The Pharma Innovation Journal 2022; 11(7): 2056-2060

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(7): 2056-2060

www.thepharmajournal.com
Received: 22-05-2022
Accepted: 17-06-2022

Vaishnavi Naik
Department of Food Science and Technology, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India

Theertha Poyil
Department of Food Science and Technology, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India

Corresponding Author:
Vaishnavi Naik
Department of Food Science and Technology, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India

Application of stevia (*Stevia rebaudiana* Bertoni.) in food products

Vaishnavi Naik and Theertha Poyil

Abstract
Because of the growing use of sugars, particularly sucrose, worldwide food processing trends have encouraged companies to employ sweeteners, particularly synthetic ones, to a greater extent. For some years, considerable attention has been paid in the literature to stevia (*Stevia rebauidana*), which contains glycosidic diterpenes with sweetening effects. Stevia is 250-300 times sweeter than sucrose, which has been approved for human consumption by FAO/WHO and CODEX. Steviol glycosides are the compounds that impart sweetness to stevia leaves, the most important of which are stevioside and rebaudioside A. Since the introduction of low-calorie foods and beverages, zero-calorie sweeteners such as stevia have grown in popularity and application in food products. They can be found in energy drinks, dairy products such as ice cream, bakery items, and fruit preserves. For adults, the Joint Expert Committee on Food Additives (JECFA) determined a daily limit of 4 mg/kg body weight.

Keywords: Stevia, glycosides, sweetness, zero-calorie, sucrose

Introduction

Our forefathers were more concerned about their health and diet than we are now. It was usual for them to use various herbs as supplements to preserve their health and to construct various remedies and tonics based on their experiences. As a result, people were healthier and more resistant to certain diseases (Jahangir Chughtai *et al*., 2020). It is commonly known that increased sugar consumption has resulted in a variety of nutritional and physiological issues, including obesity. Low caloric sweeteners have historically been studied as a viable sugar substitute; one major class of low caloric sugar substitutes is known as a high-intensity sweetener, which is at least 50-100 times sweeter than sucrose. The most frequent high-intensity sweeteners on the global market today are synthetic substances. The metallic aftertaste of such artificial sweeteners does not convey the authentic flavour of sugar (Gasmalla *et al*., 2014) [1].

Stevia (*Stevia rebaudiana Bertoni*.) is a type of perennial shrub in the Compositae family. It is native to South America but is currently grown in many parts of the world, including Asia, Europe, and North America. Stevia is also known as honey leaf, candy leaf, or sweet leaf because to the presence of steviol glycosides, which have 100-300 times the sweetness of sucrose (Ahmad *et al*., 2020) [2]. Stevia is a natural sweetener with considerable therapeutic benefit and commercial importance due to its widespread demand (Singh *et al*., 2019) [3]. Stevia preparations come in a variety of forms, including fresh and dried Stevia leaves, Stevia leaf powder, extracts, and liquid concentrates. Stevia extract is an excellent alternative to artificial sweeteners because it is 200 to 300 times sweeter than sugar (Peteliuk *et al*., 2021). Stevia is widely used as a sugar substitute in foods, beverages, and medication in many countries, and commercial goods containing stevia derivatives have been developed. Surprisingly, the leaves of stevia offer superior functional and sensory qualities to other high potency sweeteners, and it is expected to become a key source of high potency sweetener for the booming natural food market in the future. Many studies have demonstrated that stevia has a variety of health advantages, including anti-diabetic, anti-obesity, anti-tumor, anti-hypertensive, anti-microbial, anti-caries, and antioxidant qualities. Furthermore, several investigations have found that steviol glycosides from stevia leaves are not teratogenic, carcinogenic, or mutagenic, and do not induce subacute or acute toxicity (Ahmad *et al*., 2020) [2].

