Health Hazards of High Fructose Corn Syrup: Review Article Ayat Khalaf Ahmed *

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ABSTRACT

Background: In the modern diet, high fructose corn syrup (HFCS) is a common sweetener, especially in processed foods and drinks. Even though HFCS is widely used. Worries about its potential health risks have been grown recently.

Objective: This review article aimed to give a thorough grasp of the health hazards associated with HFCS.

Methods: We searched Google Scholar, Science Direct, PubMed and other online databases for Health Hazards of High Fructose Corn Syrup Consumption. The author also reviewed references from pertinent literature, however only the most recent or comprehensive studies from 2015 to 2023 concentrating on the metabolic, cardiovascular, hepatic and gastrointestinal health impacts of HFCS were included. Documents in languages other than English were disqualified due to lack of translation-related sources. Papers such as unpublished manuscripts, oral presentations, conference abstracts, and dissertations that were not part of larger scientific studies were excluded.

Conclusion: High fructose corn syrup consumption is linked to significant threats to health. The main goals of public health campaigns should be to raise awareness of the possible hazards of HFCS and to decrease its use. Limiting its use in food goods through regulations may also be required to encourage the use of healthier substitutes. To better understand the long-term health impacts of HFCS especially in vulnerable groups, more research is required. Policymakers can create efficient plans to lessen the negative health effects of HFCS and consumers can make educated dietary choices by being aware of these hazards.

Keywords: Fructose, Corn, Syrup, hazards, Consumption.

INTRODUCTION

Fructose corn syrup is a sweetener made from maize starch which is mostly made up of fructose and glucose. It became well-known in the 1970s as a less expensive substitute for sucrose and has subsequently been added to a variety of food items ^[1].

It is frequently used in beverages, processed foods and baked goods. This adds significantly to calorie consumption in many diets. Several researches have been done on its possible risks and health implications because its use is rising in tandem with obesity and related metabolic problems^[2].

OBESITY AND WEIGHT GAIN

Diet is one of the multiple factors that contribute to the complex condition of obesity. The high level of sweetness in food containing high-fructose corn syrup is one of the causes that has led to their continuous consumption. This characteristic leads to an increase in appetite, which increases their consumption of food that contain this substance. Due to the fact that nearly all manufactured foods and beverages include high-fructose corn syrup with added sweeteners, people consume it frequently and consistently. Foods labeled as "low fat" often contain the same or even more calories than their full-fat counterparts because manufacturers typically add sugar such as high-fructose corn syrup to compensate for the loss of flavor and texture. This trend has led to increased consumption of these products, which may contribute to rising obesity rates ^[3].

NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD)

The rising prevalence of non-alcoholic fatty liver disease (NAFLD) has drawn attention to the association between HFCS and liver health. Cross-sectional study by **Younossi** *et al.* revealed that the prevalence of NAFLD was higher in people who consumed more fructose from their diet than in people who consumed less ^[4].

Because fructokinase acts independently of hepatic energy status, up to 85% of the fructose in sugarsweetened beverages will be absorbed during their initial passage through the liver resulting in unregulated fructose uptake both when fed and when fasting ^[5]. Uric acid and lactate production are elevated in the liver as a result of the fructose overload. Fructose and its metabolites promote the production of apolipoprotein CIII (apoCIII) and de novo lipogenesis (DNL) and cause inducing the expression of sterol regulatory element binding protein 1c (SREBP-1c) and carbohydrate response element binding protein (ChREBP) ^[6] and decreased fat oxidation ^[7].

Upregulated DNL and hindered fat oxidation increase the hepatic lipid supply, which raises lipid levels like diacylglycerol (DAG) and reduces hepatic insulin sensitivity by interfering with insulin receptor activation [8].

Insulin resistance impairs the liver's capacity to promote glycogen synthesis and inhibit glycogenolysis, which raises blood glucose levels and triggers the release of compensatory insulin^[9].

INSULIN RESISTANCE AND TYPE 2 DIABETES

There is experimental evidence that fructose consumption negatively impacts insulin sensitivity and hepatic lipid metabolism in both humans and animals. Insulin resistance in adipose, muscle and liver is one possibility for fructose-induced hyperinsulinemia ^[10-12].

This finding is supported by plausible processes linked to the elevated production of uric acid and de novo lipogenesis (DNL) brought on by the liver's uncontrolled absorption of fructose ^[13].

The main limitation of randomized controlled trials (RCTs) is that their duration is limited to a few months. The detrimental impact of HFCS on metabolic parameters in nutrition lacks a well-defined threshold. There was no difference in blood pressure, LDL-HDL, total cholesterol or fasting blood glucose in a 10-week randomized controlled trial (RCT) when a group consumed a maximum of 18% HFCS in diet. However, there was a substantial increase in triglycerides and a minor increase in weight in the HFCS group as compared to the controls [14].

CARDIOVASCULAR IMPACT

A growing evidence indicates that consuming too much fructose is widely associated with elevated blood pressure. Maternal high-fructose consumption caused programmed hypertension in adult children. Combination of high fructose and high salt intake caused salt-sensitive hypertension. The fundamental mechanisms behind these two events are comparable and intricate. These include increased oxidative stress, dysbiosis of the gut, activation of nephron ion transporters, activation of the intrarenal renin–angiotensin system and dysregulation of Tlymphocytes ^[15].

Fruit juice consumption is seen as a source of vitamins and nutrients, making it a generally acknowledged healthy. However, fructose, a simple sugar with potentially negative effects is abundant in fruit beverages. Excessive fructose consumption can result in hypertriglyceridemia ^[16].

When fructose and glucose were co-ingested together as HFCS, a substantial interaction between the two monosaccharides led to a rise in lipoprotein risk factors. Therefore, it cannot be assumed that glucose is a harmless component of HFCS and the effects of HFCS on lipoprotein risk factors are not exclusively mediated by the fructose level. These findings suggest that HFCS may be just as detrimental as isocaloric doses of pure fructose, which emphasizes how urgent it is to put policies in place to restrict the consumption of free sugar ^[17].

GUT MICROBIOTA ALTERATIONS

There is growing evidence that HFCS may have a negative impact on the composition of the gut microbiome. HFCS may have a detrimental effect on the

composition of the gut flora, which is essential for general health. High fructose diets alter the diversity of the gut microbiota resulting in dysbiosis, increased intestinal permeability, which is commonly known as "leaky gut".

Toxins and bacteria can enter the bloodstream due to this condition, which may aggravate metabolic illnesses and cause inflammatory reactions, which is linked to a number of gastrointestinal illnesses and systemic inflammation ^[18].

CONCLUSION

High fructose corn syrup is known to exhibit serious health hazards such as obesity, insulin resistance, cardiovascular disease, non-alcoholic fatty liver disease and changes in gut flora. Public health authorities, regulatory bodies, and consumers all need to pay immediate attention to the pervasive use of HFCS in processed foods and beverages. It is essential to reduce HFCS intake through healthy food choices and public health campaigns in order to lessen its harmful health effects and enhance general well-being. To investigate the long-term impacts of HFCS consumption and to advise dietary recommendations meant to lower its intake, more research is required.

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