The impact of country and exposure to sugary drink marketing on youth brand recall and preferences

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Thesis submitted to the University of Ottawa in partial fulfillment of the requirements for the Master of Science degree in Epidemiology

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Preface

Student Contributions

The student, Lauren Remedios, was the primary author of the article and content included in this thesis. Lauren Remedios was responsible for planning the methodology, conducting analyses, interpreting findings, and drafting the manuscript. Each of the processes were completed with critical guidance and in collaboration with Dr. Monique Potvin Kent, Dr. Marie-Hélène Roy-Gagnon, and Dr. Lana Vanderlee. All authors reviewed and approved the final article manuscript presented in this thesis.

Ethics Approval

This thesis involved the analysis of secondary data from child participants of the International Food Policy Study (IFPS) Youth Survey 2019. The IFPS was established through the University of Waterloo and obtained ethical approval both through the University of Ottawa (H-06-20-5908) and through the University of Waterloo's Research Ethics Committee. This study also received ethics approval from the University of Ottawa's Research Ethics Board (MOD2-5908) to use the IFPS Youth Survey 2019 data for secondary analysis.

Acknowledgements

I would like to thank my thesis supervisor, Dr. Monique Potvin Kent, for her significant guidance, mentorship, and support throughout this degree. I am extremely grateful for your continuous encouragement and opportunities to grow academically and professionally.

Thank you to my TAC members, Dr. Marie-Hélène Roy-Gagnon and Dr. Lana Vanderlee for your generosity with your time, and for your patience and critical contributions particularly towards my statistical analyses and framing of the study results. This thesis has greatly benefited from your input and our discussions. Thank you also to Dr. David Hammond for taking the time to provide thoughtful and important feedback in the early drafts of the presented manuscript and to Élisabeth Demers-Potvin for your support with the development of the open text coding manual.

I would also like to acknowledge my fellow MSc colleagues Chanelle Ayoub and especially Mariangela Bagnato. I am very appreciative for all of the support and friendship that you have given along the way. Thank you also to Dr. Mary Alice Hefford, for generously offering your time and advice throughout my entire grad school journey.

Finally, thank you to my family and friends for their constant support throughout this degree. Thank you especially to my parents, who have always taken the time to listen to my ideas and to Joel Riordan for your patience throughout my degree and willingness to help me tackle coding challenges.

Abstract

Background

Consumption of sugary drinks (SD) among children is a prevalent public health issue that is exacerbated by the powerful marketing of such beverages to youth.

Methods

A secondary analysis of the International Food Policy Survey Youth Wave 2019 was conducted to assess the impact of self-reported exposure to SD marketing within the past 30 days or SD brand advertisements on youth brand preference and brand recall overall, by country, and by age group. Ordinal, multinomial, and binary logistic regression were used to examine these associations.

Results

Youth brand preference and recall were positively associated with self-reported exposure to general and brand-specific SD marketing within and across all countries. Both children and adolescents were similarly impacted by SD marketing. Soft drinks, sports drinks, and fruit juice brands were most commonly recalled by youth.

Conclusion

Global marketing policies should consider older children and adolescents to adequately protect and support child health.

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Chapter 1: Introduction

1.1 Background of the Problem

Non-communicable diseases (NCD) such as cardiovascular diseases, diabetes, cancers, or respiratory diseases, accounted for 71% of deaths worldwide in 2019, roughly equivalent to 41 million people, according to the World Health Organization (WHO).[1] These types of diseases impose a significant burden on the health of individuals as well as the global economy. Many NCD-related risk factors, particularly obesity, stem from early life, and as a result, childhood and adolescence are considered critical periods for NCD-prevention.[2] The global prevalence of childhood obesity has rapidly increased in recent decades and remains a significant public health challenge in the 21st century.[3] Worldwide, recent estimates suggest over 40 million children under the age of 5 are overweight and nearly 340 million children and adolescents between 5 to 19 years old are overweight or obese.[3,4] Excess weight and obesity during childhood can profoundly affect children's health in multiple capacities.[5] Many health consequences previously only diagnosed in adults, such as cardiovascular diseases and diabetes, are increasing in prevalence amongst youth with obesity.[5] Of additional concern is that these medical conditions may track into adulthood.[5]

It is widely recognized that youth obesity results from an energy imbalance. This imbalance is partly attributed to poor diets characterized by the overconsumption of ultra-processed foods and inadequate fruit and vegetable intake.[5] Current dietary guidelines set by the World Health Organization recommend consuming a minimum of five servings of fruits and vegetables per day while also limiting daily intake of excess fat, sugar, and sodium, as part of preventative measures against childhood obesity.[6] Despite these recommendations, most studies

in North America, Europe, and Australia indicate that many youth fail to meet and/or adhere to these thresholds.[7–10]

Poor diet quality in youth is further exacerbated by dramatic increases in the consumption of unhealthy foods and beverages, including fast food, snack foods, and sugary beverages.[11,12] Increasingly, public health focus has centered around sugary drinks (SD), which are a substantial source of added sugars and calories in children's diets.[13] The Heart and Stroke Foundation defines SDs as containing free sugars (monosaccharides and disaccharides) added by manufacturers as well as naturally-occurring sugars including honey, syrups, and fruit juice concentrates.[14] Accordingly, a wide range of beverages fall within this category, namely soft drinks, sports and energy drinks, 100% fruit juices, sweetened teas or coffees, drinkable yogurts, and flavoured milk or water.[15] Sugary drinks are a leading source of caloric intake among all age groups in Canada.[16] Consumption of such beverages is particularly high amongst young Canadians; children and adolescents aged 9 to 18 years consume an average of 578ml of SDs daily, an estimate far greater than any other age group.[17] This equates to over 40 grams of sugar per day.[14] In conjunction with other dietary sources of free sugars, children's' SD intake can well exceed the WHO's dietary recommendations for free sugars, which suggest intake be limited to a maximum of 10% of an individual's daily energy intake (i.e., approximately 42 grams for children between 7-10 years old).[18] Data from the United States suggest sugar-sweetened beverage (SSB) intake amongst American youth is equally concerning; approximately 60% of children and adolescents regularly consume at least one SD,[19] and SSBs (i.e., sugary drinks excluding fruit juices) alone contribute to more than 10% of youth's total sugar intake.[20] Similarly, among other countries such as Mexico, Australia, and the United Kingdom, SSBs represent a significant share of child and adolescents' sugar intake.[21–23]

Consumption and other dietary patterns are driven by several individual-level factors, however less attention is aimed at the collective role that environmental dimensions play in shaping these eating behaviours and diet. The food environment is a product of the interaction between various physical, social, economic, and policy-related contexts, which in turn influence the availability, accessibility, and affordability of food and beverage products.[24,25] The collective impact of these conditions compounded by the frequent promotion of highly processed foods and beverages and the relative cheapness and accessibility of such products fosters an obesogenic environment, one that is ultimately responsible for the global increase in obesity and diet-related non-communicable diseases.[26]

1.2 Food and Beverage Marketing to Children and Adolescents

The global extent of SD consumption is associated with the successful marketing of unhealthy food and beverages.[27,28] Exposure to food and beverage marketing (hereafter referred to as food marketing) serves as an environmental cue to increased consumption of unhealthy products.[29] Food and beverage marketing is defined by the WHO as "any form of commercial communication that is designed to or has the effect of, increasing recognition, appeal and/or consumption of particular products".[15] Marketing is comprised of 4 main strategies: product (e.g., packaging), place (e.g., location), price, and promotion (e.g., advertising).[11] Food and beverage companies leverage each of these strategies to maximize the effectiveness of their marketing among the target audience. [11] Analyses of children's environments reveal that food marketing occurs in multiple settings, most notably on television and online (the Internet, websites, social media, etc.).[30,31] Indeed, advertisements directed at children are also rapidly becoming a pervasive presence in public spaces (e.g., recreational centres, schools, and supermarkets).[30,32] Child-directed advertising almost exclusively promotes unhealthy foods and

SDs remain a prominent food/beverage category among such advertising content.[33] Traditional media advertisements include persuasive marketing techniques such as promotional characters, emotional and taste appeals, or premium offers to interest children,[34] while digital media offers brands greater opportunities to appeal to youth by leveraging the interactivity and increased personalization of digital platforms.[30]

Food and beverage companies invest millions of dollars per year to advertise high fat, sugar, and salt products across a wide variety of media platforms and child settings, often employing sophisticated marketing strategies to influence consumer preferences and behaviours.[33,35–37] In Canada alone, approximately $628.6 million was spent on food and beverage advertising in 2019.[38] The majority of national food and beverage advertising expenditures were derived from restaurants (55.7% of all expenditures) and a large share (87.2%) of spending promoted food and beverage products or brands considered "restricted" for advertising to children in Canada.[38] In the same year, in the United States it was reported that fast-food restaurants alone spent $5 billion in advertising and that this expenditure had increased since 2012.[39]

With respect to beverage marketing expenditures, a more recent report from the United States revealed that $1.04 billion was spent to promote sugary drinks specifically in 2018, an observed 26% increase from 2013 in advertising expenditures directly related to sugary drinks.[40] Over half ($745 million) of these advertising expenditures were for sodas or sports drinks.[40] The most recent estimates available in Canada showed that despite an overall decline in beverage marketing expenditures over time, expenditures remained high in 2019 and approximately $30 million was spent on beverage advertisements.[38] Advertising expenditures were further classified to show that almost $18 million was spent across Canada on energy drinks, juices, and soft

drinks targeted towards adolescents.[41] Although no other formal assessments of beverage marketing expenditures have been conducted in other countries, the body of literature regarding the presence and children's exposure to beverage advertising continues to grow.

