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RESEARCH ARTICLE

INTAKE OF SUGAR-SWEETENED BEVERAGES AND EFFECT ON HEALTH.

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Abstract

Sugar-sweetened beverages (SSBs) are beverages that contain added caloric sweeteners or fruit-juice concentrates. Over the past few decades, consumption of SSBs around the world has tripled, especially among young adults. Increased use of SSBs is seen in all ethnic and socio-economic groups. Importantly, various studies have linked increased consumption of SSBs with an increased incidence of heart disease, stroke, diabetes, chronic pulmonary diseases, and cancer. Multiple mechanisms such as an increase in inflammatory markers increased oxidative stress, or change in metabolism have been implicated. The following review highlights the increased consumption of sugar-sweetened beverages and their effects on human health. An accurate view of this subject would contribute to increased knowledge and improved awareness among people towards consumption of sugar-sweetened beverages. However, it remains an open question requiring further research and studies.

Introduction:-

Sugar-sweetened beverages (SSBs) are typically defined as beverages containing added caloric sweeteners such as sucrose, high-fructose corn syrup (HFCS), or fruit-juice concentrates, which include, but are not limited to, soft drinks, fruit drinks, sports drinks, energy and vitamin water drinks, sweetened iced tea, and lemonade [1]. Over the past few decades, the consumption of sugar has tripled worldwide [2], and SSBs are the leading sources of added sugars in the American diet. According to Centers for Disease Control and Prevention (CDC), on an average, 6 out of 10 children (63%) and 5 out of 10 adults (49%) consume a sugar-sweetened beverage on a given day [3].

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Importantly, the increased consumption of SSBs by people of all ages and ethnic groups has been implicated in the increased incidence of heart disease, stroke, diabetes, and cancer. The occurrence of these diseases has been linked to elevated medical, psychological, and social costs. The goal of this study is to offer an up-to-date overview of the existing information available on trends in consumption of the SSBs, and evidence linking these beverages to adverse health outcomes. An accurate view of this subject would contribute to increased knowledge and improved awareness among people towards consumption of SSBs.

Review:-

1-Cardiovascular system

Cardiac diseases such as coronary heart disease (CHD), myocardial infarction and heart failure are one of the leading causes of mortality and morbidity globally [4]. Traditional risk factors, such as hypertension, smoking, gender, and obesity are considered significant predictors of CHD. However, being a new risk factor for CHD, limited data is available on the health effect of SSBs on cardiometabolic diseases. In this section, we have gathered data from various studies linking the association between consumption of SSBs and the development of cardiometabolic disorders.

Huang C et al. summarized the evidence concerning sugar-sweetened beverages (SSBs) consumption and risk of the CHD [5]. The authors of the study documented that one-serving per day increase in sugar-sweetened beverages consumption was associated with a 16% increased risk of CHD [5]. The risk of developing CHD can be positively correlated with the amount of the SSBs consumed. In a prospective cohort study conducted by Fung T et al., it was observed that subjects had a stronger correlation for development of CHD when the amount of the SSBs was increased by two servings, demonstrating a dose-response relationship for the development of cardiac diseases including CHD and myocardial infarction [6].

One of the proposed mechanisms for the development of CHD involves the role of inflammatory markers due to consumption of the SSBs. Results from the Health Professionals Follow-up Study showed increased levels of several inflammatory factors, including C-reactive protein (CRP) and interleukin-6 in parallel to the increased SSBs consumption [7]. Also, the type of sugar added to the SSBs can also play a different role in the cardiovascular response to SSBs. In the SSBs, high-fructose corn syrup is the most commonly used sweetener. Though the glycemic load of fructose is lower than glucose, studies have shown that it has several unfavorable adverse effects on weight gain and lipid profiles [8]. Short-term randomized controlled trials showed that even moderate amounts of fructose consumption impaired glucose and lipid metabolism [9] and decreased insulin sensitivity [10], playing a crucial role in the development of metabolic disorders, contributing to atherosclerosis, thus resulting in a higher risk of CHD. Another detrimental effect of fructose reported by epidemiological and intervention study is the increase of uric acid level in serum, which is a risk factor for CHD [11-12].

2- Central Nervous System

SSBs, particularly drinks containing sugar and caffeine, can affect our sleep patterns, impair memory, and may lead to stroke and dementia. In regards to sleep, many studies show that SSB may be linked to shorter sleep duration. In one study, the link is reportedly described as short sleep duration being associated with consumption of the energy drinks in middle and high school students and with SSBs in middle school students only [13]. To further support this, shorter sleep duration was associated with a higher intake of regular soft drinks, while earlier bedtimes were associated with a lower intake of regular soft drinks and higher consumption of energy drinks and sports drinks in this international study of children [14]. Although this may show that energy drinks and sports drinks are somewhat safer, more research is indicated to determine this.

Furthermore, short sleep is associated with a higher intake of sugar-sweetened caffeinated sodas, a relationship which may have outstanding, though unrecognized, implications for physical health. The directionality of this relationship cannot be determined from this study. While caffeinated drinks could account for impaired sleep, it is possible that short sleep could influence one's appetitive drive for sugared caffeine drinks. The authors emphasize that it's not yet clear whether drinking sugar-sweetened beverages causes people to sleep less, or whether sleep deprivation makes people seek out more sugar and caffeine to stay awake, though previous research suggests both could be true [15].

