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Adolescent Added Sugar Consumption and Colon Cancer Risk in Hispanic Adults: A Public Health Perspective

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Introduction

The rising incidence of colorectal cancer (CRC) globally, coupled with concerning trends in early-onset CRC, necessitates a comprehensive understanding of its risk factors [1], [2]. Dietary habits, particularly during adolescence, are increasingly recognized as playing a significant role in CRC development [2]. This literature review examines the current evidence on the association between adolescent added sugar consumption and colon cancer risk in Hispanic adults, focusing on the public health implications of this relationship. The review will analyze existing studies, highlighting methodological strengths and weaknesses, identifying research gaps, and synthesizing findings to inform future research and public health interventions.

Adolescent Sugar Intake and CRC Risk: An Overview

Numerous studies have investigated the link between sugar intake and CRC risk, but the evidence remains complex and often contradictory [3], [4]. Some studies suggest a positive association between high sugar and sugar-sweetened beverage (SSB) consumption during adolescence and an increased risk of colorectal adenomas, precursors to CRC [2]. Joh et al. [2] found a positive association between high adolescent intake of simple sugars (fructose, glucose, added sugar, total sugar) and SSBs with the risk of conventional adenomas, particularly rectal adenomas. Specifically, for every 5% increase in total fructose intake per day, the multivariable odds ratio for total adenoma was 1.17 (95% CI 1.05–1.31), and for high-risk adenoma, it was

1.30 (95% CI 1.06–1.60) [2]. Similarly, Hur et al. [5] observed a more than doubled risk of early-onset CRC (EO-CRC) among women consuming two servings of SSBs per day compared to those consuming less than one serving per week in adulthood. Furthermore, each additional serving per day of SSB intake during adolescence (ages 13-18) was associated with a 32% higher risk of EO-CRC [5].

However, other studies have failed to demonstrate a clear association between overall sugar intake and CRC risk [3], [6]. In a large-scale Japanese cohort study, Kanehara et al. [3] found no significant association between various types of sugar intake and CRC risk in middle-aged adults. While a positive association was observed between total sugar consumption and rectal cancer in women, this was not statistically significant in men [3]. Similarly, Cho et al. [6] found no association between high sugar intake and the prevalence of colorectal adenomas in the Japanese population. These conflicting findings underscore the need for further research to clarify the complex relationship between sugar intake and CRC risk, considering factors such as ethnicity, age, and other lifestyle factors.

Methodological Considerations and Research Gaps

The studies reviewed employed various methodologies, including prospective cohort studies [2], [3], [5], [7], case-control studies [8], [9], and cross-sectional studies [6]. Prospective cohort studies offer a more substantial design for assessing temporal relationships between exposure and outcome, but they are expensive and time-consuming and may suffer from attrition bias [2]. Case-control studies are more efficient but susceptible to recall and selection bias [8]. Cross-sectional studies provide a snapshot of the association at a single point in time, limiting the ability to infer causality [6].

Several methodological limitations exist across the studies:

Dietary assessment: Most studies relied on self-reported nutritional data through food frequency questionnaires (FFQs) [2], [3], [5], [6], which are subject to measurement error and recall bias. Dietary recall accuracy can vary depending on factors like age, education, and cultural background [10].

Confounding factors: Many studies adjusted for potential confounding factors such as age, sex, BMI, smoking, physical activity, and alcohol consumption [2], [3], [5]. However, residual confounding may still exist, affecting the observed associations [11].

Subgroup analyses: While some studies conducted subgroup analyses by sex, age, or BMI [2], [3], [5], further stratification by ethnicity, particularly within Hispanic populations, is crucial to understanding potential variations in risk [12].

Specific sugar types: Studies often examine total sugar intake or a limited number of particular sugar types [2], [3]. A more detailed assessment of different kinds of added sugars and their contributions to CRC risk is needed [13].

Longitudinal studies: Long-term follow-up is essential to establish the long-term effects of adolescent sugar consumption on CRC risk in adulthood [2]. Many studies lack the extended follow-up periods necessary to fully capture the development of CRC [11].

Hispanic populations: A significant gap exists in the literature regarding the specific impact of adolescent sugar consumption on CRC risk within diverse Hispanic populations [14], [15]. The limited number of studies focusing on Hispanic populations hinders the ability to draw definitive conclusions about this subgroup [12]. Further research is needed to address the distinct dietary patterns and cultural influences within different Hispanic subgroups [14].

Biological Mechanisms and Pathways

The potential biological mechanisms linking high sugar intake, particularly during adolescence, to increased CRC risk remain to be fully elucidated [16], [17]. However, several plausible pathways have been proposed:

Inflammation: High sugar intake can promote chronic inflammation, a known risk factor for CRC [16]. Stewart et al. [16] found associations between sugar intake and certain inflammation-related biomarkers in CRC patients, although the findings were influenced by adiposity.

