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A REVIEW STUDY ON VARIOUS TYPES SUGARS& THEIR FUNCTIONAL PROPERTIES

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ABSTRACT

Sugar is a carbohydrate building block that may be found naturally in a variety of foods such as fruit, milk, vegetables, and grains. Added sugar, on the other hand, can be found in flavored yogurt, sweetened drinks, baked goods, and cereals, and it is extensively utilized in industry. Carbohydrates come in a variety of forms, including monosaccharide and polysaccharide, and have a variety of characteristics in the food business and nutritionally. Sugars serve a variety of functions in the food business, including preservation, antioxidants, and the enhancement of color, taste, and texture, in addition to their primary function of sweetness. Many foods rich in added sugar offer energy, but they are also low in other nutrients, affecting the balance of nutrients such as minerals, vitamins, and proteins. As a result, excessive sugar consumption is very hazardous, particularly at crucial periods such as infancy, pregnancy, and aging. To maintain the body healthy, it's critical to limit the amount of high-sugar foods consumed. This page discusses the many kinds of sugars, their role in diet, and their health implications.

KEYWORDS: *Added Sugar, Nutrients, Sugars, Health, Functional*

1. INTRODUCTION

Sugar, which is typically sucrose, is a natural, nontoxic, sweet tasting, water soluble crystalline carbohydrate that provides the body with 4K.calories per gram. Beet sugar or cane sugar is the most common source of sugar; however, other sources include honey, corn syrup, fruits and vegetables, and so on. Sugar's main purpose in food is to give sweetness and energy; however, sugar also plays a critical part in preservation, fermentation, color, and texture. Because a rise in sugar consumption has been linked to a variety of diseases, including obesity, cardiovascular disease, and type 2 diabetes in recent years, food organizations have established stringent guidelines for assessing sugar intake in diets**[1]–[3].**

1.1.Sugar's History:

Sugar has been manufactured in India since ancient times; it was once costly, therefore honey was more often used for sweetening throughout the globe. Sugarcane was a tropical South Asian and Southeast Asian plant that was chewed to obtain its juice. By the 1st century, sugar had been

discovered in Europe and was being utilized as an imported medication rather than a food. Sugar remained largely insignificant until the 5th century, when Indians found ways to convert sugarcane juice into granulated crystals, which are simpler to store and transport. Venice was Europe's main sugar refining and distribution center in the 15th century. In the 17th century, China planted its first sugarcane plantations[4–**6]**. At least two expeditions to India were sent in 647 AD to acquire sugar refining technology, according to Chinese records. When Arab forces invaded the area, they brought with them the expertise of sugar production as well as a passion for sugar as a food, condiment, and medicinal. Islamic forces invaded most of Spain in the early 700s, bringing with them the sugar culture. Sugar became more widely accessible, popular, and regarded a need in the nineteenth century. Sugar's development in taste and demand as a necessary dietary component ushered in significant economic and societal changes.

1.2.Carbohydrate intake:

Carbohydrates are one of the most abundant macromolecules on Earth, and sugar and starch constitute a staple of most people's diets. Carbohydrates serve as energy reserves, fuels, metabolic intermediates, and components of the RNA and DNA structural framework, among other things. Carbohydrates are aldehydes, ketones with numerous hydroxyl groups, and are categorized as monosaccharide (which cannot be hydrolyzed into smaller sub-units), disaccharide, and polysaccharide. They are made up of carbon, oxygen, and hydrogen and have the empirical formula (CH2O) n. Glucose It's called an aldohexose (C6H12O6) because it has an aldehyde group and six carbon atoms; it comes in two forms: open-chain (acyclic) and ring (cyclic). Water is soluble in glucose, resulting in a neutral solution. Glucose is the body's main source of fuel for cellular metabolism**[1], [3], [7].**

1.3.Fructose is a sugar that has a high fructose content:

Fructose may be found in a wide variety of fruits. Plants and certain microorganisms can synthesize fructose from carbon dioxide and water, whereas animals can convert glucose to fructose through sorbitol. Fructose is a hexose monosaccharide that may exist in a non-cyclic, straight chain form and contains a ketone group at carbon-2 in the chain. There are two enantiomers of fructose, L and D, although D fructose is nearly primarily found in nature.

1.4.Galactose:

This sugar, which has six carbons (hexose), is an essential monosaccharide and component of the lactose disaccharide found in milk. D galactose is an epimer of D-glucose, since the only stereo chemical difference between the two sugars occurs at carbon 4. It is a source of energy for cell metabolism.