SSBs have also been found to increase the risk of stroke and dementia. According to a large prospective cohort study, it was observed that higher consumption of sugar-sweetened and low-calorie sodas was associated with a

higher risk of stroke [16]. According to the data, sugar-sweetened beverages have been found to have reduced memory and even cause memory loss. People who consumed more sweetened drinks had poorer memory and reduced brain volume overall (particularly in the hippocampus, the area that's known to "house" short-term memory), compared to people who didn't drink sugary drinks. The authors calculated that one to two sugary drinks per day was associated with 1.6 years of brain aging; more than two drinks per day was associated with two extra years of aging. For memory, the association was even more pronounced: One to two, and higher than two, sugary drinks per day corresponded to 5.8 and 11 years of brain aging, respectively [17]. One of the mechanisms proposed for these effects of SSBs on the brain is due to increased oxidative stress by a decrease in antioxidant enzymes such as monoamine oxidase and acetylcholinesterase, and antioxidants such as glutathione and catalase. Thus, sugar-sweetened beverages are leading to stroke and dementia [18].

3- Digestive and Excretory System

Gastric acid reflux is present in approximately 40% of adults, and it may occur with no obvious precipitant [19]. Certain foods and beverages that are mainly associated with heartburn are coffee, citrus drinks, spicy foods, tomato-based products, and chocolate [19]. One of the mechanisms suggested for drinks to cause heartburn is high titratable acidity of citrus beverages and juices and low pH of soft drinks [20]. Feldman M et al. reported heartburn scores associated with soft drinks that ranged from 0.77 (Pepsi) to 0.45 (7UP) ($P < 0.001$ for each soft drink vs. water). Reported heartburn scores were not significantly different for non-diet vs. diet soft drinks from the same company. As the pH of the beverage increased, the heartburn score decreased with a significant association. The degree of flatness does not alter the pH of the drink [20]. Moreover, carbonated beverages can lead to a transient reduction in lower esophageal sphincter basal pressure, resulting in exacerbation of gastroesophageal reflux disease (GERD) [21].

4- Respiratory System

Asthma and Chronic Obstructive Pulmonary Disease (COPD) are highly prevalent pulmonary chronic diseases in Western countries. In one study by Park S et al., they documented that non-obese adults who consumed SSBs \geq two times/day had 66% higher odds of having current asthma than did non-SSB consumers [22]. Similarly, previous data showed that the odds of having asthma were significantly higher among Australian adults who drank 0.5 L/day (16.9 oz.) of soft drinks than among those who did not drink soft drinks, after controlling for sociodemographic and behavioral characteristics and for overweight or obese status ($BMI > 25 \text{ kg/m}^2$) [23].

5- Endocrine System

Over the past two decades, obesity has escalated to epidemic proportions around the world, especially in the United States. According to the World Health Organization (WHO), >1 billion adults across the globe are overweight, putting them at risk for several adverse health effects [24]. Consumption of sugar-sweetened beverages (SSBs), drinks with high sugar content particularly carbonated soft drinks, are a vital contributor to the epidemic of overweight and obesity. Overweight and obesity are associated with numerous comorbidities including, but not limited to, hypertension, coronary artery disease, stroke, GERD, asthma, diabetes, depression, and cancers of breast, endometrium, colon, and prostate [25].

Sugar-sweetened soft drinks increase the risk for type 2 diabetes because of their high amount of rapidly absorbable carbohydrates. They contain significant amounts of high-fructose corn syrup, which has similar effects on blood glucose as sucrose [26], and consumption of sugar-sweetened soft drinks induces a fast and dramatic increase in both glucose and insulin concentrations [27]. Cola-type soft beverages contain caramel coloring, which is rich in advanced glycation end products, which may increase insulin resistance [28-29]. Thus, all these factors contributing to the development of diabetes mellitus type 2.

Intake of Fruit juice is not associated with diabetes risk, which suggests that added sugars and naturally occurring sugars in beverages have different metabolic effects. Glycemic index in fruit juices is lower than sugar-sweetened soft drinks and fruit punches [30]. As opposed to adverse impacts of sugars fruit juices have vitamins, minerals, fibers and phytochemicals which have beneficial effects. In contrast, fruit punches have very little nutritional value in comparison of fruit juice because it has massive amounts of added high-fructose corn syrup [31]. Therefore, fruit punch consumption is associated with increased diabetes risk suggests that its detrimental effects on the body may be similar to sugar-sweetened soft drinks.

To summarize, increased and frequent intake of sugar-sweetened beverages may be associated with more significant weight gain, and it also increases the risk of type 2 diabetes by providing excessive calories and large amounts of rapidly absorbable sugars. Public health strategies to prevent obesity and diabetes mellitus type 2 should focus on reducing sugar-sweetened beverage consumption.

Conclusion:-

In the past few decades, consumption of beverages containing sugar has tripled worldwide, especially among young adults. Whether beverages containing added caloric sweeteners or fruit-juice concentrate, they all have been known to have harmful effects on the human body through different mechanisms. The objective of this issue to increase the knowledge and improve awareness among people towards sugar-sweetened beverages to decrease its further use to enhance the quality of life, thus eliminating its harmful consequences. However, it remains an open question requiring further research and studies.

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