CHANGE IN TRENDS OF NEW PRODUCT DEVELOPMENT WITH THE USE OF NATURAL SUGAR SUBSTITUTES

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ABSTRACT: Sugar is an impenetrable part of the food we consume. But copious sugar is not salutary option for our health because it may lead to higher blood pressure, Weight gain, inflammation and other health risks. Presently food industry is emphasis on surrogating of white sugar with natural sugar substitutes. Natural ingredients are steadily becoming more prominent among connoisseur, and the growing relevance of naturalness among consumers has had significant repercussions for the food sector as a result of natural sugar substitutes are adopted by many foods industry for development of new goods. A natural sugar substitutes like honey, date sugar, stevia, agave nectar, maple syrup, molasses etc enhancing sweet taste in food product as well as add some nutritional value too. They are also affected texture, color and caloric content of goods. These natural sugar substitutes are sweeter than white sugar and acquire vogue among connoisseur, due to their lower caloric and glycemic indices, as well as anticariogenic properties. This review article centered on change in trends of new product development with the use of natural sugar substitute and also includes special consciousness to their use and impact on consumer health.

Keyword: *Agave nectar, Food products, Natural sweetener, Product development, Stevia etc.*

Presently, the trends towards vigor, physique, and well-being have become more popular among the devourer. As they attempt to make healthier food choices, consumers are requesting a broader selection of low-calorie items. Natural ingredients are steadily becoming more popular amidst devourer, and the growing relevance of naturalness among devourer has significant repercussions for the food industries (Ariana Saraiva, 2020). Food industries has alternate their way towards developing new food products by replacing white sugar with natural sugar substitutes. A natural sugar substitute is food ingredients that imitate the taste of sugar but has lower calorie content (Kirtida R. Tandel, 2011). Due to difference in proportions of sucrose and fructose content in natural sweeteners, they are slowly engrossed by the body and have a lower glycemic index than white sugar. This succor is to retain blood sugar levels in a healthy range, erecting them healthier sugar substitutes that can also be utilized by diabetics. The main focus of this review were to provide details on and understand natural sugar substitute in new product development, as well as their impact on devourer health and in food industry. Special emphasis was paid to natural sweeteners that are universally regarded as having a nice taste, high solubility, and high stability, as well as being safe and having an acceptable cost-on-use, specifically Agave syrup, Date syrup, Honey, Maple syrup, Molasses, Stevia.

NOTABILITY OF NATURAL SUGAR SUBSTITUTE IN NEW PRODUCT DEVELOPMENT

The most luscious taste is 'sweet', which stimulates our senses and persistent the quality of food product (Reberto Castro-Munoz,2016). A high sugar intake is linked to an increased risk of type- 2 diabetes, obesity, cardiovascular disease, and dental decay (Carocho et al., 2017). Consumers are more aware and concerned about their sugar levels than ever before, and are actively searching out healthier food options, such as reduced sugar, sugar from natural sources, and unaltered flavor. Consumer demand have engender the food industry to produce significant R&D investment to develop new products using natural sweeteners (Olivo, 2019). Sweeteners are basically chemical compounds that are found in nature and chemically synthesized component with sweet taste that influences their consumption as sweetening agents (Małgorzata Grembecka, 2015). Nearly a billion people today have an insufficient diet, Which is often high in processed food, added sugars, and solid fat. People become overweight or obese as a result of this scenario, which is linked to the development of non communicable diseases like diabetes and coronary heart disease. As a result, they're seeking for sugar substitutes that are also nutritious. Although natural sweeteners are usually considered harmless and contain several important nutrients such as vitamins and minerals, due to this reason food industries are changing trends in new product development by using natural sweeteners. Replacing white sugar with natural sweeteners reduces calorie intake of consumers

(Christopher Gardner, 2012). Natural sweeteners not only affect the color, flavor, texture and preservation of developed product but also decrease several health risks like diabetes, coronary heart diseases and control weight gain.