Oxidative stress: Excess sugar can induce oxidative stress, damaging cellular components and potentially contributing to cancer development [17]. Lombello et al. [17] highlight the role of oxidative stress as a mechanism linking processed and ultra-processed foods, often high in added sugars, to CRC.

Gut microbiota dysbiosis: High sugar intake can disrupt the gut microbiota, altering its composition and function [17], [18]. An imbalance in gut microbiota, known as dysbiosis, has been linked to increased CRC risk [17]. Herchenhorn and Tarouquella [18] discuss the potential link between nut consumption, which may modify the gut microbiota, and reduced colon cancer recurrence.

Insulin resistance and hyperinsulinemia: High sugar intake can lead to insulin resistance and hyperinsulinemia, which have been implicated in CRC development [6], [19]. Increased insulin levels may promote cell growth and proliferation, contributing to tumorigenesis [19].

Advanced Glycation End Products (AGEs): High-sugar diets and high-temperature cooking processes can lead to the formation of AGEs in foods [20]. AGEs are implicated in promoting inflammation and oxidative stress, potentially contributing to cancer development [20]. Panguluri and Findlay [20] highlight the potential link between dietary AGEs and breast cancer risk, suggesting the need for further research into their role in other cancers.

Public Health Implications and Interventions

The potential implications of adolescent sugar consumption on CRC risk in Hispanic adults are significant from a public health perspective [21], [22]. Given the rising prevalence of obesity and chronic diseases associated with high sugar intake, particularly within Hispanic communities, targeted interventions are crucial [23], [24]. These interventions should consider the following:

Dietary guidelines and education: Public awareness of the potential link between adolescent sugar consumption and CRC risk is essential [25]. Educational campaigns targeting adolescents and their families, emphasizing the importance of limiting added sugar intake and adopting healthier dietary patterns, are vital [26], [27]. The effectiveness of these interventions should be assessed across different Hispanic subgroups [12].

Policy interventions: Policy interventions, such as sugar-sweetened beverage taxes and regulations on marketing to children, have been proposed to reduce SSB consumption [21], [22], [28]. The cost-effectiveness of such interventions should be carefully evaluated, considering the potential impact on health outcomes and economic burden [21], [22], [29]. Lee et al. [21] explored the health and economic impacts of various SSB tax policies in the United States. Shangguan et al. [22] modeled the potential effects of voluntary sugar reduction targets in the US. Alcaraz et al. [29] estimated the disease burden attributable to SSB consumption in four Latin American and Caribbean countries.

Technology-based interventions: Technology-based interventions, such as smartphone apps and online tools, may help monitor sugar intake and provide personalized feedback [30]. These interventions can be adapted to different cultural contexts and integrated into existing health promotion programs [30].

Multi-sectoral approaches: Effective interventions require a multi-sectoral approach involving collaboration among government agencies, healthcare professionals, the food industry, educators, and community organizations [31]. This collaborative effort is necessary to address the complex interplay of factors contributing to high sugar intake and CRC risk [31].

Addressing health disparities: Interventions should focus on reducing health disparities within Hispanic populations, considering socio-economic factors, cultural beliefs, and access to healthcare [23], [24], [22]. Xu et al. [23], [24] highlight the need to consider racial and socioeconomic disparities in cancer-related behaviors among adolescents and parents.

Conclusion

The existing literature on the association between adolescent added sugar consumption and colon cancer risk in Hispanic adults is complex and presents conflicting findings. While some studies suggest a positive association, others have not found a clear link. Methodological limitations, including reliance on self-reported dietary data, potential confounding factors, and limited

research on Hispanic populations, contribute to this uncertainty. Further research is crucial to address these limitations and clarify the complex interplay between adolescent sugar intake, biological mechanisms, and CRC risk within diverse Hispanic subgroups. Public health interventions should consider multi-sectoral approaches, including dietary guidelines, policy interventions, technology-based strategies, and culturally tailored programs, to reduce sugar consumption and mitigate the risks of CRC within Hispanic communities. A strong focus on addressing health disparities and promoting healthy lifestyles throughout adolescence is paramount for reducing the burden of CRC. Future research should prioritize longitudinal studies with large, diverse samples and detailed dietary assessments, incorporating genetic and other biomarkers to understand the underlying mechanisms better and develop effective prevention strategies [32]. Including more varied Hispanic populations in future studies is crucial to providing culturally relevant and effective interventions [12]. The role of specific types of added sugars, the impact of dietary patterns, and the interaction with other risk factors also require further investigation [13], [17], [11]. Understanding the interplay between dietary factors, gut microbiota, and inflammation in CRC development within Hispanic populations is a significant area for future research [16], [17], [18]. Finally, evaluating the long-term impact of adolescent dietary habits on adult health outcomes, including CRC risk, is essential for developing effective public health strategies [2], [5].

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