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RESEARCH ARTICLE

SUGAR: THE SWEET POISON

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Abstract

Excessive sugar consumption is a growing issue effecting the lives of many by contributing in many health diseases as well as impacting human body negatively. Owning to sugar addiction it has become challenging to stop easting excessive sugar. Higher intake of sugar leads to numerous heart disease risks and also other common health problems like diabetes. This research paper explored the negative effect of sugar on human organs like the brain and the heart and describes the effect of sugar on the upcoming generation of children. It also examines the addictive nature of sugar and suggests ways to avoid sugar and practice a healthy lifestyle.

Introduction:-

There is worldwide increase in obesity during the past 30 years in both high-income and low-income countries, which may be due to Western diet and decreased physical activity, The Western type of diets particularly sugary foods are not restricted to industrialized societies and the increase in obesity due to Western diet and sedentary behaviour, is often faster in developing countries than in the developed world, Obesity and overweight are associated with cardiovascular diseases (CVDs); hypertension, stroke, coronary artery diseases and type 2 diabetes which could be the major cause of mortality. The estimated numbers ofoverweight and obese adults worldwide in 2005 were 937 million (922-951 million) and 396 million (388-405 million), respectively. It is further estimated that there would be 2-16 billion overweight people and 112 billion obese individuals by 2030, if the same trends continue. [1] Sugar is added in so much of what we consume, and a lot of the time we do not even know it is in what we are eating. The results from the 15-year study on added sugar and heart disease also show that participants who took in 25% or more of their daily calories as sugar were more than twice. as likely to die from heart disease as those whose diets included less than 10% added sugar Overall, the odds of dying from heart disease rose simultaneously with the percentage of sugar in the diet. In addition, studies show that large amounts of fructose can raise triglycerides, LDL, blood glucose, insulin levels, and increase abdominal obesity in as little as 10 weeks [2]. Added sugars make up at least 10% of the calories the averageAmerican eats in a day. But about one in 10 people get a whopping one-quarter or more of their calories from added sugar.To put that in perspective, a 12-ounce can of regular soda contains about 9 teaspoons of sugar, so quaffing even one a day would put all women and most men over the daily limit. "If you're going to have something sweet, have a fruit-based dessert," says Dr Fung. "That way, at least you're getting something good out of it." Ofcourse, plain fruit with no added sugar is ideal. If you're trying to curb a soda habit, Dr Fung suggests mixing a little fruit juice with seltzer water as a replacement.[5]Despite various researches and studies, sugar continues to be the most widely used product in our daily live. Through this paper we aim to elaborate on our topic: sugar the sweet poison and shed some light on the same

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Added Sugars and its Influence on Body Health

Our body would cease to function properly if there is no sugar intake. Naturally occurring sugars causes huge profits in our diet like, sugars found in fruits, lactose, milk sugar, etc. However, the sugars called as "added sugars", i.e, sugars added during processing of food, beverages and other preparations are harmful to our body. Both sucrose and high fructose corn syrups contain a large amount of fructose (50% in sucrose and 55% in the HFCS). Intake of these sugars is harmful to our body because fructose is metabolized only by liver that means a large amount of very low density lipoproteins is produced along with fats. Also, intake of these sugars cannot be controlled by brain as brain resists leptin (a protein for energy intake regulation and to check the efficacy of metabolism) [20]. Sugar also forms an integral part of the human eye. Its primary function in the eye includes; maintenance of the structural component of the eye, andthe provision of nourishment to the surrounding structures of the eye wherein it is found.Sustained high sugar level results inhyperglycaemia, and if left unchecked can result in Diabetes Mellitus. Diabetes mellitus is a group of metabolic diseases, characterized by chronic hyperglycaemia due to deficiency in the production, and/or usage of insulin. Diabetes mellitus can occur as either Type 1(due to poor secretion of insulin) or Type 2 (due to poor usage of insulin for glucose metabolism).Diabetes Mellitus presents with a myriad of ocular complications and has beenidentified as the leading cause of legal blindness globally. Complications secondary to diabetes affects almost every part of the eye and could result in diabetic retinopathy, cataracts, glaucoma, keratopathy, dry eye syndrome, and many others[21].