Food marketing to children has been identified on television, digital media (including social media, websites, and the Internet), packaging, in supermarkets, outdoor settings (e.g., billboards, bus shelters) and other recreational settings.[31,42] In North America, children and adolescent's exposure to and the frequency of food marketing have been documented by several studies. While evidence of food marketing has been documented on multiple media channels and child settings in Canada, most research focused on television and digital media.[42] Television and online media also dominate the examined media in the food marketing literature from the UK and US.[43] Similar trends in exposure have been noted in Latin America. A recent synthesis of food marketing studies in Latin America revealed television to be the main platform for promoting foods with between 5.6% and 36.4% of advertisements related to foods and beverages.[44]

1.2.1 Youth as a Market Segment

Youth are frequently the target of food and beverage marketing practices due to their powerful role as consumers.[30] Children under 13 years old are especially vulnerable as they lack the cognitive skills necessary to understand the persuasive intent of marketing, yet exert considerable influence over family food purchases.[11] Adolescents, who hold greater independence and autonomy with their spending habits, are also susceptible to the influence of marketing appeals, which capitalize on their developmental concerns of fitting in with their peers.[45] Food and beverage companies frequently exploit these unique vulnerabilities by designing their products and associated advertisements to build and reach their younger

consumer base. Companies may achieve these goals through a number of different strategies including the use of child or adolescent-appealing marketing techniques in product or advertisement designs, advertisement placement, pricing strategies, and other promotional tactics.[11] Embedded marketing techniques are a particularly effective approach to surreptitiously integrate persuasive marketing into commercial content targeting youth while simultaneously providing brand exposure. These types of techniques are also known to differ by age group. For instance, brand or licensed characters and child actors are popular techniques incorporated by food companies in child-appealing marketing while adolescent-appealing marketing most often features adolescent themes (e.g., socializing, fashion, etc.) or adolescent actors.[46,47]One study on television found that children's fast food advertisements on television focused on visual branding and heavily featured toy premiums and movie cross promotions while adult-targeted advertisements for the same restaurants emphasized elements of food products, such as taste and price.[48]

1.2.2 Child and Youth Exposure to Food and Beverage Marketing

The impact of marketing is dependent on exposure to and the power of the food marketing.[49] Exposure to food marketing is a function of the potential exposure, also referred to as frequency, and actual exposure. Power refers to message content, design, and execution. The WHO has encouraged continued monitoring of food and beverage marketing to help benchmark child and youth exposure levels. The available literature is limited with respect to an examination of international patterns in food marketing, as well as evidence quantifying food marketing to children on media platforms beyond only television. Moreover, the vast majority of studies have been conducted in North America and Australia.[50] It was recently estimated that children aged 12 to 17 in Canada were exposed to approximately 1,632 food and beverage advertisements on

television alone during 2019 (Potvin Kent et al., unpublished). Of these advertisements, sugary drinks were a prominent source of exposure. Despite global differences in exposure to food and marketing, the body of literature overwhelmingly indicates that high calorie and nutritionally poor foods and beverages are advertised to children around the world.[35,43,51]In New Zealand, it was estimated that children view an average rate of advertisements viewed daily by children was 27.3 and that home, public spaces, and schools were the main sources of exposure.[52] Other research has demonstrated that children and adolescents view an average of 1.4 and 2.6 food advertisements per 10-minute period on social media.[53]

1.3 Impact of Food and Beverage Marketing

Children and adolescents face multiple avenues of exposure to food and beverage marketing from an early age. It is the pervasiveness of unhealthy food and beverage marketing within and across multiple media platforms and child spaces which poses a significant threat to public health, as repetitive exposure to such advertising may produce a myriad of downstream health effects. Kelly et al. proposed a hierarchical framework of the numerous effects linked with food marketing based on available research (Appendix A); this work proposed a logical sequence of individual-level effects as a result of food promotions ranging from proximal effects, such as food brand awareness or preference, to intermediate effects, such as purchasing behaviours, and distal effects, such as consumption and weigh-related outcomes.[54] The current literature predominantly focuses on proximal and intermediate outcomes of food marketing exposure in children, such as food preferences, purchasing behaviours, and consumption patterns.[33,54–56] Of these outcome measures, the evidence demonstrating the impact of food marketing on intake and consumption is most robust, with one recent systematic review and meta analysis determining that a significant increase in food intake was associated with food marketing across 46 experimental and non-experimental studies, regardless of media platform.[56] The mean age of

children however, did not significantly moderate this association.[56] Similarly, another systematic review specifically focusing on proximal measures in children 0 to 18 years reported a strong international evidence basis for increased consumption and favourable attitudes towards marketed foods on television, movies, and product packaging.[55] However, the same review also cited a need for research investigating implicit responses to food marketing exposure.

Emerging evidence suggests that adolescents are uniquely affected by food and beverage marketing in comparison to younger children, yet the paucity of existing research is limited with respect to the scope of eating-related outcomes, age groups, and geographic locations.[57] Studies examining outcomes in youth typically involve children under 12 as most global policy action is aimed at this age group due to their perceived vulnerabilities to marketing. Older children and adolescents, particularly those above 15 years, are rarely studied.[47,55,57,58] One study examining Canadian television data found the proportion of fast food advertisements to be significantly greater on adolescent programming compared to other child and adult age group programming.[59] Neurobiological studies investigating the mechanism through which food marketing impacts youth have shown that adolescence is a period of intense neurological changes, where areas of the brain involved in processing reward and appetitive cues are fully developed and increasingly sensitive to environmental cues, while brain regions involved in inhibitory control are underdeveloped.[60–64] In short, compared to younger children and adults, adolescents are less equipped to resist reward cues, such as branding, themes of fun, socializing, or risk-taking behaviour, which are common in adolescent-targeted food marketing.

1.3.1 Impact of Food and Beverage Marketing on Brand Recall

The observed extent and nature of child-directed food and beverage advertisements is driven largely by the food industry's intent to promote their brand and build lifelong brand

attachments among their young consumers.[30,54] Food and beverages are one of the most branded types of products in the marketing space compared to other product types.[65] Branding refers to a symbol or logo unique to a product and which differentiates it from its competitors.[66] Under this premise, successful marketing campaigns follow a brand-focused approach, whereby advertisements employ powerful marketing strategies to appeal to their target audience and aim to develop brand equity by influencing brand preferences, awareness, and purchasing behaviours.[30] This 'branding' approach is at the crux of marketing, health, and psychosociological research, as the underlying theory of this approach posits that marketing stimuli can produce an explicit or implicit response in individuals, regardless of whether an individual is consciously aware of the marketing cue.[67] These responses consequentially manifest as the positive brand attitudes which can lead to long-term health implications.[54,67] Research has observed that the strength of these attitudes is a function multiple variables including age of advertising exposure, frequency of exposure, and placement, and that early childhood exposure to unhealthy food advertising can produce positive brand attitudes which persist into adulthood.[68,69]

Brand awareness is considered an important contributor towards brand equity and is considered the first step along the hierarchical pathway of food promotion effects outlined by Kelly et al. (2015).[54] Brand recall is one dimension of brand awareness and refers to a consumer's ability to identify a brand from memory within the context of a situation.[66] Advertisements may be cognitively processed and retained either explicitly (i.e., a conscious awareness) or implicitly.[70] With respect to food marketing, this concept is typically assessed through cross-sectional surveys.[54] One study demonstrated a significant increase in the brand recognition and attitudes among younger children between 7 to 12 years old post acute exposure

to television and online food advertisements.[71] Exposure to food marketing evokes a similar response in pre-adolescents and adolescents; the results of nine experimental studies suggested a positive correlation between marketing exposure and increased product and brand recall.[57]

1.3.2 Impact of Food and Beverage Marketing on Brand Preference

Dietary preferences are another response to marketing exposure and have been well studied in the literature.[55] In the context of food marketing, measurements of preference include explicitly asking children to rank their preferences of promoted products, recording changes to product preferences after various advertising exposure conditions, or the use of a taste preference scale or score to rank advertised products.[54] Emerging research has also explored the use of emojis as a novel and valid approach to measuring food and beverage preference in response to food marketing, particularly among children and adolescents.[72–75] Moreover, the results of one study suggest that the inclusion of emojis better predicts children's food choices and describes their emotional profile towards food products.[75]

Empirical evidence supports an association between food marketing and increased preferential attitudes in child populations.[58,76,77] Children aged 6 to 13 in England were found to select unhealthier food items after exposure to food commercials compared to after exposure to non-food commercials, and food preferences among those with greater regular television viewing habits were subject to greater influence from food commercials compared to children with lower levels of television viewing.[78] There is moderate evidence supporting an association between television advertising exposure and increased preference for sweets. Among children aged 8 to 15 years in the United States, unhealthy food and beverage preference was significantly associated with time spent examining promoted products in food and beverage advertisements.[79] Similarly, more favourable attitudes and preferences for advertised food products were found

among children between 8 to 14 years in Australia who were exposed to food advertisements on television or the Internet.[80] No studies have compared the association between food and beverage marketing exposure and preference among different children and adolescent age groups.

