Tonic: Stevia contains protein, calcium, phosphorus, iron, potassium and ash of crude fibre, which are essential for the maintainence of good health and are comparable to commonly used cereals in India. Few studies have shown that Stevioside has a protective effect on the degradation of vitamin C in comparison to other sweetners (3).

USFDA has approved Stevia as a dietary supplement or an herb but not as a sweetener(8).

Safety Profile: Recently completed studies on the general and reproductive toxicity demonstrates its safety at high dietary intake levels. Moreover , there is no indication of genotoxic potential of Stevioside. No allergic reactions to it seem to exist (3,9,10).

Conclusion

Substituting sugar with low calorie, natural sweetener may be an efficacious weight management strategy in view of recent reports questioning safety of articicial sweeteners

References

1. Fowler SP, Williams K, Resendez RG, Hunt KJ, Hazuda HP, Stern MP. Fueling the obesity epidemic? Artificially sweetened beverage use and long-term weight gain. *Obesity (Silver Spring)* 2008; 16(8):1894-900
2. Anton SD, Martin CK, Han H, *et al*. Effects of Stevia, aspartame and sucrose on food intake, satiety and postprandial glucose and insulin levels. *Appetite* 2010 ; 55(1):37-43
3. Stevia: Prospects as an Emerging Natural Sweetner. WHO INDIA 2007
4. Goyal SK, Samsher, Goyal RK. Stevia (Stevia Rebaudiana) a bio-sweetner: a review.*Int J Food Sci Nutr* 2010; 61(1):1-10.
5. Ghanta S, Banerjee A, Poddar A, Chattopadhyay S. Oxidative DNA damage Preventive activity and anti oxidant potential of Stevia Rebaudiana (Bertoni) Bertoni, A natural sweetner. *J Agric Food Chem* 2007; 26;55 (26):10962-67
6. Ulbricht C, Isaac R, Milkin T, *et al*. An evidence-based systematic review of Stevia by the natural standard, research collaboration. *Cardiovasc Hematol Agents Med Chem* 2010; 8(2):113-27
7. Chatsudthipong V, Muanprasat C. Stevioside and related compounds: therapeutic benefits beyond sweetness. *Pharmacol Ther* 2009 ; 121(1);41-54
8. Regulation (EC) No. 258/97 of the European Parliament and the Council (notified under document number C (2000) (77) Official Journal L 061, 08/03/2000 p.0014
9. Williams LD, Burdock GA. Genotoxicity studies on a high-purity rebaudioside A prepration. *Food Chem Toxicol* 2009 ; 47(8):1831-36
10. Qing Yang. Gain Weight by ' Going diet?'Artificial sweetners and the neurobiology of sugar cravings. *Yale j Biol Med* 2010;83(2):101-08