Effect Of Sugar On Heart

Over the course of the 15-year study on added sugar and heart disease, participants who took in 25% or more of their daily calories as sugar were more than twice as likely to die from heart included less than 10% added sugar. Overall, the odds of dying from heart disease rose in tandem with the percentage of sugar in the diet—and that was true regardless of a person's age, sex, physical activity level, and body-mass index (a measure of weight).[5]In order to incriminate excessive consumption of sugar in the causation of coronary heart disease (CHD), several types of evidence are needed: Accurate data on sugar intake in total populations and in sub-groups. Corresponding data on CHD prevalence, incidence or mortality rate. Unequivocal demonstration that in propitious circumstances the lowering of sugar intake, involuntarily or voluntarily, is specifically associated with a fall in the frequency of CHD or its associated risk factors. Information on the response of experimental animals to sugar in a variety of contexts.Knowledge of the metabolic mechanisms which deal with sugar and their physiological and pathological sequelae.[3]The role of dietary carbohydrates in cardiovascular health has been a subject of particular interest. Previous studies have suggested that types of carbohydrate intake were more important than total carbohydrate intake for determining coronary heart disease (CHD). Typical Western diets are composed of many foods with large amounts of starch and sugar, which raise blood glucose more than some foods naturally high in sugar, like fruit [10]. Individual types of sugar in the diet, such as glucose or fructose, may also have differential impacts on CHD risk [4]Exactly how excess sugar might harm the heart isn't clear. Earlier research has shown that drinking sugar-sweetened beverages can raise blood pressure. A high-sugar diet may also stimulate the liver to dump more harmful fats into the bloodstream. Both factors are known to boost heart disease risk.[5] We can think of sugar as white death, as sugar is responsible for heart attacks, strokes and even some cancers. Sugar is causing disability and morality to a much higher degree than most people are aware of a recent study pointed out that worldwide 184,000 deaths are per year are attributable to sugar-sweetened beverages consumption; among those there are 133,000 deaths from diabetes, 45,000 deaths from cardiovascular diseases and 6,450 deaths from cancers.[6]

Sugar And Your Brain

Even the Brain, our most important organ, is not same from the negative effects of sugar. Although the American association recommends no more than 25g of added sugar per day for women and 38g for men, researchers analysed data from more than 7,000 men and women from a 22-year survey that men who consumed a lot of sugar—more than 67g daily—were 23% more likely to develop a mental disorder after five years compared to those who consumed less than 39.5g a day [18]. Research has revealed that high-sugar foods can hurt memory and learning. These sugary foods and drinks can bring about structural changes in the brain, disrupting the communication between brain cells. Specific molecules, such as AMPA acid receptors, critical for brain flexibility, can become compromised, leading to neurological dysfunction. This dysfunction, characterized by reduced synaptic plasticity and a diminished capacity for the brain to establish and strengthen connections between neurons, can ultimately result in cognitive impairments, affecting both learning and memory retention. Additionally, two essential components, vitamin B and chromium, play a significant role in regulating our emotional health. Elevated sugar levels can potentially disrupt the optimal functioning of key mood-regulating agents, including neurotransmitters like serotonin and dopamine, which, in turn, may lead to unexpected episodes of irritability and hostility. These