1.3.3 Impact of SD Marketing on Children and Adolescents

As previously mentioned, sugary drinks are a common source of children and youth's marketing exposure.[35] Of particular concern, are the effects, on both a proximal and distal scale, as well as the health implications of exposure to sugary drink marketing. Television advertising data from across 22 countries revealed soft drinks and flavoured waters to be among the most frequently advertised food and beverage products globally.[35] Other research also suggests that sugar-sweetened beverages are among the most commonly promoted food and beverage products viewed by adolescents online.[81] For example, between 23%-83% of energy drink advertisements on television aimed at adolescents promoted alongside athletes or celebrities or featured extreme sports to appeal to this age group's greater propensity for risk taking behaviours.[82] On television, short-term exposure to sugar-sweetened beverage advertisements was associated with a 9.4% increase in elementary school children's soft drink consumption in the United States.[83] In younger children aged 1 to 5 years, higher adiposity levels were associated with those who viewed sugar-sweetened beverage television advertisements.[84] The evidence specific to pre-adolescents and older children differs. One systematic review noted that while numerous studies supported a positive association between food marketing exposure and increased high sugar intake in pre-adolescents and adolescents, little evidence was found to support increased intake of high sugar beverages specifically.[57] One study which did observe a positive association concluded that unhealthy food marketing exposure was significantly associated with higher soft drink consumption and lower water consumption.[57] Of equal concern is that sugary drink marketing is influencing family purchases. Much of the current literature examines the impact of

television on children's eating outcomes however, the expansion of the digital media environment puts youth at an increased risk for exposure to food marketing.[57,85] Digital marketing provides beverage companies with greater opportunities to target children and adolescents through the advent of personalized marketing techniques, the ability to continuously promote content, and allows them to capture a wider audience than with traditional advertising such as television.[86] Some of the documented effects of SD marketing specifically include increased household purchases and elevated intake of advertised beverages among children and adolescents.[83,87,88] Taken together, the findings of these studies demonstrate the impact of beverage marketing on multiple indicators on the pathway to diet-related outcomes.

1.4 International and National Food Marketing Policy

Policy and government plays a key role in the context of creating healthy food environments.[15] Though current research has increased awareness of the potential impacts of SD marketing and has spurred a global consensus to protect children from the harms of unhealthy food and beverage marketing, little regulatory progress has been made. In 2010, the WHO Member States endorsed a set of recommendations on the marketing of food and non-alcoholic beverages to children. The WHO subsequently encouraged the monitoring of food marketing to children and developed a set of recommendations to guide international efforts towards reducing children's exposure to food and beverage marketing.[89] The WHO has since emphasized the need to address SD in particular as part of the global action to prevent non-communicable diseases.[89] Most recently, the WHO has linked the implementation of food marketing restrictions to global nutrition and NCD targets for 2025.[90]

Since the implementation of the WHO's recommendations, most regulatory progress has taken place in developed nations such as the United Kingdom, Canada, the United States,

Australia, and Chile, with most countries relying on food industry-led restrictions to food and beverage advertising to children.[91] The design and scope of these self-regulatory approaches differs by country (Appendix B); for example in Canada, the regulatory framework for food marketing to children includes of the *Canadian Children's Advertising Initiative* (CAI), a voluntary initiative whereby 15 food and beverage companies pledged not to advertise unhealthy products to children under 12 years old.[92,93] However, independent assessments of this initiative indicate fundamental problems, namely with its inconsistent nutritional standards, leniency, and lack of compliance.[91,94] Health Canada has also stipulated restrictions specific to the advertising of energy drinks to youth under the Food and Drugs Act, which include restrictions prohibiting the promotion of caffeinated energy drinks with alcohol or to children, yet evidence indicates that these additional regulations are often circumvented by Canadian beverage companies.[95–97] The Canadian broadcast industry has also established its own regulations for advertising to children through the *Broadcast Code for Advertising to Children*. This *Code* provides vague guidelines of what can be advertised to children (e.g., healthy foods cannot be disparaged, snacks can not be portrayed as meal replacements) and does not indicate any formal penalties for companies which do not adhere to these regulations.[98]

Other international self-regulatory models have also received substantial criticism from public health researchers and advocates for their failures to reduce unhealthy food and beverage marketing to children.[91] Food marketing regulations on broadcast media in the UK are co-regulated through the government and advertising industry while regulations on non-broadcast media is entirely self-regulated by advertisers.[99] Future policy development requires knowledge of the association between youth exposure to SD marketing on the behavioural precursors of obesity to justify and construct more robust policies in this area.

1.4 Rationale of Thesis

Emerging evidence suggests that adolescents are uniquely affected by food and beverage marketing in comparison to younger children, yet the paucity of existing research is limited with respect to the scope of eating-related outcomes, age groups, and geographic locations.[57] Moreover, despite the associations between food and beverage marketing exposure and youth dietary outcomes, no research has focused specifically on SD marketing or this relationship within an international context. The most conspicuous evidence gap is the absence of research examining exposure to SD marketing in relation to the potential determinants of children's dietary behaviour (i.e., preferences, attitudes, and beliefs). Such studies are fundamental to understanding the extent to which food and beverage marketing influences diet mediators of childhood obesity, as well as to informing broader policy action. This study will provide valuable evidence on two fronts: (1) it will describe the relationship between exposure to SD marketing and brand recall and preference among youth, an age group severely underrepresented in the literature, and (2) on a broader policy level, it will highlight international variations in this relationship, which may add weight to the evidence base used by both national and international policymakers to develop SD marketing restrictions related to youth.

1.5 Thesis Research Objectives and Hypotheses

The objectives of this study were:

1. To examine the association between self-reported exposure to SD advertising on youth's SD preferences and brand recall.
2. To explore whether this association varies internationally between Canada, USA, UK, Chile, Mexico, and Australia.

3. To examine whether this association differs between age groups (children versus adolescents).

It was predicted that:

1. Exposure to SD advertising would be positively associated with youth's brand preferences and recall.
2. Associations between exposure and brand preference and recall would differ across countries, particularly in the UK, where extensive television food marketing restrictions have been in place for several years.
3. Stronger associations between exposure and brand preference and recall would be observed in adolescents (13-17 years old) compared to children (10-12 years old).

Chapter 2: Methods

2.1 International Food Policy Study

This study used cross-sectional data from the International Food Policy Study (IFPS), an international web-based survey led by the University of Waterloo in collaboration with international researchers using a quasi-experimental design. The IFPS aims to evaluate the influence of national-level food marketing policies on dietary patterns and behaviours in adults 18 years and above across five countries (Canada, USA, UK, Mexico, and Australia). In 2019, youth aged 10 – 17 years and respondents in Chile were also included in the IFPS surveys. The data analyzed in this study were collected in the first wave of the IFPS youth survey conducted between November to December in 2019, in which 11,108 youth respondents participated from among the six countries: Australia (n=1,435), Canada (n=3,682), Chile (n=1,252) Mexico (n=1,616), the UK (n=1,520), and the US (n=1,603). The IFPS was approved by the University of Waterloo's Research (ORE#41477) and Ethics Committee and the University of Ottawa Research Ethics Board (H-06-20-5908).

2.1.1 Sampling Strategy

Parents of potential youth participants were contacted through Nielsen Consumer Panel Insights and their country-specific affiliate panels using both probability and non-probability sampling methods. Online survey panel companies such as Nielsen typically use non-probability sampling methods, where adults become panelists by signing up and providing demographic information. Panelists are then targeted by the survey company for survey completion based on their demographics. A complete description of the IFPS sampling strategy is available in Hammond et al 2022.[100] Interested adult panelists were screened to determine if their child was between 10 to 17 years old. Those with children within the study age range were provided with

information about the study and were asked to provide online consent for their child to participate. Children were also screened to determine eligibility based on age and sex. Quotas for age and sex were applied only in the UK and US to ensure a diverse and representative sample. Target language quotas were applied in Canada for French and English, and in Spanish in the US, as proportional to the population distribution.

2.2 Thesis Variables

This study explored the association between self-reported exposure to the frequency of SD marketing and SD brand specific marketing with SD brand preference and brand recall.

2.2.1 Definition of Sugary Drinks

The term 'sugary drinks' encompasses all non-alcoholic drinks with free sugars (added sugars and sugars naturally present in honey, syrups, or fruit juice concentrates) as previously defined by Hammond et al.[17] Examples include 100% fruit juices, soft drinks, energy drinks, sweetened coffees/teas, etc.

2.2.2 Main Predictors

The main predictors included in this study were as follows:

(1) Exposure to SD marketing.

In the last 30 days, how often did you see or hear advertisements for these kinds of food or drinks? Ads for sugary drinks.

A. Never
B. Less than once a week
C. Once a week
D. A few times a week
E. Every day
F. More than once a day
G. Don't know
H. Refuse to answer

(2) Exposure to SD brands. Children's exposure to SD brands will be measured through whether participants had seen any advertisements in the past 30 days for any of three specific SD brands such as Coca-Cola, Red-Bull, and a country specific 100% juice brand (e.g., Tropicana, Golden Circle, Watt's, del Valle, Innocent, and Simply Beverages).

Have you seen any advertisements for this drink brand in the last 30 days? (Coca-Cola, Red-Bull, country-specific 100% juice)

[Ask for each brand image one at a time; randomize order of screens]

A. Yes
B. No
C. Don't know
D. Refuse to answer

2.2.3 Outcome Measures

Two main outcome variables were considered in this cross-sectional analysis:

(1) The first outcome variable will be youth drink brand preference.

How much would you like to have this drink?

[Show same brand image as above]

- Don't know
- Refuse to answer

(2) The second outcome measure will be SD brand recall.

Please name up to 5 drink brands:

- Brand 1: [open-text]
- Brand 2: [open-text]
- Brand 3: [open-text]

- Brand 4: [open-text]
- Brand 5: [open-text]
- I don't know any drink brands
- Refuse to answer

As brand recall was an open text variable in the IFPS, each response was manually reviewed and coded to determine if the response was a valid SD brand, a SD product, or other (food product/brand, generic (e.g., "water"), or nonsense). A brand was considered to be a generic line of products, such as Gatorade, while responses which named a specific drink flavour, such as Gatorade Fruit Punch, were considered to be a product. A coding manual was developed to further categorize valid SD brand responses based on the parent company and beverage brand type (Table 1). The beverage type categories were based on those previously used in the Beverage Frequency Questionnaire.[101] The coding of responses followed a hierarchical process, as outlined by Figure 1. Any SD products named by respondents were mapped to an SD brand. All coding was completed by the primary author of this thesis. A 10% sample of all responses were reviewed a second time to ensure the accuracy of the coding.