1.5.Carbohydrates are categorized as follows:

Monosaccharides are absorbed without additional chemical degradation in the small intestine. Glucose is absorbed in the intestinal villi as part of a co-transport system with sodium ions; it then enters the capillary blood and travels to the liver. Polysaccharides, oligosaccharides, and disaccharides, for example, must be broken down by different enzymes before being absorbed in the small intestine. Polysaccharides are broken down into oligosaccharides by salivary amylase, which is found in saliva. The acidity in the stomach deactivates this enzyme. Pancreatic amylase breaks down the polysaccharides that make it past salivary amylase in the gut. Brush border

enzymes in the intestine further hydrolyze oligosaccharides and disaccharides into monosaccharides. Dextrinase, glucoamylase, maltase, sucrase, and lactase are examples of such enzymes. Because the colon does not produce digestive enzymes, chemical digestion stops at the small intestine**[8–10].**

1.6.Sugar Sources and Types:

Fruits, fruit juice concentrate, cane sugar, beet sugar, molasses, nectar, honey, corn sweetener, brown sugar, and invert sugar are just a few examples of sugar sources and kinds. This essay will concentrate on a few of them.

1.6.1. Maple Syrup:

It's produced by boiling down the sap from maple trees; the sap includes 5% sucrose and the rest is made up of other sugars (oligosaccharides). It is made up of 88-99 percent sucrose when it is condensed into syrup form. A serving of maple syrup contains calcium, potassium, and trace quantities of B vitamins, manganese, magnesium, and zinc, among other vitamins and minerals.

1.6.2. Molasses:

It is a by-product of sugar production, consisting of the syrup (plant juice) extracted from raw sugar beet or sugar cane during its processing into sucrose. Sucrose is the most common sugar, and when it is processed, it becomes more invert sugar. Although blackstrap molasses is the result of additional sugar crystallization and has a somewhat larger mineral content, it includes relatively little calcium and iron.

1.6.3. Glucose-Fructose Syrup:

Enzymatic isomerization of glucose produces glucose-fructose syrup. Because only 42 percent isomerization is accomplished, the addition of fructose is required to produce greater concentrations (e.g., 55 percent). By chromatographic enrichment, fructose is extracted from the syrup. HFCS substitute's sugar in many sweet foods due to its similar sweetening power. The most common natural sweetener is sucrose, also known as table sugar. It is a disaccharide composed of one molecule glucose and one molecule fructose that is typically obtained from sugar cane or sugar beets and refined to a white crystalline end product, and is used as a standard for sweetness measurement.

1.6.4. Honey:

Honey is mostly made up of the carbohydrates fructose and glucose, but it also includes around 200 other chemicals (other sugars, enzymes, amino acid and minerals). Several of these enzymes, such as glucose oxidase and bee defensin-1, are linked to honey's antibacterial characteristics. Honey is made from nectar gathered by honeybees from flowers. Honey should never be given to a kid under the age of one year because it may contain spores of Clostridium botulinum, the bacterium that causes Infant Botulism.

1.7.Flavour:

The sweetness of sugars like glucose, fructose, and sucrose is the most noticeable sensory characteristic. Lactose (milk sugar) is the least sweet, while fructose is the sweetest sugar. Sugar is used as a sweetener in a wide range of foods.

1.8.Preservation:

Sugar decreases water activity in a food system (e.g. jam) by absorbing free water and raising osmotic pressure, reducing microbial and mold development and prolonging food storage life. Sugar may also be used to preserve fruits, either in syrup with apples and pears or in crystallized form, where the preserved material is boiled in sugar until it crystallizes and then kept dry. Citrus fruit (candied peel), angelica, and ginger peels can all be treated with this technique.

1.9.Taste:

Sugar has a crucial and unique function in food taste by combining with other ingredients to enhance or diminish certain flavors. A little quantity of sugar added to cooked vegetables and meat enhances the natural tastes of the meal without making it seem sugary. It's critical to establish a good balance between sourness and sweetness in sour applications like drinks, jams, and marmalades, which all include sweet and sour components. This is typically accomplished by combining sugar with citric acid. Sugar is often used to mask or reduce the bitterness in bitter applications (chocolate and coffee).

