

DEVELOPMENT OF LOW-SUGAR DESSERTS USING NATURAL SWEETENERS

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ABSTRACT

The increasing consumption of sugar-rich foods has become an important nutritional and public-health concern. Desserts such as cakes, puddings, cookies, ice cream, mousse, and other confectionery products commonly contain considerable amounts of sucrose, which contributes sweetness as well as important functional properties such as texture, moisture retention, browning, and mouthfeel. The World Health Organization recommends reducing the intake of free sugars to less than 10% of total energy intake, with a further reduction to below 5% suggested as an additional health goal. represents an important opportunity for food product innovation. The present research focuses on the development of low-sugar desserts using naturally derived sweeteners such as stevia, dates/date paste, and other suitable natural sweetening ingredients. Natural sweeteners differ considerably in sweetness intensity, bulk, moisture content, flavor, color, and technological functionality. Stevia-derived sweeteners, for example, provide intense sweetness at low concentrations but may produce bitterness, lingering sweetness, or herbal/licorice-like aftertaste. Recent research indicates that blending stevia with bulk ingredients such as erythritol, allulose, dietary fiber, or other matrix components can help compensate for losses in bulk. The study will involve formulation and standardization of selected low-sugar dessert products, followed by evaluation of their sensory characteristics, physical properties, nutritional composition, and consumer acceptability. A control formulation containing conventional sucrose will be compared with formulations containing selected natural sweeteners or sweetener combinations. Sensory attributes including appearance, color, aroma, taste, texture, sweetness, aftertaste, and overall acceptability will be assessed using a hedonic scale. The research is expected to identify formulations capable of reducing sugar while maintaining desirable sensory and functional qualities. The findings may contribute to the development of more nutritionally conscious dessert products suitable for consumers seeking reduced-sugar alternatives.

KEYWORDS: *Low-sugar desserts; natural sweeteners; stevia; date paste; erythritol; sugar reduction; sensory evaluation; product development; consumer acceptability; food formulation.*

INTRODUCTION

Sugar is one of the most widely used ingredients in dessert and confectionery products. It provides sweetness and contributes substantially to the sensory characteristics that consumers associate with cakes, biscuits, puddings, ice cream, desserts, and other sweet foods. However, excessive consumption of free sugars is a nutritional concern because high sugar intake can contribute to excessive energy intake and is associated with dental caries and unhealthy weight gain. The World Health Organization recommends that adults and children reduce free-sugar consumption to less than 10% of total energy intake and suggests that reducing intake below 5% may provide additional health benefits. Desserts are particularly relevant to sugar-reduction research because many traditional recipes depend on relatively large quantities of sucrose. Reducing sugar in such products is not always straightforward. Sucrose is not simply a sweetening agent. In baked products, for example, sugar contributes to texture, moisture retention, browning, flavor development, and overall structure. Consequently, simply removing a substantial proportion of sucrose may result in products that are less acceptable to consumers. Research on pastry products has shown that sugar replacement can affect texture. The development of low-sugar desserts therefore requires more than replacing sucrose with

another sweet substance. Mazzocchi, C., Møller, A. H., Benucci, I., Esti, M., & Dalsgaard, T. K. (2025). Found that The formulation must reproduce, as far as possible, the sensory and technological functions of sugar while lowering the amount of free sugar in the final product. This has stimulated interest in naturally derived sweeteners and sweetening ingredients.

Natural sweeteners encompass a diverse group of substances. They include high-intensity sweeteners such as steviol glycosides from *Stevia rebaudiana*, as well as bulk sweetening ingredients and naturally occurring carbohydrates such as certain polyols and rare sugars. Sharma, R., Arti, Junaid, P. M., & Patel, M. K. (2025). explained A recent comprehensive review classified natural sweeteners into non-nutritive sweeteners and bulk sweeteners, including polyols such as erythritol and rare sugars such as tagatose and allulose. The review also emphasized that these ingredients can influence food structure and sensory Stevia has attracted considerable interest in reduced-sugar food development because steviol glycosides have a high sweetness intensity and can therefore be used at relatively low concentrations. Their use can reduce the quantity of sucrose required in a formulation. However, stevia does not completely reproduce all of the technological functions of sugar. Some consumers perceive stevia-containing foods as having bitterness, lingering sweetness, herbal notes, or a thinner mouthfeel. Recent research specifically examining stevia-derived sweeteners in reduced-sugar foods has identified .One strategy for addressing these limitations is the use of sweetener blends. Instead of depending on one sweetener, a formulation may combine an intense natural sweetener with a bulk ingredient. Such combinations may provide a more balanced sweetness profile while helping compensate for the loss of solids caused by sucrose reduction. Research on reduced-sugar foods indicates that combinations involving stevia with erythritol, allulose, dietary fiber, or other food-matrix components may improve Date-based ingredients represent another interesting approach. Dates contain naturally occurring sugars together with dietary fiber, minerals, and other components. Date paste can also contribute color, flavor, moisture, and bulk to food products.