Chemical Formulation

Stevia rebaudiana is well-known for its sweetening characteristics, but it is also recognised for being a rich source of nutritional and functional components such as protein, fibre, minerals, vitamins, phenolic acids, free radical scavenging and antioxidant potential, nutraceutical benefits, and so on. Fresh Stevia leaves are over 80% moisture and give 270 kcal/100 g calories (Savita *et al*., 2004). The moisture content of dried leaves is usually determined by the extent and technique of drying. It is recommended that these leaves be dried in the sun or in an oven to minimise degradation. Post-harvest drying of Stevia leaves for about 8 hours is required to concentrate the sweet glycoside components in the leaves (Samsudin & Aziz, 2013). Gasmalla *et al*. (2014) [1] discovered that Stevia has a significant amount of protein and may absorb enough water throughout product development. Stevia leaves have a protein content ranging from 6.2 to 20.42 percent. The fat level of Stevia extraction was discovered to be 4.34%, which is not high enough when compared to other oil sources, but the fatty acid composition of Stevia presents it as a good source for optimum growth. Stevia leaves contain 6.13±0.63% fat and 18g/100g of fibre, according to Gasmalla *et al*. (2014) [1]. Regular consumption of dietary fibre in meals gives health benefits such as promoting regular digestion, reducing constipation, maintaining body weight, removing excess cholesterol content, and protecting the body from cardiovascular problems by maintaining normal blood pressure. It also aids in cancer prevention by providing a surface for colonic bacteria to cling to, as well as easing food transit through the intestines (Sánchez-Muniz, 2012). Savita *et al*. (2004) determined the chemical constituents of Stevia, declaring moisture content, calorific values, protein content, fat content, ash content, and crude fibre as 4.45-10.73 percent, 362.3-384.2 kcal/100 g, 12.44-13.68 percent, 4.18-6.13 percent, 4.65-12.06 percent, and 4.35-5.26 percent, respectively. Segura-Campos *et al*. (2014) discovered that Stevia is a rich source of crude protein (12.11-15.05 percent), carbs (64.06-67.98 percent), and crude fibre (5.92-9.52 percent). However, 28.61-29.12 g/100 g of total dietary fibre content was discovered, with insoluble dietary fibre accounting for the majority (87.79-70.02 percent). There was a significant amount of acid detergent lignin (2.28-8.98 percent), neutral detergent fibre (18.11-19.29 percent), and acid detergent fibre (14.16-17.77 percent) detected. Hemicellulose and cellulose content were 1.51-3.96% and 8.79-11.78%, respectively (Sánchez-Muniz *et al*, 2012).

Active compounds

Stevia, the common name for the stevioside extract from the leaves of *Stevia rebaudiana*, is a new potential renewable raw food thing on the global market. It is a natural, sweet tasting calorie free botanical that may also be used as a sugar substitute or as an alternative to artificial sweeteners. Steviol glycosides are diterpenes that have been isolated and identified as stevioside, steviolbioside, rebaudioside A, B, C, D, E, F, and dulcoside. Their contents range from 4 to 20 percent fresh leaf weight depending on growing conditions, culture, and tillage practises. Stevioside was determined to be the most common stevia glycoside in plant leaves (4-13 percent w/w). It is followed by rebaudioside A (2-4% w/w), rebaudioside C (1-2% w/w), and dulcoside A (0.4-0.7% w/w). Steviolbioside, rebaudioside B, D, E, and F were also found in the leaf extracts, but only in trace amounts (Geuns *et al*., 2003). According to Mishra *et al*. (2010), the major sweetening ingredient discovered in the leaf of the plant *Stevia rebaudiana* (from 5-15 percent dry weight) is stevioside, followed by rebaudioside (3-6 percent). The tridimensional chemical form of stevioside and other stevia glycosides produces resistance to acid and enzymatic hydrolysis, ensuring their inalterability even under biochemical and physiological conditions (Khiraoui *et al*., 2017).

Compound	Sweetness Relative to Sucrose
Stevioside	250-300
Rebaudioside A	350-450
Rebaudioside B	300-350
Rebaudioside C	50-120
Rebaudioside D	200-300
Rebaudioside E	250-300
Steviolbioside	100-125
Dulcoside A	50-120
Rebaudioside M	200-350

(Kazmi *et al*., 2019; Singh *et al*., 2019) [6, 3]