1.10. Antioxidant Function:

Sugar's hygroscopic characteristic reduces the availability of water, which would otherwise be needed by potential oxidants, resulting in a mild antioxidant effect. Sugar's antioxidant action decreases rancidity, discoloration, and degradation of certain foods (e.g. canned fruits and baked goods). Many early stage products of the Maillard reaction (in which sugar is involved) have also been demonstrated to function in tandem with other natural antioxidants (e.g. vitamin E) to prevent lipid and protein oxidation, thus prolonging food shelf life.

1.11. Color:

Millard reaction and caramelization are two ways that sugar may color food. Browning and flavour are produced by the Maillard reaction, which happens between sugar and amino acids in goods such as bread, coffee, hot sweets, and cakes. Pigmentation, which produces colour and fragrance, is one of the Maillard reaction's end products. When carbohydrates are subjected to high heat, they caramelize. There are no amino groups involved in these reactions, unlike Maillard reactions. This reaction happens often when conventional sucrose syrups and caramels are made, which are widely utilized in soft drinks, beer, confectionery, and pastry goods.

1.12. Texture is number:

Sugar's capacity to interact with water and exist in both amorphous and crystalline forms provided it functional characteristics that allowed it to create desired texture in a variety of foods. Depending on how the melted sugar is processed, the molecules may reform in a crystalline (from a few micrometers to several millimeters) or amorphous (glassy, rubbery, gooey texture) condition. When enough sugar is added to a solution to bind water molecules, it provides mouth feel by raising viscosity, decreases water activity, raises boiling temperature, and lowers freezing temperature, causing proteins, starches, and hydrocolloids to behave differently. Cotton candy is an example of sucrose in its glass state, whereas taffies and caramel sweets are examples of sucrose in its "rubbery" plasticized form. Sucrose may be completely or partly replaced with other sugars or polyols in these sweets.

1.13. Fermentation:

Sugar fermentation is carried out by yeasts under anaerobic circumstances, resulting in the production of carbon dioxide. This step is critical in the production of bread, beer, and wine. Sugar plays an important role in bread making (aside from taste) as a leavening agent by forming carbon dioxide, which causes bread dough to rise before and during baking. Sugar also has a high affinity for binding to gluten, so when dough is kneaded, a gluten structure with high elasticity forms, allowing the dough to stretch without collapsing under the expansion of gases.

1.14. Obesity:

Obesity and overweight are conditions in which an abnormal or excessive amount of fat accumulates in the body and causes impairment. Many factors may contribute to the obesity epidemic, including excessive calorie consumption, easy access to highly appealing foods, and lack of physical exercise. Sugars and refined carbs have been suggested as being more obesogenic than other nutrients, based on little data. Certain foods, such as those with added sugars, may elicit addictive reactions in certain people, leading to compulsive and obsessive overeating.

1.15. Sugar and Diabetes:

Because of the high quantities of high-fructose corn syrup, which promotes fast blood glucose rise, sugar-sweetened soft drinks may raise the risk of diabetes. Sugar-sweetened beverage intake was linked to increased weight gain and type 2 diabetes risk, even when other risk variables were controlled for. Due to the easily absorbable carbs in sucrose sweetened soft drinks and foods, they may raise the risk of type 2 diabetes. Caramel coloring is used in cola-type soft drinks, and it is high in advanced glycation end-products, which may cause insulin resistance.

1.16. Sugar and Lipids:

Sucrose-rich diets generate a lot of fructose and glucose, which is delivered to the liver via the hepatic portal vein. Because fructose bypasses the regulatory reaction catalyzed by phosphofructokinase, it undergoes faster hepatic glycolysis than glucose. This allows fructose to overflow the pathways in the liver, resulting in increased fatty acid biosynthesis, increased fatty acid esterification, increased VLDL secretion, raised serum triacylglycerol, and ultimately elevated LDL cholesterol. Other carbs have less of an impact on increasing blood lipids, especially triacylglycerol, than sucrose and fructose.

1.17. Sugar and Cancer:

The link between high pancreatic cancer and a high-sugar diet was discovered in this research. The short-term increase in pancreatic cancer risk linked to a high accessible carbohydrate and low fat diet may be capturing dietary changes linked to subclinical illness. A high-sugar diet has been shown to encourage cancer formation and to induce the progression of tumors in the colon to malignancy. Added sugars were linked to an increased risk of esophageal adenocarcinoma, whereas supplemental fructose was linked to an increased risk of small intestine cancer.

