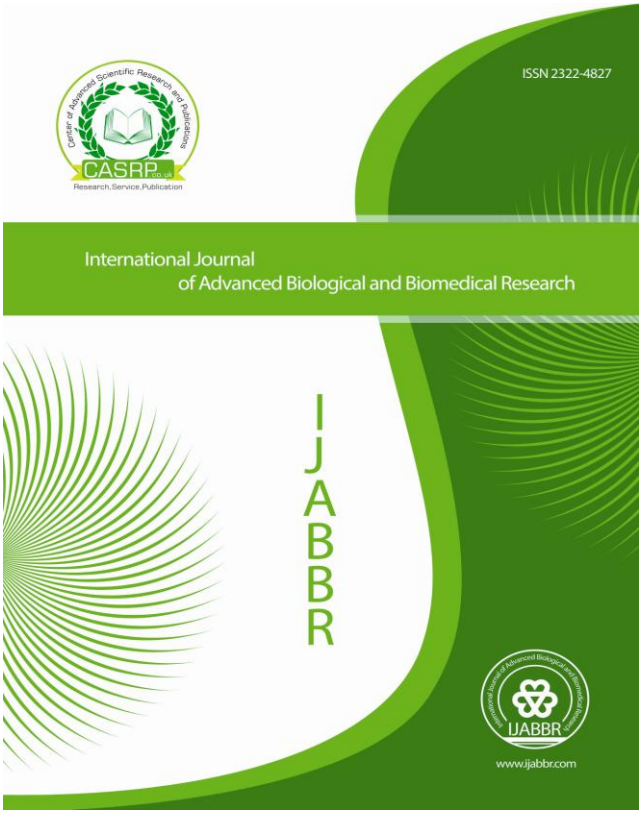

Available online at www.casrp.co.uk/journals

CASRP PUBLISHER

International journal of Advanced Biological and Biomedical Research 4(1) (2016) 58–61

doi: 10.18869/IJABBR.2016.58

Original Article **Open Access**

Sweetness equivalence ratio of Stevia (Stevia Rebaudiana Bertoni) with sugar adopted in Ethiopia

Bekri Melka Abdo*

Wondo Genet Agricultural Research Center P.O. Box 198, Shashemene, Ethiopia.

Abstract

Low caloric sweeteners have been investigated to substitute sugar as an advantage for both nutritional and medicinal purpose. These sugar substitutes are interesting particularly for concepts marketed under a natural claim. Among these, Stevia rebaudiana is a small shrub; its leaves are used as a sweetener. Serial dilution of the hot water Crude extract of S. rebaudiana leaves and aqueous solution of table sugar were subjected to test the panelist in order to choose their preferable sweetening level from both solutions independently. After their reaction, the stevia and sugar ratio were corresponded for individual panelist perception. The nutritional composition also analyzed. Majority of the panelist preferred 2.5 mg/mL stevia solution and 50 mg/mL sugar solution for sweetening. This ratio shows 1 g of stevia is equivalent with 20 g of sugar. The nutrient composition analysis results also indicated that stevia rebaudiana is a good source of calcium, potassium, sodium, Iron and phosphorus. As conclusion hot water crude extract of stevia is 20 times sweetener than sugar with be full of good minerals when using as sweetener in different foods and drinks.

Keywords: Nutritional analysis, Sensory evaluation, Stevia rebaudiana.

***Corresponding author:** Wondo Genet Agricultural Research Center P.O. Box 198, Shashemene, Ethiopia.

Received 13 December 2015 | Accepted 12 January 2016 | Available online 19 January 2016
iThenticate screening 16 December 2015 | English editing 10 January 2016 | Quality control 16 January 2016

1. Introduction

Stevia, botanically known as *Stevia rebaudiana*Bertoni with a Family *Asteraceae* which grows wild as a small shrub in parts of Paraguay and Brazil (Lewis, 1992). The leaves have traditionally been used as a sweetener. Because of undergoing no chemical change in the extraction process, this makes it very desirable to many consumers looking for healthy alternatives to sucrose sugar. Stevia has quite high heat resistance and can be used in most cooking applications.

Steviol glycoside is a more precise term for a group of intensely sweet compounds extracted and purified from *S. rebaudiana* (Carakostas et al., 2008). Steviol glycosides have a number of positive properties, making them real alternatives to sweetening with sugar or artificial sweeteners. Their high sweetness is outstanding, being 200-350 times higher than normal household sugar. Yet another advantage is its stability across a broad pH spectrum. That means nothing stands in the way of using it in soft drinks. The stability of steviol glycosides in the end product is generally considered very well. Steviol glycosides have been used for several years in a number of countries as a sweetener for a range of food products such as fruit and milk-based drinks, desserts, yoghurts, confectionaries, delicacies, and pickles.