NATURAL SWEETENERS: Sweeteners are functional food additives that impart sweetness in food (DuBois GE, 2012). Natural sweeteners are sugar and sugar alternatives that provide sugar like taste while contributing to lower calorie than sugar with possible other health benefits such as enhancing digestibility. Natural sweeteners are categorized into saccharide and non-saccharide sweeteners (Surana SJ, 2006). Natural sweeteners are extracting from fruits, leaves and other parts of plants. Despite the fact that natural sugar substitutes may contain useful bioactive chemicals, particularly polyphenolic compounds, known and appreciated for their antioxidant effects, many additional natural alternatives to sugar are accessible but not commonly used (Arpita Das, 2016). Plant saps/syrups (e.g., maple syrup, agave nectar), raw sugar and grain syrups (e.g., molasses, barley malt, and brown rice syrup), honey, and fruit or vegetable sugars are some of the naturalsugar alternatives (e.g., date sugar, carrot).

NATURAL SWEETENERS USED IN NEW PRODUCT DEVELOPMENT

The natural sweetener which are generally used in new product development and have many health benefits, some of them are discussed here:

Agave syrup: Agave nectar or agave syrup is a natural sweetener extracted from its fructan hydrolysis. The nectar, its principle carbohydrate reserve in the form of fructans, is stored in the agave core (pina ˜ in Spanish) of the Agave ssp. plant. Growing in arid and semi-arid environments, the Agave genus uses a crassulacean acid metabolism and photosynthetic adaptation to the periodic water supply (Roberto Castro-Munoz,2016). When agave pines are cooked, a naturally sweet material is generated (Erika Mellado, 2015). Agave nectar is a low-glycemic, slow-release carbohydrate with a strong prebiotic capacity (Ozuna et al, 2020). Agave also has a high fructose content (90%) and low glucose levels, which could be a drawback because long-term fructose consumption can lead to insulin resistance and the development of type 2 diabetes (Gardner, 2017). Because of its low bitterness that does not grow with concentration, agave nectar is a suitable sugar alternative (McCain, Kaliappan, & Drake, 2018). Agave syrup is utilized in the development of food products such as cookies, granola bars, and muffins. Agave syrup reduced the amount of sugar in the finished product while keeping the organoleptic features that consumer's desire.

DATE SYRUP: Date syrup is extracted product from dates, are fruit trees(Phoenix dactylifera L.) in the Midle East region, recognize as a dark brown substance. The relevance of the date fruit is based on its high carbohydrate content (70–80% w/w), dietary fibre (8.7%), amino acids, proteins (1.8%), vitamins, salts, and minerals (Roberto Castro-Munoz, 2016). It also has at least six vitamins, including B1 thiamine, B2 riboflavin, nicotinic acid, vitamins A and C, and nicotinic acid (28. Ibrahim et al., 2020). Dates have a high nutritional value and are a rich source of minerals. It contains a lot of antioxidants, has a low glycemic index, and could be a good sweetener for diabetics (Farahnaky et al, 2016). Although date sugar is high in fibre, vitamins, and minerals, it only comprises 50–70% sugar molecules, which directly affect certain of the required physical qualities (such as solubility), restricting its use in the bakery business (Kumar, Ali, & Manickavasagan, 2020). Date syrup, on the other hand, is an useful sugar substitute in ice cream and yoghurts because it helps preserve good organoleptic features.

HONEY: Honey is defined as "a naturally delicious material generated by honey bees from plant nectar or secretions of living plant components" (Codex Alimentarius Commission, 2001). From the dawn of human history, honey has been the only natural sweetener available. The relationship between man and honey dates back to the Stone Age (Bogdanov et al., 2008). Around 200 different compounds can be found in honey. Monosaccharides account for around 75% of the sugars in honey, with disaccharides accounting for 10%–15% and miscellaneous sugars accounting for the remaining 5%–15%. Honey's energy value and viscosity are due to the sugars it contains (Da Silva et al., 2016). It contains vitamins, proteins, amino acids, and polyphenols with a high total nutritional value, in addition to being a natural carbohydrate source (Muhammad & Sarbon, 2021; Vara et al., 2019). Honey's high caloric content has earned it a reputation as a natural energy booster. This trait appeals to cereal and bar manufacturers, who use honey not just as a sweetener and flavor enhancer, but also as a functional ingredient (Vara et al., 2019). Its viscosity functions as a binder, assisting in the compactness of the cereal mixture in cereal bars. Sugar is still the most commonly utilized sweetener in new products, despite the promising features presented by cereal and bar products. By 2016, sugar was used in 78 percent of cereals and bars on the market, while honey was used in only 21% of them (NHB, 2021). Interestingly, honey has been used in the fermentation process in the brewing industry for millennia. Fermented beverages made from wild grapes, hawthorn, and rice have been discovered.