Natural sweetener development for the food industry

There is a clear link between sugar consumption in the diet and the prevalence of dental caries. As a result, intensive research for a low calorie, non-cariogenic sweetener has been conducted to provide an alternative chemical to sugar for usage in food and pharmaceuticals, and the food sector has launched various artificial sweeteners to sweeten food and beverages. The invention of synthetic sweeteners, many of which are regarded safe for teeth, such as aspartame, saccharin, cyclamate, xylitol, and mannitol, has resulted from research for sucrose substitutes (Gupta *et al*., 2017) [7]. These sweeteners have also been utilized as sugar alternatives for people suffering from caries. However, animal studies have shown that, in addition to their benefits, artificial sweeteners induce weight gain, brain tumours, bladder cancer, and a variety of other health problems. As a result, research must continue to find natural foods and components that protect against dental caries, particularly those with practical dietary applications and can help make dietary guidance more effective. The ideal product would be calorie-free, non-carcinogenic, non-mutagenic, not heat degradable, cost-effective to manufacture, and deliver sweetness with no bad aftertaste. Obtaining these features in a single product, however, has proven incredibly difficult. Active chemicals derived from plants have been utilized as treatments for a variety of illnesses and microbial infections since antiquity. Recent study has also focused on the discovery and evaluation of novel, potentially non-cariogenic natural sweeteners. In Japan and certain other Asian, European, and American countries, several highly sweet plant ingredients are commercially used in foods and beverages as non-cariogenic sugar alternatives, including the diterpene glycoside, stevioside, a steviol glycoside derived from *Stevia rebaudiana* (Bertoni) (Ferrazzano *et al*., 2017) [8]

Stevia application

In the food sector, sweeteners are the most significant ingredients. Stevia is primarily utilized in the food and beverage industries as a sweetener and taste enhancer. In terms of importance, the health market comes in second. By-products are the third most important market. Stevioside is a powerful sweetener, and Stevia extract is widely used in Japan, China, Russia, Korea, Paraguay, Argentina, Indonesia, Malaysia, Australia, New Zealand, South America, and other nations to sweeten native teas, medicines, food, and beverages. Stevia extract may be favoured over other low-calorie sweeteners (saccharin, aspartame) since its source is natural, which may appeal to health-conscious consumers (Gasmalla *et al*., 2014) [1]. Stevia has been used for millennia as a bio-sweetener and for additional therapeutic purposes such as blood sugar regulation. Its white crystalline ingredient (stevioside) is a calorie-free natural herbal sweetener that is 100-300 times sweeter than table sugar. Japan is presently the world's leading user of steviosides derived from stevia leaves. Stevia is widely farmed for its sweet leaves and medicinal properties. Stevia has gained popularity as a low-carbohydrate and low-sugar dietary replacement, with extracts having up to 300 times the sweetness of sugar. Stevia may also help with obesity and high blood pressure, according to medical research. Stevia is appealing as a natural sweetener to persons on carbohydrate-controlled diets since it has no effect on blood glucose. Hossain *et al*., 2017 [9]; Gasmalla *et al*., 2014) [1]

Value-added products are created to increase the value of food items by adding ingredients, processing, or packaging. Consumers find value-added food products more appealing and useable than the original commodity. Stevia leaves are commercially used either directly or after processing in the manufacture of numerous value-added products. Stevia has been partially or completely included as a functional food component into baked, dairy, confectionery, and other items. The current analysis focuses on the commercial use of stevia in a variety of food products and its impact on a variety of attributes. Sweetened food items such as cakes, cookies, muffins, and biscuits are substantial contributors to global sugar intake. Sucrose is an essential component in baked foods. It contributes not only to the flavour, but also to the texture and structure. Excess sugar ingestion, on the other hand, causes an abrupt rise in postprandial glucose levels. Regular eating of excessive amounts of sugar-containing foods is related with an increased risk of obesity, diabetes, dental caries, and coronary heart disease. Stevia sweetener is heat-stable up to 200 degrees Celsius, acid-stable, and non-fermentable, making it acceptable for usage in a variety of food applications. Furthermore, its organoleptic properties were determined to be satisfactory, implying that it might be employed as a sucrose alternative (Kroyer *et al*., 2010 & Prakash *et al*., 2013) [10, 3]. Non-nutritive high intensity sweeteners contribute to the product's sweet taste, but texture, colour, and flavour must also be preserved. As a result, when stevia is used as a partial replacement for sugar, other additives such as bulking agents, hydrocolloids, proteins, and so on need be used to compensate for the texture loss (Sukhman *et al*., 2018)

Stevia, which can replace sugar as a sweetener, has yet to benefit the confectionery business. Stevia can be utilized in chocolates and sweets not only to meet market demand from diabetics, but also to reap the benefits of this herb's anti-tooth decay properties. Stevioside can also be found in chewing gum, mints, mouthwash, toothpaste, and some cosmetics. This low-calorie natural sweetener is widely used in a variety of food products, including biscuits, jams, chocolates, ice creams, baked goods, soft drinks and fruit drinks, sauces, sweet corn, delicacies, pickles, yoghurt, soju, soy sauce, candies, sea foods, and popular beverages such as diptea, coffee, and herbal tea (Gasmalla *et al*., 2014) [1].