However, because dates and date-derived ingredients contain naturally occurring sugars, they should not automatically be considered equivalent to non-caloric sweeteners. In the context of this study, date paste would therefore be investigated primarily as a naturally derived sweetening and bulking ingredient and its total sugar contribution would be measured rather than assuming that “natural” means “sugar-free.”The distinction between low-sugar and sugar-free is important in product development. A low-sugar product contains less sugar than a conventional comparison product, whereas a sugar-free formulation involves much stricter criteria depending on the applicable food-labeling regulations. Consequently, the present study focuses on reduction of sugar rather than claiming complete elimination of sugar.Consumer acceptance is another essential component of low-sugar dessert development. A product may have a favorable nutritional profile but fail commercially if consumers dislike its taste or texture. Sensory evaluation therefore provides an important method for determining whether a reformulated dessert remains acceptable. Malila, Y., Owolabi, I. O., Chotanaphuti, T., Sakdibhornssup, N., Elliott, C. T., Visessanguan, W., ... & Petchkongkaew, A. (2024). Found that Research on ice cream containing different combinations of sweeteners has demonstrated the importance of sensory profiling and consumer acceptance when replacing sucrose. In one study involving 106 consumers, combinations of sweetening agents producedThe challenge is particularly important because

sugar performs multiple technological functions. In baked foods, sucrose contributes not only sweetness but also browning through reactions occurring during heating, moisture management, texture, and flavor. When sucrose is reduced, these properties can change even if sweetness is successfully development requires consideration of the entire food matrix rather than sweetness alone.

Natural sweeteners may also differ substantially in their energy contribution, sweetness intensity, digestive behavior, and sensory characteristics. For example, erythritol is a sugar alcohol that is absorbed to a large extent and provides very little metabolizable energy; however, it can produce a cooling sensation and may have These characteristics demonstrate why selection of sweeteners should be based on both nutritional and technological considerations. Şengül, E., & Tekin, S. Effects of Gallic Acid on Nrf-2 and HO-1 Levels on ACR-Induced Kidney Damage in Rats.explains The increasing demand for healthier food choices creates an opportunity to investigate desserts that maintain desirable sensory characteristics while containing less conventional sugar. A successful low-sugar dessert should ideally retain acceptable appearance, aroma, taste, sweetness, texture, and overall palatability. Liakos, K. G., Athanasiadis, V., Bozinou, E., & Lalas, S. I. (2025). Explines It should also be practical to prepare using ingredients that are accessible and appropriate for the intended consumer group.The present research will therefore focus on the development, standardization, and sensory evaluation of low-sugar desserts prepared with natural sweeteners. Different formulations will be developed and compared with a conventional control. The study will investigate how natural sweeteners influence sensory characteristics and selected physical and nutritional properties.The research is relevant to food science because sugar reduction involves both nutritional and technological challenges. It is also relevant to nutrition and food product development because consumers increasingly seek products that combine desirable taste with improved nutritional characteristics. By identifying suitable formulations, this research may provide a basis for developing reduced-sugar dessert products for health-conscious consumers.

RESEARCH OBJECTIVE

- 1 To develop and evaluate low-sugar dessert formulations using selected natural sweeteners and determine their sensory acceptability compared with a conventional sugar-sweetened dessert.

RESEARCH QUESTION

- 1 Can natural sweeteners be used to develop low-sugar desserts with acceptable sensory characteristics and consumer acceptability compared with conventional sugar-sweetened desserts?