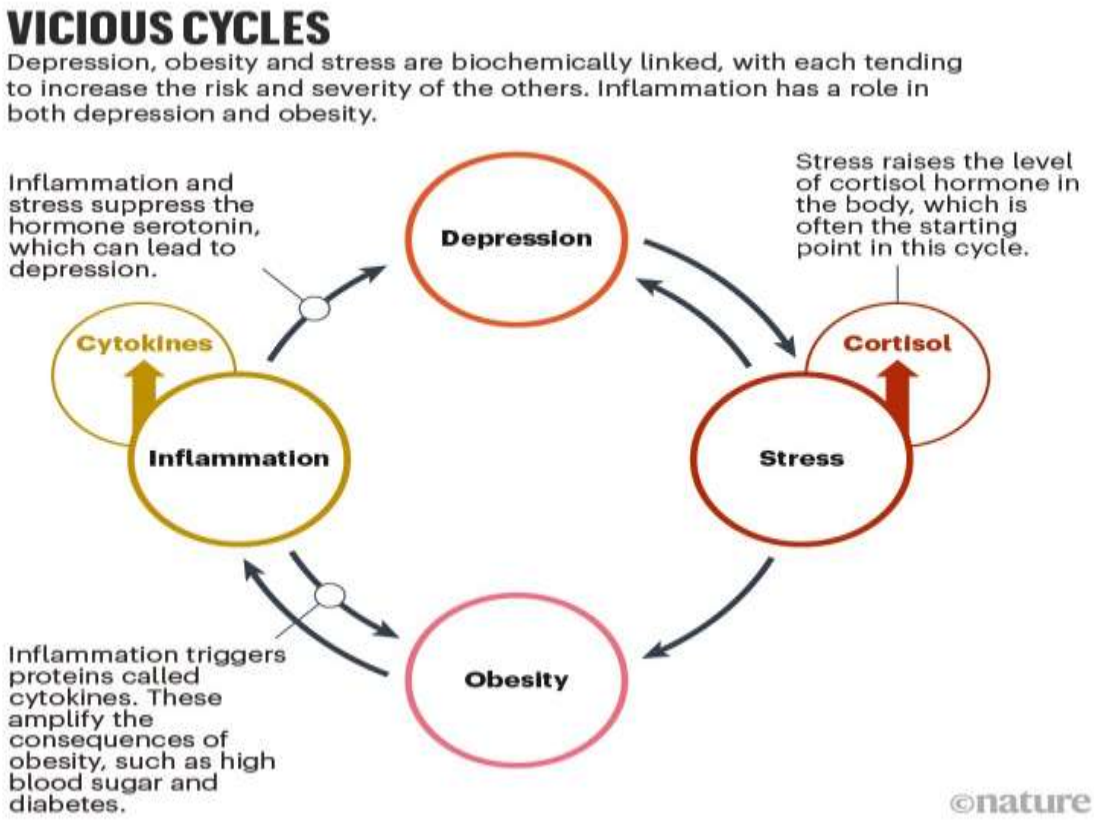
effects can manifest in individuals of different age groups [15]. Long-term diabetes(either type 1 or type 2)has many consequences for the brain and for neurons in the brain. High blood glucose levels can affect the brain's functional connectivity, which links brain regions that share functional properties, and brain matter. It can cause the brain to atrophy or shrink. And it can lead to small-vessel disease, which restricts blood flow in the brain, causing cognitive difficulties and,if severe enough, spurring the development of vascular dementia.Type 2 diabetes accelerates brain aging. which, in turn accelerates the progression of functional decline[19]

Sugar And The New Generation

In recent years, even Adolescents and young children are no it safe from the evils of sugar. Added sugar intake during adolescence has been associated with weight gain and cardiometabolic risk factors. According to WHO, the intake of free sugars should be less than 10% but sugar intake is high among younger age groups across many countries with added sugars comprising 12.8% of total energy intake among Australian adolescents, 12.3% In the UK and 17.3% among US adolescents [14]. This high sugar intake in the brain causes neurological issues, such as structural abnormalities, chemical imbalances, or neurotransmitter dysregulation in the brain can lead to the development of mood disorders (e.g., depression), alterations in one's personality (e.g., changes in behavior, emotional and responses, and cognitive functions), and disrupt the overall equilibrium of one's mental well-being. This relationship is multifaceted, affecting individuals across various age groups. In children, sugar consumption has been notably linked to more frequent displays of irritability, particularly following the "sugar crash" that often follows a sugar-laden snack. This observation underscores the immediate effects of sugar on the emotional well-being of young minds [15]. Results of research studies suggest that consumption of high levels of sugar-sweetened beverages by adolescents may impair neurocognitive functions affecting decision-making and memory, and may even put them at risk for developing mental health disorders [16]. Excessive consumption of palatable high fat/high sugar foods may exacerbate cognitive deficits including impulsivity and impaired decision-making, evoke enduring reward processing alterations that continue into adulthood, and promote the development of addiction-like behaviors. These studies support the hypothesis that adolescence is a period of vulnerability to diet induced cognitive and behavioral alterations. Consumption of such diets leads to cognitive deficits in PFC mediated behaviors, particularly those requiring modulation of attention towards stimuli [17].