In Ethiopia, the gap between sugar production (198,762 tons) and consumption (276,400 tons) represents a serious problem from the year 2010 to 2011 (CSA, 2014). Nowadays, attention is must be needed upon using Stevia in food industries, in order to close the gap between the production and consumption. The increasing consumption of sugar (sucrose) has resulted in several nutritional and medical problems, such as obesity. Therefore, low caloric sweeteners have been investigated to substitute sugar (Jaroslav et al., 2006). The sugar substitute is also particularly interesting for concepts marketed under a “natural” claim. The present work was conducted to study the sweetness equivalence ratio of leaves of *S. rebaudiana* with table sugar and its nutrient compositions were also studied. Indeed these works address the efficient use of stevia as a sweetener in foods and local drinks for substitution of sugar.

2. Materials and methods

2.1. Sample preparation

The stevia leaf samples were harvested from matured herbs which were grown from Wendo Genet Agricultural Research Center and washed the dust with water. The prepared herbs were dried under shaded area.

2.2. Extraction

Stevia sample (4 g) were extracted in 100 mL hot water and stayed for 20 min for steering according to Nishiyama et al. (1992). The solutions were filtered using cheesecloth. Serial dilutions were prepared from the filtrated solution. At the meantime 20 g of table sugar were dissolved in 100 mL boiled water and prepared serial dilution.

2.3. Sensory evaluation

A panel of 45 judges (29 males and 16 females) were tested the prepared solution starting from dilute to concentrate ratio and chosen their preferable sweetness level from both media (sucrose & stevia). Water was provided to rinse the mouth each time, while a panelist carried out an evaluation. All the panelists were tertiary and above educated level, and staff of Wendo Genet Agricultural Research Center. Based on panelist sweetness level, the sweetness equivalence ratios were analyzed.

2.4. Nutritional analysis

The fat content of the samples was extracted with chloroform/methanol in a Sohlet apparatus. Total protein content was determined by the Kjeldahl method. Aditionaly ash, crude fiber, tannins and irons (Fe) contents were determined according to the method of AOAC (2000) using Atomic Absorption Spectrophotometer. The flame photometer was applied for the determination of calcium (Ca), potassium (K) and sodium (Na) according to the method described by Pearson (1976) and Abou-Arab et al. (2010). Phosphorus was determined via dry ash method.

3. Results and discussion

From table 1, 20 % of the panelist perception showed that 1 g of stevia leaf powder is equivalent with 15 g of table sugar. Approximately half of the total panelist (47 %) perception revealed that 1 g of stevia is equivalent with 20 g of table sugar. Less percent of the panelist (4 %) perception judged 1g of stevia is equivalent with 25 g of table sugar. Above 60 % of the panelist reaction confirmed that 1 g of stevia is greater or equal to 20 g of table sugar in using as a sweetener. Majority of the panelist preferred 1:400 (w/v) stevia to water and 1:20 (w/v) table sugar to water ratio respectively. This ratio revealed that 1 g of stevia is equivalent with 20 g of sugar. This result is in agreement with the result reported by Savita et al. (2004).

The results obtained from the nutritional analysis of dried Stevia leaf showed that moisture, protein, fat, crude fiber, ash, and carbohydrates were 7.35, 16.92, 0.5, 10.12, 7.52, and 67.71 %, respectively (Table 2). These results are in agreement with those reported by Savita et al. (2004); Gisleine et al. (2006); Manish and Rema (2006) and Abou-Arab et al. (2010). They reported that protein, fat, crude fiber, ash, and carbohydrates were (6.2 - 20.42 %), (2.5 - 5.6 %), (13.56 - 18.5 %), (7.41 - 13.12 %) and (35.2 - 61.93 %) in that order. Besides proximate its antinutritional factors (tannin) was also analyzed, which is 0.188 %. As compared to the EUSTAS (2007) (European stevia association) quality label report, the analysis result of protein, water and ash content values were complies within the recommended range. From this study, Stevia leaves are a good source of carbohydrates, protein, and crude fiber which are the essential factors for maintenance of health. On the other hand, high ash content indicates that the Stevia leaves are good source of inorganic minerals. Beside, a low fat value confirms that the leaves are not enriched with oil. The bitterness test left over after swallowing the stevia is may be due to the presence of tannins which have a characteristic of bitterness and astringency.