LITERATURE REVIEW

Sucrose is traditionally used in desserts because it provides a characteristic sweet taste and performs several technological functions. In baked products, it affects moisture, texture, color, flavor development, and structure. Consequently, sugar reduction can cause changes beyond sweetness. A review of non-caloric sweeteners in pastry products reported that sucrose replacement may influence texture, mouthfeel, color, moisture. The technological role of sucrose makes product reformulation challenging. When sucrose is removed, the product loses solids as well as sweetness. A high-intensity sweetener can restore sweetness, but it generally cannot replace the physical volume or structural contribution of the removed sugar. Therefore, additional ingredients may be required to compensate for these losses. This is particularly important in products such as cakes and cookies. Sugar contributes to the development of desirable color and flavor during heating, while also affecting the final texture. A reduction that is nutritionally desirable may therefore result in a product that is dry, dense, pale, brittle, or otherwise different from the conventional product. The relationship between high free-sugar consumption and dietary health has generated considerable attention. The WHO recommends reducing free sugars to below 10% of total energy intake in both adults and children and suggests that intake below 5% may provide additional benefits. The WHO guideline specifically considers evidence related to unhealthy weight gain and dental caries. It defines free sugars to include sugars added to foods by manufacturers, cooks, or consumers, as well as sugars naturally present in honey, syrups, fruit juices. These recommendations have encouraged researchers and food manufacturers to investigate strategies for reducing sugar in commonly consumed foods.

Dessert reformulation is particularly relevant because desserts frequently contain substantial quantities of added sugar. However, a reduction in sugar should not be interpreted as automatically making a product nutritionally ideal. Zhan, Y., Lin, Z., Liang, J., Sun, R., Li, Y., Lin, B., ... & Yang, Z. (2024). A dessert may contain less sugar but still contain considerable amounts of fat, energy, or other ingredients. Therefore, product development should evaluate the complete nutritional profile rather than focusing exclusively on sugar. Natural sweeteners have received increasing research attention as possible alternatives to conventional sucrose. They include plant-derived intense sweeteners and naturally occurring bulk sweeteners. A recent comprehensive review describes natural sweeteners as including non-nutritive compounds such as stevia and bulk sweeteners such as erythritol, maltitol, mannitol, tagatose, and allulose. The principal attraction of natural sweeteners is their potential to provide sweetness while allowing reduction of conventional sucrose. However, each sweetener has specific advantages and limitations. Sweetness intensity, aftertaste, bulk, solubility, thermal stability, moisture interaction, and effects on texture can differ substantially. Consequently, natural sweeteners should not be regarded as interchangeable. Their suitability depends on the type of dessert and the desired final characteristics. Stevia-derived sweeteners are obtained from compounds known as steviol glycosides. They are intensely sweet and can be used in relatively small quantities. This characteristic makes them attractive for reducing sucrose in foods.

Recent research describes stevia-derived sweeteners as widely used in reduced-sugar and sugar-free foods because of their high sweetness intensity and low energy contribution. Ali,

R. M., Shoaib, M., Mansoor, F., Bashir, S., & Arshad, H. (2026). explainsA formulation may therefore require optimization of the concentration of stevia rather than simply replacing sucrose on a one-to-one basis.Recent research also indicates that stevia can be combined with other ingredients to improve its performance. Combinations involving erythritol, allulose, dietary fiber, and other matrix components may help compensate for reductions in bulk Erythritol is a sugar alcohol that occurs naturally in some foods and is also commercially produced through fermentation. It provides very little metabolizable energy and is commonly used in reduced-calorie food formulations. A recent review reports that erythritol is absorbed to a large extent and is subsequently excreted, with little reachingOne limitation is that erythritol can produce a cooling sensation in the mouth. Its sweetness is also lower than that of sucrose, meaning that it may need to be combined with a high-intensity sweetener when a strong sweetness level is required. Excessive intake of sugar alcohols can also cause gastrointestinal effects in some)From a formulation perspective, erythritol can provide bulk that a high-intensity sweetener such as stevia cannot provide. Therefore, combinations may offer better functionality than either ingredient alone.

Dates are an important naturally sweet fruit and are commonly used in traditional foods. Date paste can provide sweetness, moisture, bulk, color, and characteristic flavor. These characteristics may be beneficial in desserts where replacing some sucrose while maintaining body and moisture is important.However, date paste should not be described as a sugar-free ingredient. Dates contain naturally occurring sugars, and the resulting formulation may still contain substantial total sugars. The nutritional value of a date-sweetened dessert should therefore be determined analytically or through appropriate nutritional calculation.The principal research interest in date paste is its ability to function as more than a sweetener. Unlike highly purified intense sweeteners, date paste can contribute physical solids and flavor to a formulation. This may make it useful in products such as energy balls, cookies, bars, puddings, and certain baked desserts.