4. MAPLE SYRUP

Maple syrup is a natural sweetener made from a variety of maple tree species native to Canada, the most prevalent of which being Acer saccharum Marsh (Garcia et al., 2020). Maple syrup includes phenolic chemicals, which provide it antioxidant, anti-mutagenic, and anti-proliferative characteristics in humans (Reberto Castro-Munoz, 2016). There are four types of maple syrup: golden, amber, dark, and very dark (Brochu et al, 2019). A darker colour is linked to increased phenolic chemicals (e.g., protocatechuic acid, coniferyl alcohol, vanillin) and mineral content, according to recent research (Nimalaratne et al., 2020). Another natural sugar that has been suggested as a healthier sweetener option is maple syrup. Maple syrup also contains a large amount of the phytohormone abscisic acid, which has anti-diabetic properties (Mellado-mojica et al., 2016). Additionally, since- glucosidase activity suppression, which reduces glucose absorption in the intestine, maple syrup ingestion can lessen glycemic and insulin responses (Mora & Dando, 2021). The main application of maple syrup is used in new product development in bakery products, pancakes, beverages, snacks, sweet savory popcorn, fluffy mouses, soups.

5. MOLASSES

Molasses is a general phrase that refers to sugarcane or sugar beet juice that has been condensed. This sweetener is made from the residual syrups of the sucrose crystallisation process, where crystallisation inhibitors collect. Molasses is the name given to these syrups, which are primarily employed as livestock feed and as a substrate for ethanol production (Palmonari et al., 2020). The molasses' approximate compositions correspond to 17–25 percent water, 30–40 percent sucrose, 4–9 percent glucose, and 5–12 percent fructose, depending on the syrup's recovery stage. A number of substances, including as amino acids and vitamins, are also present in minor amounts (Reberto Castro-Munoz, 2016). Molasses extracts have been shown to improve infection resistance and auto-inflammatory activity by retaining high-added-value components (e.g., phenolics) from their sources. Furthermore, molasses is regarded as a low-cost antioxidant source (Chen et al., 2015). Molasses also has some unique food processing capabilities, such as hiding unpleasant flavors. Molasses is used as a coloring ingredient, particularly in baked foods, where it imparts golden, black, and brown hues that improve the visual appeal. Molasses is a sweetener that can be used in dairy products such as yoghurts (Noureldin et al., 2020). Molasses is also utilized as a carbon source in industrial-scale fermentation, such as the Saccharomyces cerevisiae yeast fermentation for bread and the generation of food-grade ethanol (Wu et al., 2020).

STEVIA: Stevia Rebaudiana is a South American perennial herb plant known for its highly sweet taste and prospective pharmaceutical and medical uses (Lemus-Mondaca et al., 2015). Stevia's sweetness is due to diterpene glycosides molecules, notably stevioside and rebaudioside. Rebaudiana has gotten a lot of attention from scientists and industry because of its nutritional benefits and potential as a sucrose substitute in commercial food items (Bursa'c Kovacevic, Maras, et al., 2018). In the food sector, sweeteners are the most significant components. Because its source is natural, stevia extract could be a preferred sweetener above other low-calorie sweeteners (saccharin, aspartame), which may appeal to health-conscious consumers. Stevia sweetener is heat-stable up to 200°C, acid-stable, and non-fermentable, making it appropriate for usage in a variety of food applications (Kroyer G, 2010). Many worldwide food firms use stevia in their goods, including Coca-Cola, which employs the sweetest sections of the Stevia plant in its Diet Coke in Japan and submitted patent applications in 2007 to extract the sweetest parts of the Stevia plant. It wants to produce and promote "rebina" for use in its drinks (prakash, 2008). Stevioside exhibited good stability in tea and coffee beverages at increased temperatures for 1 hour, up to 120 °C. Stevia could be beneficial to the baking business as well. Only a small amount of Stevia leaf powder can be used to sweeten cooked and baked foods like puddings and cakes. Stevioside is non-fermentable and has no browning reaction when cooked. Furthermore, stevi-oside is found in chewing gum, mints, mouthwashes, toothpaste, and several cosmetics. This low-calorie natural sweetener is widely used in a variety of foods, including biscuits, jams, chocolates, ice creams, baked foods, soft drinks, and fruit drinks (Goyal 2010, Jayaraman,2003), sauces, sweet corn, delicacies, pickles (Tadhani, 2006, hossain 2010), candies, sea foods (karyama 2003), and the common beverages like dip tea, coffee, and herbal tea.