Figure 1. Overview of open text response coding

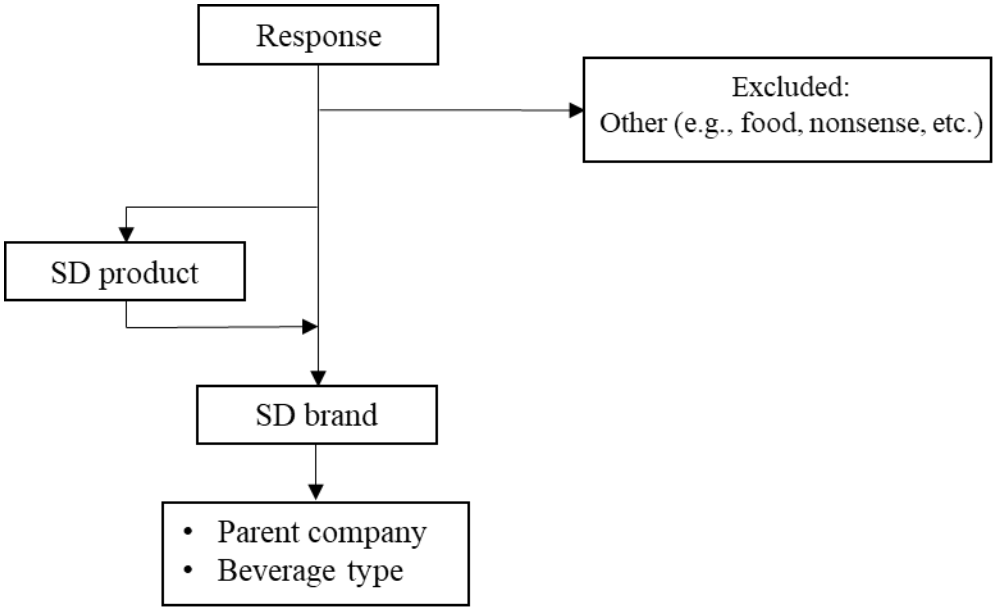

Table 2. Open text coding manual

Variable	Description
Response type	Brand (e.g., Gatorade) Product (Gatorade Fruit Punch) Excluded: food brands, generic beverages (e.g., "water"), gibberish responses
Beverage brand type	Soda (regular and diet) Sports drinks Energy drinks Frozen drinks Coffee and tea (with and without sugar) Fruit juice (with and without sugar) Water (flavoured and unflavoured) Smoothies Dairy milk (flavoured and unflavoured) Alcohol Mixed (i.e., more than one category) Plant milk (flavoured and unflavoured) Other (e.g., powdered drink mixes, soda water, protein water, etc.)
Parent company	General company which owns the brand

2.2.4 Variable Transformations

Table 1. Description of variable transformations

IFPS Variable	Response Options	Transformed Variable
Main Predictors		
Frequency of self-reported exposure to SD marketing	1= Never 2= Less than once a week 3= Once a week 4= A few times a week 5= Every day 6= More than once a day 7= Don't know 8= Refuse to answer	1= Low frequency of exposure (Never, less than once a week, once a week) 2= Medium-high frequency of exposure (A few times a week, every day, more than once a day)
Exposure to Coca-Cola, Red Bull, or juice brand marketing	1= Yes 2= No	0= No advertisement exposure 1= Viewed 1-3 advertisements

IFPS Variable	Response Options	Transformed Variable
		*Note: this variable transformation was only applied to brand recall models
Outcomes		
Preference for Coca-Cola, Red Bull, or juice	 A B C D E F G • Don't know • Refuse to answer	1= Strongly dislike (A-C) 2= Neutral (D-E) 3= Strong preference (F-G)
Brand recall	• Brand 1: [open-text] • Brand 2: [open-text] • Brand 3: [open-text] • Brand 4: [open-text] • Brand 5: [open-text] • I don't know any drink brands • Refuse to answer	1= 0-3 brands recalled 2= 4-5 brands recalled
Covariates		
Sex	1= Male 2= Female	N/A
Age	Continuous (values between 10-17 years old)	1= Children (10-12 years old) 2= Adolescents (13-17 years old) *Note: this variable transformation was only applied for the subgroup analysis by age groups
Perceived income adequacy	1=Not enough money 2=Barely enough money 3=Enough money 4=More than enough money -77=Don't know -88=Refuse to answer	1= Not enough money or barely enough money 2= Enough money or more than enough money
Ethnicity	1= Majority 2= Minority -99=Not stated	1= Majority* 2= Minority *Majority in Canada, USA, UK was defined as White only. In Mexico and Chile it

IFPS Variable	Response Options	Transformed Variable
		was defined as Non-Indigenous and English-speaking only in Australia.
Country	1=Canada 2=Australia 3=United Kingdom 4=United States of America 5=Mexico 6=Chile	N/A

2.3 Statistical Analysis

All statistical analysis was conducted using the survey procedures available in SAS v.9.4 software. A complete case analysis approach was undertaken, whereby any participants with missing, "don't know" or "refuse to answer" responses for any of the main predictors, covariates, or outcomes of interest, were removed from the dataset. The final weighted analytical sample was n=8,502 youth (n=8,493 unweighted).

2.3.1 Research Objective 1 and 2

Proportional odds model regression was used to explore the association between self-reported exposure to SD advertising and youth SD brand preferences. This type of logistic regression is the most suitable method when the outcome of interest is ordinal in nature and assumes that odds are proportional (i.e., that the effect of a predictor is the same across each level of the outcome).[102] This proportionality assumption was assessed using the Score Test for Proportional Odds Assumption in SAS, where a significant p value ($p \leq 0.05$) indicated that the proportionality assumption was violated and that a different type of regression may be necessary. The score test was assessed for all overall models. In cases where the proportionality assumption did not hold, multinomial logistic regression was performed. Binary logistic regression was applied to examine the association between self-reported exposure to SD advertising and youth SD brand

recall. This regression type is used to describe associations where the outcome is dichotomous (e.g., 0-3 vs 4 or more brands recalled).

The two-way interaction between country and the predictors of interest (exposure to SD marketing in the past 30 days and exposure to Coca-Cola, Red Bull, or juice brand advertisements) was explored by including the interaction term in each model. The model with and without the interaction term was compared using a likelihood ratio test for interaction were used to identify the presence of interaction between country and the predictors of interest. A significant likelihood ratio test ($p \leq 0.05$) indicated the need to stratify the results by country. For simplicity, all models were stratified by country if at least one statistically significant interaction was detected. As previously described, multinomial regression was conducted for any country-stratified models where the ordinal proportionality assumption was violated.

2.3.2 Research Objective 3

Three-way interaction between age, country, and the predictors of interest were explored to determine if the association between SD marketing youth brand preference or recall differed by youth age group (children (10-12 years) versus adolescents (13-17 years)). No significant interactions ($p \leq 0.05$) were detected. As a result, an exploratory subgroup analysis was performed. The domain option in the SAS survey procedures was applied for this analysis using child age group (0=adolescent, 1=child) as the variable of interest.

Chapter 3: Manuscript

This manuscript is in preparation to be submitted to a journal such as BMC Public Health.

The impact of exposure to sugary drink marketing on youth brand preference and recall

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Ethics Approval

The International Food Policy Study received ethics approval from the Research Committee at the University of Waterloo ((ORE #414) and the University of Ottawa's Research and Ethics Board (H-06-20-5908).

Funding

Funding for the International Food Policy Study Youth Survey was provided by an international health grant from the Public Health Agency of Canada (PHAC), with additional support from a Canadian Institutes of Health Research (CIHR) project grant (pjt-162167).

Competing Interests

The study has no affiliations with the food industry and there are no conflicts of interests to declare.

Availability of Data

Data may be available from the International Food Policy Study upon reasonable request.

Abstract

Background

Consumption of sugary drinks (SD) among children and adolescents is a prevalent public health issue both within Canada and worldwide. This problem is exacerbated by the powerful marketing of such beverages to youth, which is known to influence a wide range of dietary behaviours.

Methods

A secondary analysis of the International Food Policy Survey Youth Wave 2019 was conducted to assess the impact of self-reported exposure to SD marketing within the past 30 days or SD brand advertisements on youth brand preference and brand recall overall, by country, and by youth age group. Ordinal, multinomial, and binary logistic regression were used as appropriate to examine these associations.

Results

Youth brand preference and recall was positively associated with self-reported exposure to general and brand-specific SD marketing across all countries. No statistical interaction was observed between youth age and SD marketing overall or within countries. Soft drinks, sports drinks, and fruit juice brands were most commonly recalled by all youth.

Conclusion

Similar results were observed among children and adolescents within all countries. Global marketing policies should consider older children and adolescents to adequately protect and support child health.