METHODOLOGY

The study will adopt a quantitative research approach to develop low-sugar desserts using natural sweeteners as alternatives to refined sugar. The research will focus on developing different dessert formulations by varying the type and/or level of natural sweeteners. The developed products will be evaluated for sensory characteristics such as taste, sweetness, colour, aroma, texture, appearance, and overall acceptability. Nutritional characteristics, particularly sugar and energy content, may also be assessed where laboratory facilities are available. The present study was conducted to develop low-sugar desserts using natural sweeteners as alternatives to conventional refined sugar. A quantitative experimental research approach was adopted to investigate the effect of different natural sweeteners and their substitution levels on the sensory quality, nutritional characteristics, and overall acceptability of the developed desserts. The research began with the selection of suitable natural sweeteners based on their availability, sweetness, functional properties, cost, and suitability for dessert preparation. Natural sweeteners such as date paste, date powder, stevia, honey, or other suitable naturally derived sweeteners may be selected according to the requirements of the product. A standard dessert recipe containing refined sugar was prepared as the control sample, while several experimental formulations were prepared by replacing different

proportions of refined sugar with the selected natural sweeteners. The formulations were coded as T0, T1, T2, T3, and T4, where T0 represented the control and the remaining treatments represented different levels of natural-sweetener substitution. Before final product development, preliminary trials were conducted to determine the appropriate quantity of each natural sweetener. During these trials, attention was given to taste, sweetness, colour, aroma, texture, consistency, appearance, and overall quality. The most suitable formulations were selected for further evaluation. All ingredients were accurately weighed and measured, and the same preparation procedure was followed for each treatment to ensure consistency.

RESEARCH DESIGN

An experimental research design will be used. A standard dessert prepared with refined sugar will serve as the control sample, while experimental samples will be prepared using selected natural sweeteners such as stevia, dates/date paste, honey, or other suitable alternatives. Different formulations will be developed by replacing refined sugar at predetermined levels, for example, 25%, 50%, 75%, and 100%, depending on the characteristics of the selected sweetener. All other ingredients and preparation conditions will be kept constant to ensure a fair comparison. The developed desserts will undergo sensory evaluation by a selected group of panelists. A 9-point hedonic scale can be used, ranging from 1 = "dislike extremely" to 9 = "like extremely." The panelists will evaluate: The formulation with acceptable sensory characteristics and reduced refined-sugar content will be selected for further analysis. The selected sweeteners were obtained from reliable sources and stored under appropriate conditions before use. Any sweetener showing signs of spoilage, contamination, unusual odour, or deterioration was excluded. The selection of sweeteners was also based on their technological properties. For example, date paste may contribute sweetness, moisture, colour, and bulk, whereas stevia provides intense sweetness in a much smaller quantity. Therefore, the substitution levels were adjusted according to the characteristics of each sweetener rather than assuming that all sweeteners could be substituted for sugar on an equal-weight basis. A standard dessert recipe was selected as the basis for the research. The control formulation contained refined sugar according to the original standardized recipe. All ingredients were measured accurately using appropriate weighing equipment. The control product was prepared under standardized conditions. The preparation method, cooking or baking temperature, processing time, cooling conditions, and serving size were recorded. This formulation served as the reference sample for comparison with the experimental products.

DATA ANALYSIS

The collected data will be organized and analyzed using Microsoft Excel and/or SPSS. Descriptive statistics such as mean, standard deviation, frequency, and percentage will be calculated for the sensory evaluation results. The mean sensory scores of the control and experimental samples will be compared. One-way Analysis of Variance (ANOVA) will be used to determine whether there are statistically significant differences among the different formulations. Where significant differences are observed, an appropriate post-hoc test such as Tukey's test may be applied. The level of statistical significance will be set at $p < 0.05$. Results will be presented through tables and graphs to facilitate comparison between the

control and experimental desserts. The findings will be interpreted to determine how the use of natural sweeteners influences the sensory acceptability and sugar reduction of the developed desserts. Below is a long, thesis-style “Findings” section for the research topic “Development of Low-Sugar Desserts Using Natural Sweeteners.” Since you have not provided actual experimental results, the wording is framed as a sample findings section; replace the illustrative trends or values with your real data. The dessert was prepared according to a standardized procedure. Ingredients were first measured and prepared separately. Dry and liquid ingredients were handled according to the requirements of the selected dessert. The natural sweetener was incorporated at the appropriate stage of preparation. For baked desserts, the prepared mixture was transferred into standardized baking containers and baked at a predetermined temperature and time. For cooked desserts, the mixture was processed under controlled heating conditions until the desired consistency was obtained. After preparation, all samples were allowed to cool under similar conditions. Each sample was then portioned equally for sensory evaluation. The preparation procedure was recorded in detail so that the final formulation could be reproduced in future studies.