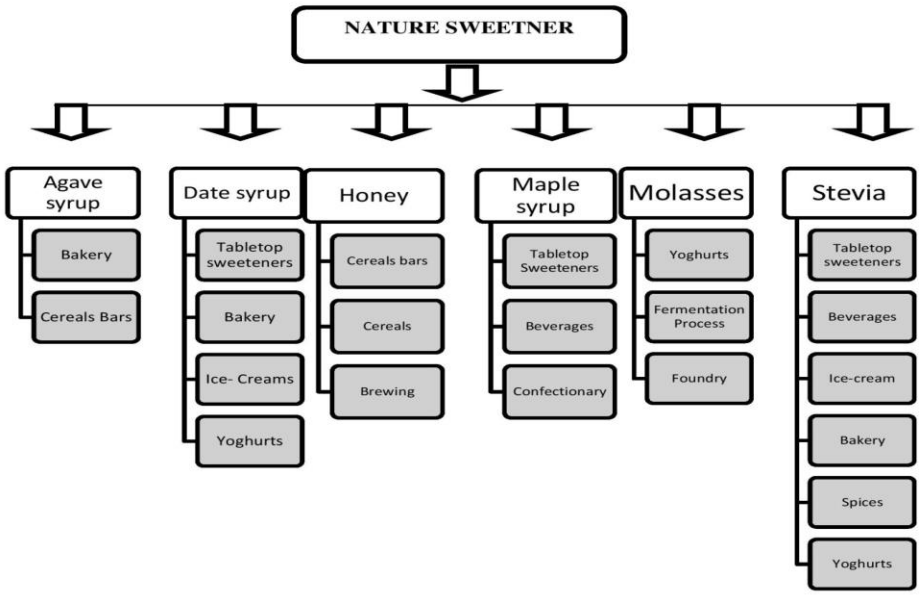

Figure- Present Applications of natural sweeteners in new products development

CONCLUSION AND FUTURE TRENDS OF NEW PRODUCT DEVELOPMENT

Throughout this review, contemporary uses of natural sweeteners in the food industry were considered, including current practices in new product development. Their main compositions as well as health benefits in sweetened food products were analyzed. Although the reviewed natural sweeteners may change many properties of developed products and have several health-related advantages that directly influence their consumption pattern. Several emerging techniques to enhancing physiochemical quality new product and benefits of replacing white sugar with natural sugar alternatives are discussed.

The applications of natural sweeteners in new food product are highly rely on the organoleptic properties, structure and texture, and the added value they confer to different products. As the food processing industry reconnoitered more sweetening alternatives to meet consumer demands. The trends for sugar replacement, food industries uses large-scale applications which have been lengthen to dairy products (mainly yoghurt), bakery goods, beverages, and even fermentation processes. More predominantly, presently market trends indicate that healthier, nutritious and minimally processed food products are required.

This represents a golden opportunity for the food industries and natural sweeteners products may play a vital role in consumer health and market. Sorghum syrup, palm sugar and monk fruit are the rising natural sweeteners that could be used in the near future. Presently the applications of these sweeteners are still limited in new product development. Several techniques to include them in food formulations, such as in yoghurt, skim milk and chocolate products, divulge that these natural sweeteners enhance the final products' organoleptic properties positively. Further studies concerning the more in health benefits for consumer, their cost effectiveness and protection of these minimally explored natural sweeteners are needed to widen their industrial use.

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