Beverages

Stevia's principal function is sweetening, but it can also change the flavour in some circumstances (Schiatti-Sisó *et al*., 2022) [12]. Stevioside and sucrose were added to water and peach juice in a study and the sweetness, sweet, and bitter aftertastes were compared. The results showed that 160 mg/L of stevioside successfully replaced 34 g/L of sucrose in juice without altering the product's sensory attributes. As a result, the functional food industry may be able to use stevioside in the manufacturing of dietetic and other low calorie foods; however, more research is required to evaluate the consequences of long-term stevioside consumption on human health (Gasmalla *et al*., 2014) [1]. Orange juice is one of the most popular non-carbonated beverages in the world because it is high in vitamin C, carotenoids, folic acid, flavonoids, and other nutrients. It acts as an antioxidant, preventing free radical damage to tissues and lowering the risk of heart disease and cancer. With the addition of stevia, low calorie orange nectar and orange juice were created. Other beverages, such as mango nectar and passion fruit juice, were developed with stevia as a partial replacement for sucrose and tested for sensory and physicochemical parameters (Schiatti-Sisó *et al*., 2022) [12]. Many worldwide food firms utilise stevia in their goods, including Coca-Cola, which employs stevia in Japan for its Diet Coke and submitted patent applications in 2007 to extract the most delicious components of the Stevia plant. It is attempting to obtain exclusive rights to develop and market "rebina" for use in its beverages (Gasmalla *et al*., 2014) [1].

Dairy products

Milk and milk-based products are essential ingredients in functional foods. Dairy processors are looking into new ways to sweeten their products without adding more calories, as people are turning away from heavily sweetened dairy-based products. The search for natural low-calorie alternatives to sweeten dairy products that reduce sugar content while maintaining texture, body, and mouthfeel has been ongoing. Stevia has emerged as a viable option for dairy products because it retains its stability when heated. Ice cream is one of the most popular frozen dairy products. Sugar effects its texture, viscosity, and freezing point, and hence has a substantial impact on consumer appeal. Sucrose is the most commonly used ice cream sweetener due to its low cost and market acceptance. However, due to the health risks connected with sucrose, stevia and other non-nutritive sweeteners are gaining favour (Sukhmani *et al*., 2018)

The use of stevia instead of sugar in ice cream and kulfi can result in a significant reduction in caloric value. According to studies, ice cream mixes with sucrose partially replaced with stevia had higher sensory scores than those with solely stevia (Ozdemir C *et al*., 2015; Alizadeh M *et al*., 2014) [13, 14]. Yogurt is one of the most well-known probiotic-containing foods. Sensory investigation of strawberry-flavored yoghurt with stevia revealed that yoghurt with a stevia-sucrose mixture had the best sensory profile (Alizadeh M. *et al* 2014) [14].

When used with other sweeteners to sweeten strawberry-flavored yoghurt, stevia had a synergistic sweetening effect. Flavored milk contains the same amount of nutrients as plain milk. Flavored milk is preferred by both children and adults, according to studies. Flavored milk, on the other hand, has a large amount of sugar, which has been related to the promotion of obesity in children and adults. Stevia is an intriguing choice for lowering the calorie value of flavoured milk. It is critical to preserve consumer acceptability of the product while decreasing the sugar content. The perception of sweetness intensity in skim chocolate milk made with stevia and monk fruit extracts was studied. It was determined that flavoured milk with stevia had the highest consumer approval (Sukhmani *et al*., 2018)

Juice and nectar drinks

For a long time, the beverage industry has focused on reducing sugar in response to increased consumer awareness of their health (Mielby *et al*. 2016); indeed, there is a wide range of carbonated beverages on the market that meet this condition; however, this does not imply that it is a resolved issue, as one of its major challenges now focuses on natural drinks such as nectar and juices. Fruit nectar must be devoid of extraneous substances and odours, have a uniform colour, smell like the fruit it comes from, and have a sugar level of at least 10° Brix. This does not apply to products sweetened with a total or partial substitute; if non-caloric sweeteners are used, the percentage will be lower, and this will be reflected in the product's level of acceptance (Mielby *et al*. 2016; Escorcia *et al*. 2019).