1.0 Introduction

Non-communicable diseases (NCD) are responsible for millions of deaths among adults worldwide and are considered a critical global public health issue.[1] Childhood obesity is a significant risk factor for a number of NCDs including diabetes and cardiovascular disease and also poses risk for several physical and mental health consequences in the short-term.[2–4] While the prevalence of obesity among children 5 to 19 years old has plateaued in high-income Western and Latin American countries between 1975-2016 among children, overweight and obesity levels remain high and reducing excess weight in children is considered a global priority by the World Health Organization (WHO).[5] The key drivers of childhood obesity stem from a wealth of individual, social, environmental, and physical factors. In particular, the food environment is instrumental in shaping youth eating behaviours, which can carry into adulthood.[6]

Globally, sugary drinks (SDs) represent the greatest source of free sugar intake in children and adolescents' diets.[7–9] These types of drinks, defined as beverages containing added or natural sugars (i.e., free sugars), encompass sugar-sweetened beverages (SSB) such as soft drinks, energy drinks, sports drinks, or sweetened coffees and teas, as well as 100% fruit juices, sweetened drinkable yogurts, and flavoured water or milk beverages.[8] Excessive sugar consumption from a young age drives lifelong sugar cravings, making it more difficult to transition children to healthier beverage options.[10,11] In Canada, children and adolescents are known to consume a daily average of 578 ml sugary drinks.[8] The consumption of free sugars is greatest among youth (9-18 years)[12] and sugary drinks, particularly soft drinks and fruit juices, are among the top sources of free sugar consumption in this age group.[8] Consumption rates of SDs are as equally alarming in other countries, including in North America, South America, and Europe, where SSBs represent a significant share of child and adolescents' sugar intake.[13–15]

Youth are a valuable demographic market to food and beverage companies due to their influence over family purchases and future as adult consumers.[16] Companies aim to develop positive brand relationships with their youth consumers by targeting children and adolescents through multiple channels and settings, but primarily on television and digital media.[17,18] Few studies have compared exposure to food and beverage marketing (hereafter referred to as food marketing) among youth globally. However, one study found that youth aged 10 to 17 in Canada, Australia, Mexico, UK, USA, and Chile, frequently reported exposure to sugary drinks and fast food, particularly on television, in which between 43-69% of youth reported seeing advertisements for unhealthy foods/drinks within the past month.[19]

Sugary drinks are heavily advertised to children and adolescents and the marketing of such products contributes to unhealthy food consumption.[20] Exposure to unhealthy food marketing is causally linked to children's eating preferences and attitudes.[20] Both short and regular exposure to food marketing are a cause for concern as exposure acts as a cue for consumption responses.[21,22] For instance, American and Australian children exposed to food advertisements on television more frequently chose advertised and unhealthier foods compared to those who were not exposed.[23,24] Of equal concern is the influence of food advertisements on memory, whereby exposure to advertisements leads to an explicit or implicit cognitive processing and prompts easier recall of advertised brands.[25] Empirical evidence from one Australian study demonstrated that children most often recalled one particular savoury snack brand and that advertisements for this brand featured promotional characters such as celebrities.[26] The effects of food marketing may also operate differently depending on age groups, however, the evidence is mixed. Adolescents (defined by the World Health Organization as children aged 10 to 19)[27] are particularly sensitive to the power of food marketing due to their development stage,

susceptibility to peer influence, and high levels of advertising exposure.[16] Despite these vulnerabilities, older children and adolescents are rarely examined as a unique population in the food marketing literature.[28]

The WHO has specifically identified SD marketing as an area requiring policy action.[29] Most countries currently rely on self-regulatory models established by the food and beverage industry to monitor and control SD marketing; however research has demonstrated that these policies are inadequate at protecting children from exposure to marketing.[30–32] Moreover, most self-regulatory policies only protect children up to 13 years old. Further research examining the effects of SD marketing on youth outcomes is needed to inform global policy efforts. To help fill this gap, this study aimed to explore the association between self-reported exposure to SD marketing on youth (10-17 years old) SD preferences and recall and to examine whether this association differed in six countries (Canada, Australia, UK, USA, Mexico, and Chile). A secondary objective included examining whether these associations differed by youth age groups (children 10-12 years versus adolescents 13-17 years). It was predicted that youth brand preference and recall would be positively associated with self-reported SD marketing and that these associations would differ across countries, particularly in the UK where extensive restrictions have been implemented since 2011. It was also predicted that differences in the associations would be observed by child age group (10-12 years old versus 13-17 years old), as older children will have a greater duration and accumulation of exposure to SD marketing due to their age.

2.0 Methods

Data were from the 2019 International Food Policy Study (IFPS) Youth Survey, an annual repeat cross-sectional survey conducted in Australia, Canada, Chile, Mexico, the United Kingdom, and

the United States.[33] Data were collected via self-completed web-based surveys conducted in November-December 2019 with youth aged 10 –17 years. Respondents were recruited through parents/guardians enrolled in the Nielsen Consumer Insights Global Panel and their partners" panels. Email invitations with unique survey links were sent to adult panelists within each country. Those who confirmed they had a child aged 10 –17 living in their household were asked for permission for their child to complete the survey (only one child per household was invited). Children aged 10 –17 years were eligible to participate, with quotas for age and sex groups in the United Kingdom and United States. After eligibility screening, all potential respondents were provided with information about the study and asked to provide assent. Surveys were conducted in English in Australia and the United Kingdom; Spanish in Chile and Mexico; English or French in Canada; and English or Spanish in the United States. Members of the research team who were native in each language reviewed the French and Spanish translations independently. The median survey time was 24 minutes.

The child's parent/guardian received remuneration in accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes). The IFPS was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#41477) and this study received ethics approval through the University of Ottawa Research Ethics Board (H-06-20-5908). A full description of the study methods can be found in the International Food Policy Study: Technical Report – 2019 Youth Survey.[34]

2.1 Measures

2.1.1 Youth sugary drink brand recall and brand preference

The main outcomes of interest of this study were youth brand preference and youth brand recall. These outcomes were selected as they are the first steps within the hierarchical framework of food marketing effects.[35] Brand preference was assessed as a self-reported emoji scale using the question: *How much would you like to have this drink?* Participants were asked to rate their preference to either Coca-Cola, Red Bull, or a country-specific 100% juice brand from a 7-point Likert-type emoji scale which ranged from "strongly dislike" to "strongly prefer", "don't know", and "refuse to answer" (Figure 1). Brand preference was recoded as a categorical variable with three levels, where "strongly dislike", "dislike", and "somewhat dislike" were combined as "dislike"; "neutral" and "somewhat prefer" combined as "neutral"; and "prefer" and "strongly prefer" combined as "prefer".

Figure 1. IFPS emoji-scale measure of youth brand preference

Youth SD brand recall was examined using the following question: *An example of a candy brand is Skittles. An example of a chip brand is Pringles. Please name up to 5 drink brands*. Participants could also select "don't know" or "refuse to answer". All open text responses were reviewed and coded to determine if the response was a valid SD brand. A summary variable was created for the analyses, to count the number of legitimate brands recalled per participant, ranging from 0 to 5 brands. The number of brands recalled was then recoded as a binary variable with 0-3 brands recalled grouped together and 4-5 brands recalled grouped to minimize small cell sizes. A recall of 0 brands meant that either the participant had selected "don't know" or the

responses provided were considered to be invalid SD brands (e.g., a generic drink such as "milk" or "cola", food product, etc.).

2.1.2 Self-reported exposure to sugary drink marketing frequency

Self-reported exposure to SD marketing was assessed based on the following question: *In the last 30 days, how often did you see or hear advertisements for these kinds of food or drinks? Ads for sugary drinks*. Response options were "never", "less than once a week", "once a week", "a few times a week", "every day", "more than once a day", "don't know", or "refuse to answer". The variable was collapsed into 2 categories of "low exposure" ("never", "less than once a week", and "once a week") and "medium-high exposure" ("a few times a week", "every day", "more than once a day") to minimize small cell sizes. Respondents who selected "don't know" or "refuse to answer" were excluded from analyses.

2.1.3 Self-reported exposure to sugary drink brand advertisements

Participants reported exposure to three global SD brands: Coca-Cola, Red Bull, and/or country-specific 100% juice brand advertisements in a randomized order. These brands were selected as they represented major brands in all IFPS countries based on Euromonitor data. Respondents reported whether they had seen or heard advertisements in the past 30 days for each brand (response options: "yes", "no", "don't know", or "refuse to answer"). An aggregate variable of brand advertising exposure was constructed by summing the number of brands viewed by a participant, ranging from 0 (participant reported "no" to exposure to all three brand advertisements) to 3 (participant reported "yes" to exposure to all three brand advertisements). This aggregate variable was only used in analyses involving the brand recall outcome. Responses of "don't know" and "refuse to answer" were considered missing and excluded from all analyses.

2.1.4 Sociodemographics

Sociodemographic characteristics included as covariates were age, sex-at-birth, ethnicity, perceived income adequacy, and country. Age was modelled as a continuous variable in all overall models but was collapsed into two categories (10-12 years old and 13-17 years old) for subgroup analysis as described below. Sex was included as a binary variable with response options of "male" or "female". Race/ethnicity was assessed as a binary variable, "majority" or "minority" and was derived from measures adapted from census methods from each country. Perceived income adequacy based on self-reported responses to the question "*Does your family have enough money to pay for things your family needs*" (response options: "not enough money", "barely enough money", "enough money", "more than enough money", "don't know", and "refuse to answer"). Categories were collapsed to create a binary variable, where "inadequate" included "not enough money" and "barely enough money" and "adequate" included "enough money" and "more than enough money". Responses of "don't know" and "refuse to answer" were excluded.