FINDINGS

The present study was conducted to develop low-sugar desserts using natural sweeteners and to evaluate their sensory acceptability and nutritional characteristics. The study focused on reducing the use of refined sugar while maintaining desirable taste, texture, appearance, aroma, and overall acceptability. Different formulations of the selected dessert were prepared using natural sweeteners at varying substitution levels and were compared with a control formulation prepared using conventional refined sugar. The development process showed that natural sweeteners can be incorporated into dessert formulations while maintaining acceptable product quality. The control formulation provided the standard for comparison because it contained conventional refined sugar. The experimental formulations were prepared by replacing different proportions of refined sugar with selected natural sweeteners. The results indicated that the level and type of natural sweetener had an important effect on the physical and sensory characteristics of the desserts. Formulations containing lower to moderate levels of natural sweeteners generally showed characteristics closer to the control sample. As the level of substitution increased, noticeable changes were observed in sweetness, colour, flavour, texture, and overall appearance. The use of natural sweeteners also influenced the appearance of the desserts.

Some natural sweeteners contributed additional colour to the products, particularly those derived from fruits or other naturally coloured ingredients. Although this change in colour was different from the control, it was generally acceptable when it was consistent with the expected characteristics of the dessert. Sensory evaluation was an important component of the study because reducing refined sugar can affect the acceptability of a dessert. The panelists evaluated the developed formulations on the basis of colour, aroma, taste, sweetness, texture, appearance, and overall acceptability. The colour scores showed differences between the control and experimental formulations. The control sample generally maintained the colour associated with the conventional recipe, whereas formulations containing certain natural sweeteners showed a slightly darker or different colour. The change in colour was particularly noticeable at higher substitution levels. This can be attributed to the natural colour of some

sweeteners and, in some cases, browning reactions during heating or baking. Despite these differences, moderate-substitution formulations were generally perceived as visually acceptable. The developed desserts were also affected by the type of natural sweetener used. Some sweeteners contributed a characteristic aroma that was distinguishable from the control. At lower or moderate levels, this additional aroma was generally acceptable and contributed to the overall sensory profile of the dessert. At higher levels of substitution, however, the characteristic aroma of the natural sweetener became more prominent. This indicates that the selection and concentration of a natural sweetener are important factors when developing low-sugar desserts. Taste was one of the most important sensory attributes evaluated in the study. The findings indicated that moderate substitution of refined sugar with natural sweeteners could produce desserts with acceptable taste. The control formulation was expected to receive a high taste score because refined sugar provides a familiar sweetness profile. Experimental formulations with moderate natural-sweetener substitution also demonstrated acceptable taste, indicating that complete dependence on refined sugar is not necessarily required to produce a satisfactory dessert. However, higher substitution levels sometimes resulted in noticeable differences in flavour.

CONCLUSION

The present study was undertaken to develop low-sugar desserts using natural sweeteners as alternatives to conventional refined sugar and to evaluate the sensory acceptability and overall quality of the developed products. The study was based on the increasing interest in reducing refined sugar consumption while maintaining the desirable sensory characteristics that consumers expect from dessert products. The findings of the study demonstrated that natural sweeteners have considerable potential for incorporation into low-sugar dessert formulations. Different natural sweeteners can provide sweetness while also influencing important characteristics such as taste, colour, aroma, texture, appearance, and overall acceptability. However, the results also indicated that the successful development of a low-sugar dessert depends on the type and concentration of the natural sweetener and cannot be achieved simply by replacing refined sugar without modifying the formulation. The development of the experimental formulations showed that reducing refined sugar resulted in observable differences in the characteristics of the desserts. The control formulation prepared with conventional sugar provided the standard sensory profile against which the experimental formulations were compared. The formulations containing natural sweeteners showed variations in sweetness, flavour, colour, texture, and appearance. These differences were more noticeable at higher levels of substitution, while moderate levels of substitution generally allowed the products to retain acceptable sensory characteristics. The sensory evaluation further demonstrated the importance of consumer acceptability in the development of low-sugar desserts. Taste and sweetness were particularly important attributes because consumers generally associate desserts with a pleasant and recognizable sweet flavour. The findings indicated that an appropriate level of natural sweetener could provide satisfactory sweetness without substantially reducing the acceptability of the product.

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