In the case of the application of stevia as a low calorie sweetener, a cocona nectar was made to evaluate the influence of stevia and sucrose concentrations on physicochemical and sensory qualities. However, no significant differences in the sensory features of the four treatments were observed; the Brix degrees (6.7°Brix) changed significantly. Various research on the sensory profiles of these goods have revealed that nectars and juices containing stevia as a non-caloric sweetener have a significant prevalence of bitterness and disagreeable taste. Furthermore, the present demand for antioxidant-rich beverages is growing at the same time as the desire for products sweetened with natural components; employing stevia as a natural sweetener while taking phenolic compounds into account; and generating high-quality berry juices with antioxidants (Schiatti-Sisó and colleagues, 2022) [12].

Bakery products

Baked goods are among the most popular foods with a high sugar content. Sweetened foods such as cakes, cookies, muffins, and biscuits are substantial contributors to global sugar consumption. In theory, complete removal of sucrose from baked products is impossible without affecting some aspects of the final product's quality because, in addition to providing sweetness, sucrose has other important functions, such as in the structure of the dough, texture, and volume of the product, hygroscopicity. (Ahmad *et al*., 2020; Sukhmani *et al*., 2018) [2]

Sucrose is hygroscopic and competes with gluten for water retention, thus it can delay the production of gluten webs, resulting in a soft texture, and slowing starch gelatinization, providing the baked product a more porous structure and better volume expansion. Because of their low water content, cookies and biscuits exhibit crystallisation, which has a direct impact on their texture and look. When the water concentration is low, sucrose crystallises, resulting in a crunchy texture and a cracked surface, which is ideal in many cookies. Sucrose also plays a key role in colour and scent attributes due to its participation in the Maillard reaction and caramelization, producing a lovely brown bark colour and a distinct aroma to this product. As a result, reducing or replacing sucrose in sweetened baked goods necessitates prior research on the least amount of sugar and/or appropriate sugar alternatives that must be used to ensure fundamental functionality (Ahmad *et al*. 2020; Luo *et al*. 2019) [2].

Bread is one of the most popular bakery goods in the world, and although being one of the oldest, its technology has progressed via the use of new ingredients, equipment, and methods. Stevia, when used as a sucrose alternative in bread items, increases the sensory and nutritional aspects of the product. Total replacement of sucrose with a mixture of stevia and mannitol slows the fermentation of the dough and reduces the specific volume of bread while improving the nutritional value of bread by lowering the glycemic index and decreasing the energy value of bread. Recently, oatmeal cookies with different percentages of sucrose replaced with aqueous stevia extract were developed, and sensory properties such as appearance, taste, smell, and texture were evaluated, demonstrating that cookies with 25 and 50 percent sucrose replaced with stevia extract were the most accepted by judges, presenting a good smell, ideal texture, sweetness, and crunchiness, in contrast to cookies with 75 and 100 percent, which showed the lowest level of acceptance. Furthermore, a higher level of water activity was observed, suggesting the probability of moulds and yeasts developing, as opposed to those partially sweetened with stevia, which would be more stable (Vigneshwari K *et al*., 2020 & Góngora Salazar *et al*., 2018).

Jellified goods

The jams and jellies industry has advanced to significant technical levels, and research continues to improve the final product in all aspects, including organoleptic, health, and technological aspects. Because they are products that a large portion of the population consumes on a daily basis, one of the primary goals is to reduce the sugar content (approximately 60 percent of its formulation). Sugar, in addition to providing a sweet taste, helps to increase total soluble solids. The interaction with water and hydrocolloids affects the texture transition (gelation), which affects features such as colour, texture, and stability of jam and jelly (Schiatti-Sisó *et al*., 2022) [12]. For example, if a total sugar substitution is performed, the formation of undesired qualities such as the appearance and texture of low-calorie jam is a constant concern with high-intensity sweeteners. To address the textural issues caused by pectins and the lack of sugar in formulations, researchers created a blackberry jam containing sucralose, stevia, and agar-agar gelling. In contrast, no significant variations in texture were discovered between treatments, and it was determined that agar-agar could be utilized as a gelling ingredient in low-calorie jams, presenting a stiffness similar to pectin. As a result, many authors propose formulation changes during its preparation, such as partial substitution of sucrose or the use of alternative ingredients such as hydrocolloids and acid regulators, which allow the gelled product to be much more similar to the original (Sutwal *et al*. 2019; Márquez *et al*. 2016).