2.2 Data analysis

A total of 11,491 children completed the survey. Respondents were excluded for the following reasons: region was missing, ineligible or had an inadequate sample size (i.e., Canadian territories); invalid response to a data quality question; and/or survey completion time under 10 minutes (n=383). The analytic sample included 11,108 respondents (Australia: n=1,435; Canada: n=3,682; Chile: n=1,252; Mexico: n=1,616; United Kingdom: n=1,520; United States: n=1,603). A sub-sample (n=8,871) were included in the current analysis after excluding respondents with missing data (including do not know and refuse to answer) for all covariates and main predictors and outcomes of interest. Data were weighted with post-stratification sample weights constructed

using a raking algorithm with population estimates from the census in each country based on age group, sex, region, and ethnicity (except in Canada). Estimates reported are weighted unless otherwise specified. All models were adjusted for age, sex, ethnicity, perceived income adequacy, and country however the regression results for these variables are not presented. Analyses were conducted using survey analysis procedures in SAS version 9.4 and data graphs were produced using R v.4.2.1 in RStudio and the dyplr, ggplot2, and patchwork packages.[36–39]

The association between self-reported SD marketing frequency or brand advertising and brand preference was modelled using proportional odds logistic regression. The proportionality assumption was assessed using the score test for all models. In cases where the proportionality assumption was not met (i.e., score test p-value <0.05), the results of a multinomial logistic regression are presented. Binary logistic regression models were constructed to examine the association between self-reported SD marketing frequency or brand advertising and beverage brand recall. Regression results are presented overall for all models. A likelihood ratio test was used to compare models with and without interaction between country and the exposures of interest. For simplicity, all models were stratified by country if at least one statistically significant interaction between country and the predictor of interest (p-value <0.05) was detected. Similarly, the likelihood ratio test was used to test for interaction between child age (children 10-12 years old versus adolescents 13-17 years old), and exposure of interest. The test for interaction was not significant (p>0.05) and thus an exploratory subgroup analysis was performed to achieve the research objective of examining differences in the associations by child age group.

3.0 Results

3.1 Study characteristics

The weighted sample characteristics of youth participants are presented in Table 1. Differences in the proportion of sociodemographics by country were observed, consistent with different population distributions in each country.

3.2 Brand preference and association with sugary drink marketing

Overall, between 10-34% of youth reported a strong preference for either Coca-Cola, Red Bull, or juice (Table 1). Results from proportional odds regression examining the association between self-reported exposure to SD and brand advertising and brand preference are shown in Figures 1-4. Across all countries, youth who reported frequent exposure to SD marketing were more likely to prefer Coca-Cola, Red Bull, and juice compared to those who did not report frequent exposure, however this association was not statistically significant for Coca-Cola preference (Figure 1). Similarly, youth who reported viewing brand advertisements for either Coca-Cola or juice were more likely to prefer the corresponding SD brand compared to those not exposed to brand advertisements. A strong association across all countries (OR=2.3, 95% CI= 1.9, 2.73) was observed between exposure to juice brand advertisements and preference for juice.

3.3 Brand recall and association with sugary drink marketing

The top three most frequently recalled SD brands overall included Coca-Cola (75%, n=6,379), Pepsi (52%, n=4,463), and Sprite (30%, n=2,516) (Table 2). Both Coca-Cola and Pepsi were the most commonly recalled brands within all countries, with an exception being Chile, where Fanta was the second most frequently recalled brand. Sports drink brands such as Lucozade in the UK (19%, n=204), Powerade in Australia (9%, n=91), or Gatorade in Canada (25%, n=655), Australia (9%, n=91), and the US (32%, n=395) were also frequently recalled. Fruit juice brands including Jumex (34%, n=482) and Del Valle (23%, n=318) were commonly recalled in Mexico.

Higher levels of SD marketing and self-reported exposure to SD brand-specific advertising (compared to low levels of exposure) was strongly and statistically associated with a greater odds of brand recall overall and within almost all countries (Figure 5) . In particular, a greater recall for SD brands was most likely among youth in Canada (OR=2, 95%CI=1.70-2.36) and Mexico (OR=2.54, 95%CI=1.76-3.67) who reported frequent exposure to SD marketing in general compared to those who reported less frequent exposure. Youth in Mexico (OR=6.02, 95% CI=1.95-18.56), Australia (OR=2.09, 95%CI=1.56-2.8), and Canada (OR=2.32, 95%CI=1.87-2.88) who viewed at least one or more advertisements for Coca-Cola, Red Bull, and/or juice were more likely to recall SD brands compared to youth who did not see these advertisements, although the country and SD marketing exposure interaction term was not statistically significant.

3.4 Age group differences in associations

An exploratory subgroup analysis was performed to further examine differences in the associations between SD marketing and brand preference and recall among child populations (Figures 6-9). No statistical difference was detected by age group across all countries or when stratified by country, however notable trends observed in these subgroup results included a greater preference for Red Bull among adolescents.

4.0 Discussion

This study found that more frequent exposure to both general and brand-specific SD marketing were associated with positive attitudes towards SD brands and a greater recall of such brands among youth in six middle to high-income countries. Most notably, exposure to juice or Coca-Cola brand advertisements was strongly related to a greater preference for juice and Coca-Cola,

respectively. Greater SD brand recall was significantly associated with greater SD marketing overall and particularly in Mexico and Chile. Effects of the associations on brand preference and recall were similar across age groups.

4.1 Brand preference

In this study, associations among youth who reported frequent exposure to SD marketing exhibited a greater preference for juice were statistically significant across all countries. These findings are unsurprising as exposure to food marketing is known to impact children's health in multiple capacities.[35] Preference for advertised food products has been observed among children post exposure across a number of media, including television,[40–42] digital media,[42–44] and food packaging.[45,46] Most studies related to brand preference to date are experimental and measure preference after exposure to brand specific advertisements.[41] Research indicates that that food marketing influences youth dietary preferences through psychological and neurobiological mechanisms. In one study involving children aged 8 to 14, exposure to food commercials was found to stimulate increased activity in the reward regions of the brain, altering children's taste perceptions and increasing the potential for children to make food decisions driven by taste as a result of such advertisements.[47] Indeed, this notion is well recognized in the advertising community. Advertisers may target consumers subconsciously and through behaviour modification to develop brand preference for advertised products.[48] The average intake of fruit juices among children and youth aged 9 to 19 years old varies substantially by country, however higher consumption of yet fruit juices are noted in the UK (between 83-93 grams/day) and the USA (65-73 grams/day).[49,50] The observed preference for juice in this study may be concerning within the overall context of youth diets as excessive consumption can provide a substantial source of free sugar and calories in youth diets.[51] This is compounded by research which

demonstrates that youth often choose fruit juices over water or as a substitution for whole fruits or vegetables.[52]

This study also observed strong positive associations between self-reported exposure to brand advertisements (e.g., Coca-Cola or juice) and brand preference. Brand marketing plays an important role in children's eating and brand preferences.[35] Children as young as 3 years old are capable of recognizing brand logos and both children and adolescents have been found to prefer branded food and beverage items over plain/non-branded items.[53] An earlier study demonstrated that preschool children were preferred familiar branded food and beverages compared to plain packaged items.[53] However, the quantitative research supporting this association specifically in adolescent populations is sparse and existing evidence is mixed. In one experimental study involving pre-adolescents (8-12 years old) in the United States, no statistically significant association was found between exposure to a soft drink brand advertisement and drink preference or choice, while in another study among Australian children 10 to 11 years old, increased positive attitudes towards advertised food and beverage products were observed post acute exposure to television brand advertisements.[54,55] Coca-Cola is recognized as a popular beverage advertiser globally and is responsible for some of the largest beverage marketing campaigns.[56] The majority of sugary drink marketing expenditures on American television in 2018 was driven by PepsiCo and Coca-Cola. Moreover, increased spending by these companies is indicative of the beverage industry's efforts to counteract declining soft drink consumption among youth.[57] Content analyses of major sugary drink brands indicate that companies are exploiting both traditional and new forms of media to target youth. One such study revealed that the marketing content of major soft drink brands, including Coca-Cola, is heavily dominated by themes considered important to youth, such as themes of happiness, sports, or social

enhancement/fun.[58] Of equal concern is that analysis of Coca-Cola's PR practices revealed that Coca-Cola explicitly intended to target youth, with some marketing campaigns to build their youth consumer base.[59] Taken together, these results may point to the targeting of youth by major beverage companies in order to build a loyal adult consumer base in the future.[60]

4.2 Brand recall

Children and adolescents who reported viewing SD marketing or at least one or more brand advertisements in this study were also more likely to recall at least four SD brands compared to those who did not report any SD marketing exposure. A similar trend was observed within country-specific results; however these results should be cautiously interpreted due to a lack of statistically significant interaction between country and the predictors of interest. This finding is supported by evidence from the literature, which demonstrated increased free brand recall among children and adolescents post exposure to food marketing on traditional platforms, such as television[40] and in print,[61] as well as on newer media such as social and digital media[62] in Chile and the United Kingdom. Soft drink brands were the most frequently recalled responses both overall and across all countries in this study. In this study, large global companies (e.g., Coca-Cola and Pepsi) made up the vast majority of free recall responses. This was often followed by sports drinks or fruit juice brands. Brand recall is an important attitudinal response as it serves as stimulus for beverage purchases.[35] As with this study, other studies have found that unhealthy food and beverage brands are the more often recalled compared to healthier brands. This may be due to the frequent use of marketing techniques by such brands to appeal to young consumers. Children's positive attitudes towards brands have been observed to be more pronounced when the advertisement features child-appealing elements such as celebrity endorsements.[26] The influence of food marketing, particularly on an implicit level such as with recall, is concerning as

it is the first step along the hierarchical pathway of food promotion effects and poses a risk to children's downstream health.[35]

4.3 Differences between age groups

Although these results must be cautiously interpreted given the exploratory nature of this analysis, the results of the subgroup analysis suggest that preference for some brands, particularly Red Bull, may differ between children and adolescents. A study examining energy drink marketing on television suggested that Red Bull advertisements are the one of the most heavily advertised energy drinks on adolescent-targeted television stations.[63] This is unsurprising as other studies have found that energy drink advertisements on social media largely feature adolescent-targeted techniques including promoting themes of cool or extreme sports that appeal to youth (Ayoub et al., unpublished). Few studies have examined child and adolescent populations together. One study found that food product preference was similar among children (aged 5 to 11) in the UK, regardless of age.[64] Moreover, similar to this current study, the interaction between advertisement exposure and age was not significant and that younger and older children were similarly influenced by food commercials.[64] Other research also failed to detect significant differences between child age groups (9 to 15 years old) when examining Chilean children's free recall and brand attitudes after exposure to McDonald's television advertisements.[65] Taken together, the findings of this study in conjunction with the current body of literature may lend credence to adolescents being as vulnerable as children to the impacts of unhealthy food marketing. Future research should pursue further inclusion and investigation of the impacts of SD marketing on adolescents as a subgroup due to their unique vulnerabilities to further delineate these effects.