1.18. Sugar and Dental Health:

Tooth decay, also known as dental caries, is a frequent cause of poor dental health, particularly in youngsters, and is caused by oral bacteria. Nutritional status, oral hygiene, fluoride exposure, dietary habits, socioeconomic position, and overall health are all factors that contribute to dental caries. Although many people connect dental caries with sweets, all fermentable carbs, including

cooked starches, sugars in fruits, and added sugar, contribute to the development of dental caries. Polyols are frequently included in chewing gum because they are not fermentable by bacteria in the oral cavity and therefore do not induce dental caries as sugars do.

2. DISCUSSION

Sugar is the only source of energy for certain bodily tissues, such as the brain and red blood cells. Humans have a sweet tooth, yet sugary foods may be harmful if consumed in excess. Sugar alternatives, such as nonnutritive artificial sweeteners and caloric sugar alcohols, should be used in moderation or avoided altogether. Excessive sugar alcohols, for example, may induce diarrhea. According to a new set of revised dietary recommendations released by the World Health Organization, free sugar intake should be less than 10% of total energy intake, because free sugars threaten the nutrient quality of diets by providing significant energy without specific nutrients, promoting a positive energy balance. Sugars have also been implicated as a cause of a variety of illnesses, including obesity, dental caries, diabetes mellitus, myocardial infarction, dyspepsia, and peptic ulcers. Increased sugar intake has also been linked to an increase in the incidence of insulin resistance and type 2 diabetes mellitus.

3. CONCLUSION

Sugar is required for proper metabolic activity, the prevention of stress on the body, and the preservation of essential cellular components. In light of the above, sugar may serve a variety of functions in food apart from its primary function as a sweetener, and it should be taken in moderation to prevent negative health consequences. Sugar consumption is linked to a variety of illnesses, therefore paying attention to what we eat is critical for maintaining a healthy body, particularly for youngsters who like sweet foods, as well as diabetics and heart patients.

REFERENCES:

1. Ilyas RA, Sapuan SM, Ishak MR, Zainudin ES. Effect of delignification on the physical, thermal, chemical, and structural properties of sugar palm fibre. BioResources, 2017; 12(4):8734-8754. doi: 10.15376/biores.12.4.8734-8754.
2. McClements DJ. Protein-stabilized emulsions. Current Opinion in Colloid and Interface Science. 2004;9:305-313. doi: 10.1016/j.cocis.2004.09.003.
3. Cieslak M. et al. Integrating physiology and architecture in models of fruit expansion. Front. Plant Sci., 2016;17:17-39 doi: 10.3389/fpls.2016.01739.
4. Van Den Steen P, Rudd PM, Dwek RA, Opdenakker G. Concepts and principles of O-linked glycosylation,. Critical Reviews in Biochemistry and Molecular Biology. 1998;33(3):151-208. doi: 10.1080/10409239891204198.
5. Drickamer K. Evolution of Ca2+-dependent Animal Lectins. Prog. Nucleic Acid Res. Mol. Biol., 1993;45:207-232. doi: 10.1016/S0079-6603(08)60870-3.
6. Tang X, Tang P, Liu L. Molecular structure–Affinity relationship of Flavonoids in Lotus leaf (Nelumbo nucifera Gaertn.) on Binding to Human serum albumin and Bovine serum albumin by Spectroscopic Method. Molecules, 2017 Jul;22(7):1036 .doi: 10.3390/molecules22071036.
7. Upare PP. et al. Chemical conversion of biomass-derived hexose sugars to levulinic acid over sulfonic acid-functionalized graphene oxide catalysts. Green Chem., 2013;**15:**2935-2943. doi: 10.1039/c3gc40353j.

8. Kobata A, Amano J. Altered glycosylation of proteins produced by malignant cells, and application for the diagnosis and immunotherapy of tumours. Immunol. Cell Biol., 2005 Aug;83(4):429-39. doi: 10.1111/j.1440-1711.2005.01351.x.
9. Plaza-Díaz J, Augustín OM, Hernández ÁG. Los alimentos como fuente de mono y disacáridos: Aspectos bioquímicos y metabólicos. Nutr. Hosp., 2013;28(4).
10. Zheng Y, Zheng M, Ma Z, Xin B, Guo R, Xu X. Sugar Fatty Acid Esters. in Polar Lipids: Biology, Chemistry, and Technology, eds M. U. Ahmad and X. Xu (Urbana, IL: AOCS Press), 215–243. doi: 10.1016/B978-1-63067-044-3.50012-1