Conclusion

Stevia leaf powder and extract are high-intensity non-nutritive natural health promoters. Stevia has been discovered to be an excellent source of nutritional elements as well as functional qualities for value addition. Stevia can be used as whole or partial replacement for sucrose in conjunction with additives such as bulking agents, gelling agents, stabilisers, flavourings, and flavourings to improve the textural and sensory qualities of the finished product. The use of appropriate combinations of steviol glycosides allows for the control of the appearance of unpleasant flavours that influence the quality of the final product, as well as the improvement of the flavour profile of stevia through some structural alterations to the steviol glycoside molecules. As a result, stevia might be utilized as a natural sweetener; also, it has antioxidant and technological capabilities such as emulsifier, texturizing agent, and colouring agent, making it an excellent ingredient for generating functional products.

References

1. Gasmalla MA, Yang R, Hua X. *Stevia rebaudiana* Bertoni: An alternative sugar replacer and its application in food industry. Food Engineering Reviews. 2014 Dec;6(4):150-62.
2. Ahmad J, Khan I, Blundell R, Azzopardi J, Mahomoodally MF. *Stevia rebaudiana* Bertoni.: An updated review of its health benefits, industrial applications and safety. Trends in Food Science & Technology. 2020 Jun 1;100:177-89.
3. Singh DP, Kumari M, Prakash HG, Rao GP, Solomon S. Phytochemical and pharmacological importance of stevia: A calorie-free natural sweetener. Sugar Tech. 2019 Apr;21(2):227-34.
4. Peteliuk V, Rybchuk L, Bayliak M, Storey KB, Lushchak O. Natural sweetener *Stevia rebaudiana*: Functionalities, health benefits and potential risks. EXCLI journal. 2021;20:1412.
5. Khiraoui A, Hasib A, Al Faiz C, Amchra F, Bakha M, Boulli A. *Stevia rebaudiana* Bertoni (Honey Leaf): A magnificent natural bio-sweetener, biochemical composition, nutritional and therapeutic values. J. Nat. Sci. Res. 2017 Aug;7(12):75-85.
6. Kazmi A, Khan MA, Mohammad S, Ali A, Ali H. Biotechnological production of natural calorie free steviol glycosides in *Stevia rebaudiana*: an update on current scenario. Current Biotechnology. 2019 Jun 1;8(2):70-84.
7. Gupta P, Gupta N, Pawar AP, Birajdar SS, Natt AS, Singh HP. Role of sugar and sugar substitutes in dental caries: a review. International Scholarly Research Notices. 2013;2013.
8. Ferrazzano GF, Cantile T, Alcidi B, Coda M, Ingenito A, Zarrelli A, Di Fabio G, Pollio A. Is *Stevia rebaudiana* Bertoni a non cariogenic sweetener? A review. Molecules. 2015 Dec 26;21(1):38.
9. Hossain MF, Islam MT, Islam MA, Akhtar S. Cultivation and uses of stevia (*Stevia rebaudiana* Bertoni): A review. African Journal of Food, Agriculture, Nutrition and Development. 2017 Dec 5;17(4):12745-57.
10. Kroyer G. Stevioside and Stevia-sweetener in food: application, stability and interaction with food ingredients. Journal für Verbraucherschutz und Lebensmittelsicherheit. 2010 May;5(2):225-9.
11. Gasmalla MA, Yang R, Hua X. *Stevia rebaudiana* Bertoni: An alternative sugar replacer and its application in food industry. Food Engineering Reviews. 2014 Dec;6(4):150-62.
12. Schiatti-Sisó IP, Quintana SE, García-Zapateiro LA. Stevia (*Stevia rebaudiana*) as a common sugar substitute and its application in food matrices: an updated review. Journal of Food Science and Technology. 2022 Mar 2:1-0.
13. Ozdemir C, Arslaner A, Ozdemir S, Allahyari M. The production of ice cream using stevia as a sweetener. Journal of Food Science and Technology. 2015 Nov;52(11):7545-8.
14. Alizadeh M, Azizi-Lalabadi M, Kheirvari S. Physicochemical, sensory, rheological properties and glycemic index of fresh date ice cream. Journal of Scientific Research and Reports. 2014;3(4):621-9.