Sugar Addiction: The vicious cycle model

In animal studies, sugar has been found to produce more symptoms than is required to be considered an addictive substance. Animal data has shown significant overlap between the consumption of added sugars and drug-like effects, including bingeing, craving, tolerance, withdrawal, cross-sensitisation, cross-tolerance, cross-dependence, reward and opioid effects. Sugar addiction seems to be dependence to the natural endogenous opioids that get released upon sugar intake. [11] The studies described above suggest that intermittent sugar access can produce numerous behaviours that are similar to those observed in drug-dependent rats. In this section, we describe neurochemical findings that may underlie sugar dependency. To the extent that these brain alterations match the effects of drugs of abuse, it strengthens the case that sugar, in some cases, can resemble a substance of abuse[9]. Any neurotransmitter that directly or indirectly stimulates Dopamine cell bodies in the ventral tegmental area reinforces local self-administration which increases our dependence on a substance. Sugar is one such food in our body which releases Dopamine and Opioids. DA, opioids, and ACh in the NAc shell are the neurotransmitters that have found to be involved with the reinforcing effects of intermittent sugar intake. During sugar withdrwal, extracellular ACh levels increase and the dopamine levels decrease causing symptoms of behavioural depression. This leads to a vicious cycle of self-medication with sweet foods that may result in obesity or an eating disorder.[12] The essential argument underlying the vicious cycle model (VCM)is that the hippocampus plays a key role in the decisions to start and end meals. Feeding on high fat and sugar (HFS) diets is then hypothesised to promote overconsumption and consequent weight gain, and also leads to alterations in hippocampal function. It is then argued that these changes in the hippocampus disrupt normal controls of ingestion, so promoting continued overconsumption, leading to a vicious cycle of further overeating. Once an individual has overconsumed sufficient HFS diet to impair hippocampal functioning, the resulting damage to the hippocampus and consequent alterations in cognitive functions make it harder to make the necessary changes in behaviour to reduce intake and adopt a healthier diet. [13] (https://www.nature.com/articles/d41586-022-02207-8)



How to get away from the sweet poison

Excessive sugar intake has been associated with the onset of several non-communicable chronic diseases seen in humans. Physical activity could affect sweet taste perception which may affect sugar intake. Therefore, it was investigated the chronic effects of swimming training on sucrose intake/preference, reactivity to sucrose taste, self-care in neurobehavioral stress, and the possible involvement of the vasopressin type V_1 receptor in sucrose solution intake.Swimming training reduced the intake of sucrose solution from the third week onwards in the two-bottle test measured once a week for 8 weeks. After the ending of the swimming protocol, sucrose intake was also reduced as per its preference. This reduced intake is probably correlated with the carbohydrate aspect of sucrose since saccharin intake was not affected.[7]Modern lifestyle, mainly brought about by technological evolution, has made man progressively sedentary, often accompanied by increased consumption of processed calorie- and fructose-rich food and beverages Given this scenario, physical exercise has a multifactorial character because of its potential to act in different pathways in virtually every body tissue. Physical training contributes acutely and chronically to health promotion by helping to treat and prevent numerous diseases, including central nervous system disorders, chronic cardiovascular disease, and metabolic disorders (e.g., obesity, diabetes, hypertriglyceridemia). In fact, countless studies have proved the beneficial role of physical exercise in treating risk factors. However, little is known about the effect of physical exercise on the neurochemical and cognitive consequences of fructose-induced MS in the brain.Caffeine is widely consumed worldwide through beverages such as coffee and tea. Both acute and chronic caffeine consumption promotes a series of beneficial health effects, provided they are ingested in adequate doses. Numerous studies have shown the therapeutic effects of caffeine on a series of risk factors associated with MS. It is also known that when associated with aerobic exercise, caffeine has an ergogenic effect by increasing epinephrine content, reducing muscle glycogen use, and stimulating triglyceride breakdown, thus accelerating fatty acid used as an energy source during exercise. Therefore, considering thatboth physical exercise and caffeine are low cost and easily accessible therapies, in addition to the possibility of having a potential synergistic effect in treating the risk factors related to MS. Considering this scenario, the present study aimed to investigate the effect of aerobic swimming training combined with caffeine supplementation in rats previously treated with fructose on neurochemical and cognitive changes and the risk factors associated with MS.[8]

Conclusion:-

After careful research, we find that even though sugar is an important source of fats in our body, excess sugar can prove to be very harmful. Another important fact to consider is HFS diet consumed by both the young and the adults. This has resulted in obesity, and high levels of blood sugar in many individuals. As the average blood sugar level and the number of chronic illnesses increases, it is essential for us to become aware about the addictive nature of sugar and its detrimental effects on the body

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