4.4 Policy implications

Overall, the findings of this study reinforce the importance of food marketing regulations to protect children and adolescents globally. The observed associations suggest that greater exposure to SD marketing and branded advertisements influence the likelihood of brand preference and recall among youth. These associations were particularly salient in Mexico and Chile, where statutory food marketing regulations have been in place since 2016 and 2018, respectively. In Chile in particular, while consumption of foods high in sugar, fat, or sodium decreased significantly among preschoolers post implementation of food marketing policies, evidence supporting a similar trend in adolescents (who would not have been captured by some marketing restrictions) was not observed.[66,67] Further research exploring the impact of food marketing policies specifically in youth populations is warranted to inform and lend support for the inclusion of older adolescents as part of global food marketing policies.

Popular brands recalled by youth in this study seemingly parallel trends documented in other beverage marketing research whereby Pepsi and Coca-Cola are primarily responsible for the majority of SD advertisements viewed by youth. Given the increasingly diverse range of platforms where youth may be exposed to SD marketing, further research is needed to monitor priority areas of SD marketing exposure to better inform policies.

4.3 Strengths and limitations

The strengths of this study include its large and diverse sample size and use of consistent measures across countries. Moreover, a key strength includes that this study demonstrated consistent findings six different countries. The use of an emoji scale as a measure of brand preference has been validated in the literature and has been demonstrated to be a more accurate

means of reflecting food/beverage preference compared to traditional methods such as a Likert scale in youth populations.[68–70] This study is subject to limitations common to survey research. Respondents were recruited using non-probability-based sampling. Therefore, although the data were weighted by age group, sex, region, and ethnicity (except in Canada), the findings do not necessarily provide nationally representative estimates. Exposure to SD marketing and branded advertisements may be underestimated due to self-reported measures which do not capture all avenues and methods of actual exposure to beverage marketing including marketing that is less visible and recognizable (e.g., through social media influencers) as well as subject to recall errors. However, self-reported exposure is highly correlated with objective exposure data.[71–73] The cross-sectional nature of this study does not permit causal conclusions such as whether exposure leads to brand preference and recall or vice versa. Estimates with large confidence intervals should be interpreted with caution due to small cell sample sizes. The lack of significant interaction between age and exposure to SD marketing may also be underpowered due to small subgroup sample sizes. Nevertheless, these findings may add to the current body of food marketing literature, in which adolescents are often excluded from analyses or are examined within the broader definition of children.

4.4 Conclusion

This study examined the relationship between exposure to general and brand-specific SD marketing and SD brand preference and recall among youth in six countries. There was some evidence of differences in the international patterns of these associations however strength of these associations did not appear to differ statistically by age group. The results of this study may be used as a justification for future research examining the impact of food and beverage

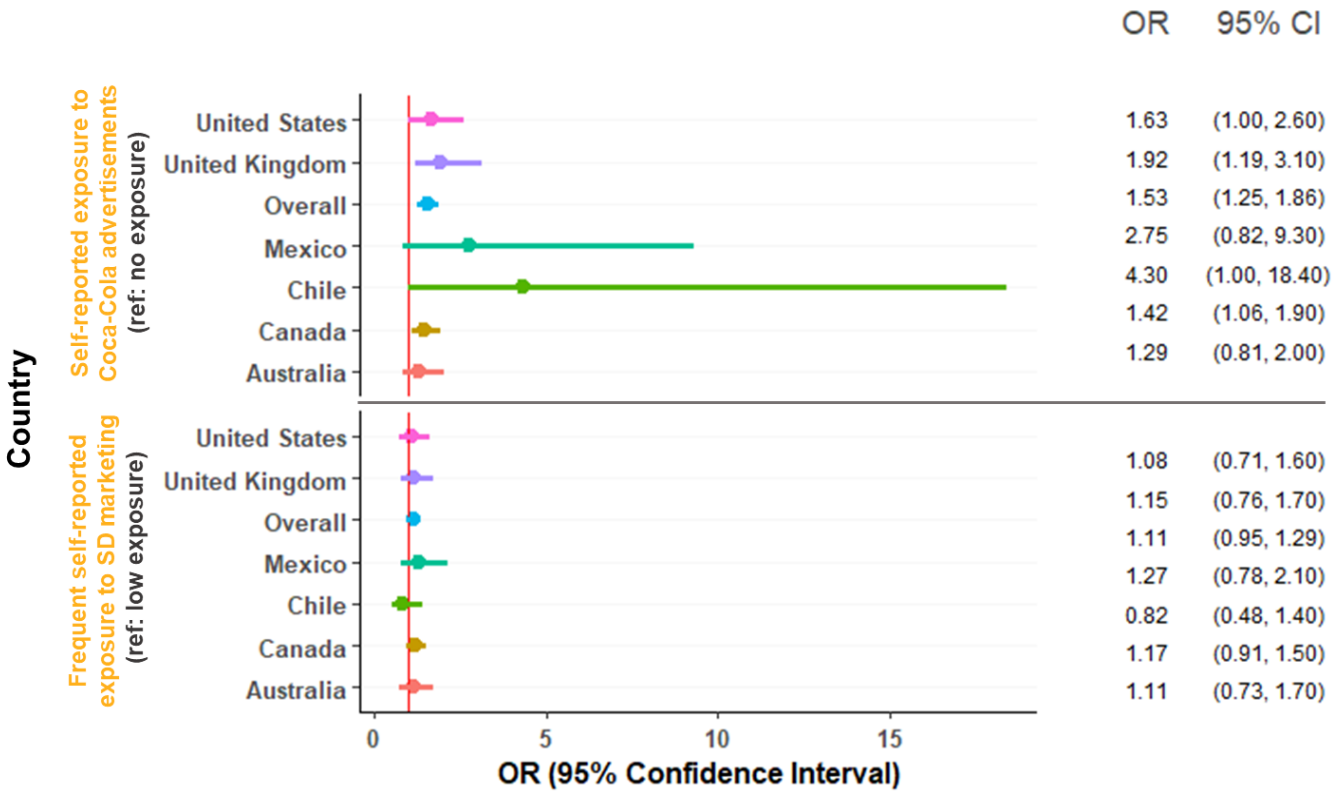
marketing in adolescent populations and to help inform international policy efforts to reduce youth exposure to SD marketing in order to protect child health.

Table 1. Sample characteristics of youth aged 10-17 in the 2019 IFPS Youth Study (n=8,502)

Variable	Canada (n=2,674) Weighted %(n)	Australia (n=1,047) Weighted %(n)	United Kingdom (n=1,082) Weighted %(n)	United States (n=1,217) Weighted %(n)	Mexico (n=1,399) Weighted %(n)	Chile (n=1,083) Weighted %(n)	Total (n=8,502) Weighted %(n)
Sex							
Male	51% (1363)	50% (521)	51% (550)	51% (625)	50% (706)	51% (550)	51% (4315)
Female	49% (1312)	50% (526)	49% (532)	49% (591)	50% (693)	49% (533)	49% (4187)
Age (years) mean (SE)	13.6% (0)	13.4% (0.1)	13.5% (0.1)	13.5% (0.1)	13.5% (0.1)	13.6% (0.1)	13.5% (0)
Ethnicity							
Majority	73% (1948)	77% (805)	83% (897)	52% (630)	78% (1093)	86% (933)	74% (6306)
Minority	27% (727)	23% (242)	17% (185)	48% (587)	22% (306)	14% (150)	26% (2196)
Perceived income adequacy							
Not or barely enough money	17% (457)	25% (261)	26% (280)	29% (356)	27% (382)	30% (330)	24% (2065)
Enough or more than enough money	83% (2218)	75% (786)	74% (802)	71% (860)	73% (1018)	70% (753)	76% (6437)
Self-reported exposure to sugary drink food marketing							
Never to once per week	45% (1213)	48% (500)	56% (605)	36% (442)	18% (249)	21% (226)	38% (3236)
A few times per week to more than once per day	55% (1461)	52% (547)	44% (477)	64% (775)	82% (1150)	79% (856)	62% (5266)
Self-reported exposure to Coca-Cola brand ads							
Yes	78% (2095)	71% (743)	72% (784)	81% (991)	98% (1369)	97% (1050)	83% (7032)
No	22% (579)	29% (304)	28% (298)	19% (225)	2% (31)	3% (33)	17% (1470)
Self-reported exposure to Red Bull brand ads							
Yes	52% (1379)	37% (386)	36% (394)	61% (744)	56% (783)	72% (780)	53% (4466)
No	48% (1296)	63% (661)	64% (688)	39% (472)	44% (616)	28% (303)	47% (4036)
Self-reported exposure to juice brand ads							
Yes	50% (1344)	28% (295)	34% (363)	37% (456)	93% (1298)	85% (925)	55% (4680)
No	50% (1330)	72% (752)	66% (719)	63% (761)	7% (101)	15% (158)	45% (3822)
Preference for Coca-Cola							
Strong dislike, dislike, somewhat dislike	37% (353)	26% (93)	24% (86)	23% (97)	19% (88)	26% (90)	28% (806)