Data presented in Table 3 indicated that the mean concentrations of macro minerals (potassium, calcium and sodium) and micro element (iron) were determined in dried *S. rebaudiana* leaves. Potassium was detected at the highest content (0.163 %) followed by calcium (0.072 %) and sodium (0.021 %). Regarding to iron, the leaves contained higher amount which was recorded 0.030 %. On the other hand, the higher level of phosphorus was detected at concentration 0.018 %.

Table 1
Sweetness equivalence of stevia in comparison to sugar.

Stevia: Sugar (g)	Perception (%)
1: 10	16
1: 15	20
1: 20	47
1: 25	4
1:30	13

Table 2
Proximate analysis.

Composition	Content (%)
Moisture	7.35
Protein	16.92
Fat	0.5
Ash	7.52
Crude Fiber	10.12
Total Carbohydrate	67.71
Available Carbohydrate	57.59
Energy (k cal)	302.54
Anti nutrition	
Tannin	0.188

Table 3
Mineral analysis.

Minerals	Content (%)
Calcium	0.072
Potassium	0.163
Sodium	0.021
Iron	0.030
Phosphorus	0.018

4. Conclusion

Based on the study, we drawn to a conclusion that the stevia leaf green powder is 20 times sweeter than table sugar and could be minimize the amount of calories intake for those who have to restrict carbohydrate/ sugar in their diet. Also, the consumers benefited when the leaves of Stevia was used as a source of minerals in different food preparations. For utilization of these herbs it needs for creating awareness among the people about the availability of natural low calorie sweetener "*stevia rebaudiana".*

References

A.O.A.C., 2000. Official Methods of Analysis of the Association of Official Analytical Chemists International 17th Ed. Published by the Association of Official Analytical Chemists International, Suite 400,2200 Wilson Boulevard, Arlington, Virginia 22201-3301. USA.

Abou-Arab, E.A., Abou-Arab, A.A., Abu-Salem, F.M., 2010. Physico-chemical assessment of natural sweeteners steviosides produced from Stevia rebaudianabertoni plant. Afr. J. Food. Sci., 4(5), 269-281.

Carakostas, M.C., Curry, L.L., Boileau, A.C., Brusick, D.J., 2008. Overview. The history, technical function and safety of rebaudioside A, a naturally occurring steviol glycoside, for use in food and beverages. Food. Chem. Toxicol., 46, 1–10.

CSA, 2014. (Central statistic agencyof Ethiopia). http://www.csa.gov.et/Accessed on October.

EUSTAS, 2007. (European Stevia Association). Summary of the Application and Specifications of the EUSTAS Quality Label. Maladeta, nº20, 22300BARBASTRO, Huesca, SPAIN.

Gisleine, E.C., Abdol, H.A., Caudio, C.A., Letícia, de A.F.F., Gilson, T., Mirian, H.T., Wilson, E.F., Roberto, B.B., 2006. Investigation of the tolerability of oral Stevioside in Brazilian hyperlipidemic Patients. Brazil. Arch. Biol. Tech. Int. J., 49(4), 583-587.

Jaroslav, P., Elena, V., Ostr, P., Karsek, M.R., Karolnka, B., Pavla, K., Josef, C., 2007. Comparison of two different solvents employed for pressurized fluid extraction of stevioside from Steviarebaudiana: methanol versus water. Analytical and Bioanalytical Chemistry, 388, 1847-1857.

Lewis, W.H., 1992. Early uses of Stevia rebaudiana (Asteraceae) leaves as a sweetener in Paraguay. Econ. Bot., 46, 336-337.

Manish, T., Rema, S., 2006. Preliminary studies on Stevia rebaudianci leaves proximal composition, mineral analysis and phytochemical screening. J. Med. Sci., 6, 321-326.

Nishiyama, P., Alvarez, M., Vieira, L.G.E., 1992. Qualitative analysis of Stevioside in the leaves of stevia rebaudiana by near infrared reflectance spectroscopy. J. Sci. Food. Agr. 59, 277-281.

Pearson, D., 1976. The Chemical Analysis of Food. 7th ed. Churchill Livingstone, Edinburg London and New York, 75.

Savita, S.M., Sheela, K., Sunanda, S., Shankar, A.G., Ramakrishna, P., 2004. Stevia rebaudiana– A Functional Component for Food Industry. J. Hum. Ecol., 15(4), 261-264.

How to cite this article: Abdo, B.M., 2016. Sweetness equivalence ratio of Stevia (Stevia Rebaudiana Bertoni) with sugar adopted in Ethiopia. International journal of Advanced Biological and Biomedical Research, 4(1), 58-61.