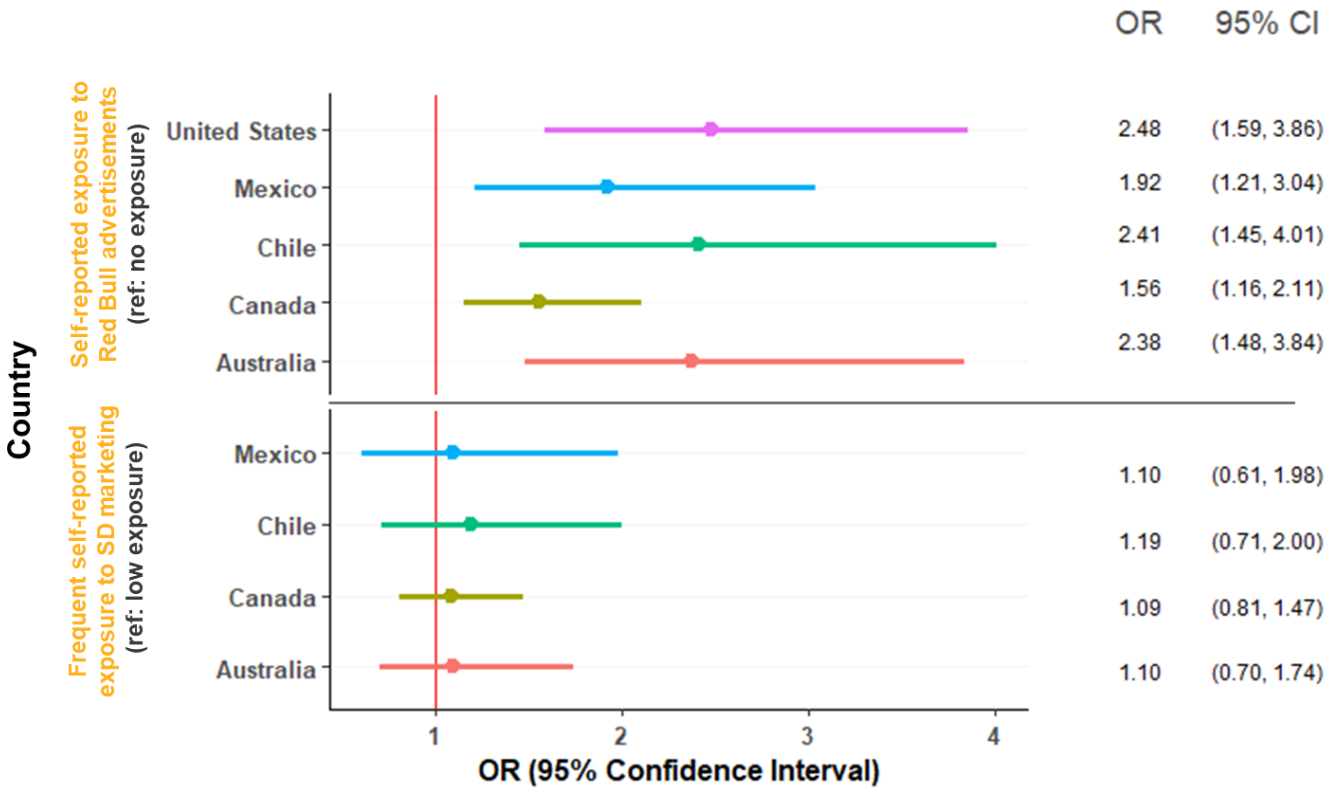
Variable	Canada (n=2,674) Weighted %(n)	Australia (n=1,047) Weighted %(n)	United Kingdom (n=1,082) Weighted %(n)	United States (n=1,217) Weighted %(n)	Mexico (n=1,399) Weighted %(n)	Chile (n=1,083) Weighted %(n)	Total (n=8,502) Weighted %(n)
Neutral preference	43% (410)	45% (159)	47% (166)	40% (169)	43% (206)	43% (147)	43% (1257)
Strong preference	21% (199)	29% (104)	29% (104)	37% (157)	38% (181)	31% (104)	29% (850)
Total	100% (962)	100% (356)	100% (356)	100% (423)	100% (475)	100% (341)	100% (2913)
Preference for Red Bull							
Strong dislike, dislike, somewhat dislike	63% (529)	66% (245)	57% (209)	56% (245)	63% (279)	61% (221)	61% (1729)
Neutral preference	29% (238)	25% (92)	30% (111)	28% (123)	31% (135)	27% (98)	28% (798)
Strong preference	8% (67)	9% (32)	13% (47)	16% (71)	6% (28)	13% (46)	10% (291)
Total	100% (834)	100% (369)	100% (367)	100% (439)	100% (443)	100% (365)	100% (2817)
Preference for Juice							
Strong dislike, dislike, somewhat dislike	11% (99)	10% (33)	13% (47)	7% (23)	8% (37)	15% (58)	11% (297)
Neutral preference	55% (486)	65% (211)	52% (187)	56% (198)	50% (241)	52% (198)	55% (1521)
Strong preference	33% (294)	24% (78)	35% (126)	38% (133)	42% (203)	32% (121)	34% (956)
Total	100% (879)	100% (323)	100% (361)	100% (354)	100% (481)	100% (376)	100% (2774)
Recall of drink brands							
No brands	38% (1015)	40% (422)	33% (355)	33% (401)	19% (263)	16% (179)	31% (2634)
1-5 brands	62% (1659)	60% (625)	67% (727)	67% (816)	81% (1137)	83% (904)	69% (5868)

Figure 1. Estimates from separate adjusted proportional odds logistic regression models examining the association between exposure to SD marketing and Coca-Cola ads and Coca-Cola brand preference among youth in six countries (n=2,913)



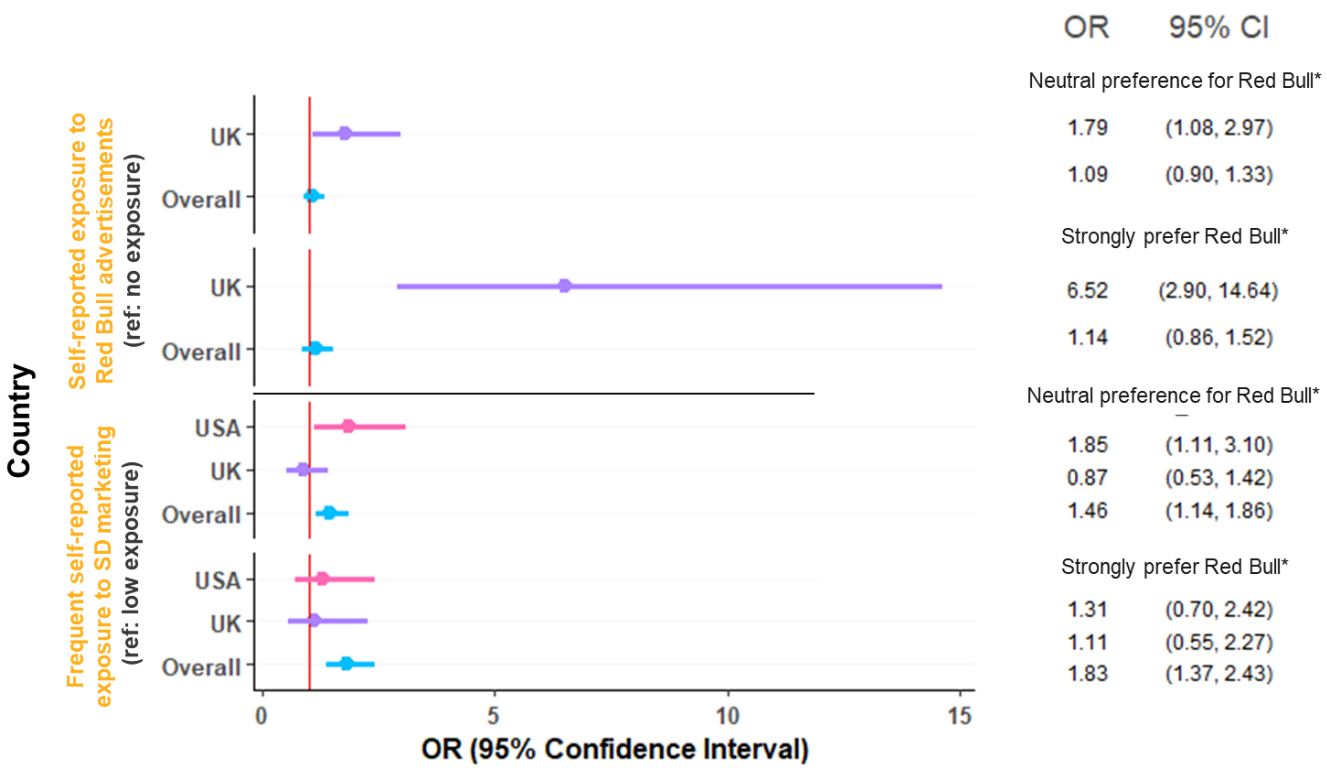
Note: All models adjusted for sex, age, race/ethnicity, and perceived income adequacy. No statistical interaction between country and either exposure predictor was detected ($p>0.05$). Results from overall models should be interpreted.

Figure 2. Estimates from separate adjusted proportional odds logistic regression models examining the association between exposure to SD marketing and Red Bull ads and Red Bull brand preference among youth in six countries (n=2,817)



Note: Multinomial overall estimates and estimates for the UK and US (where the score test was significant (p>0.05)) are shown in Figure 3. All models adjusted for sex, age, race/ethnicity, and perceived income adequacy. No statistical interaction between country and either exposure predictor was detected (p>0.05). Results from overall models should be interpreted and are presented in Figure 3.

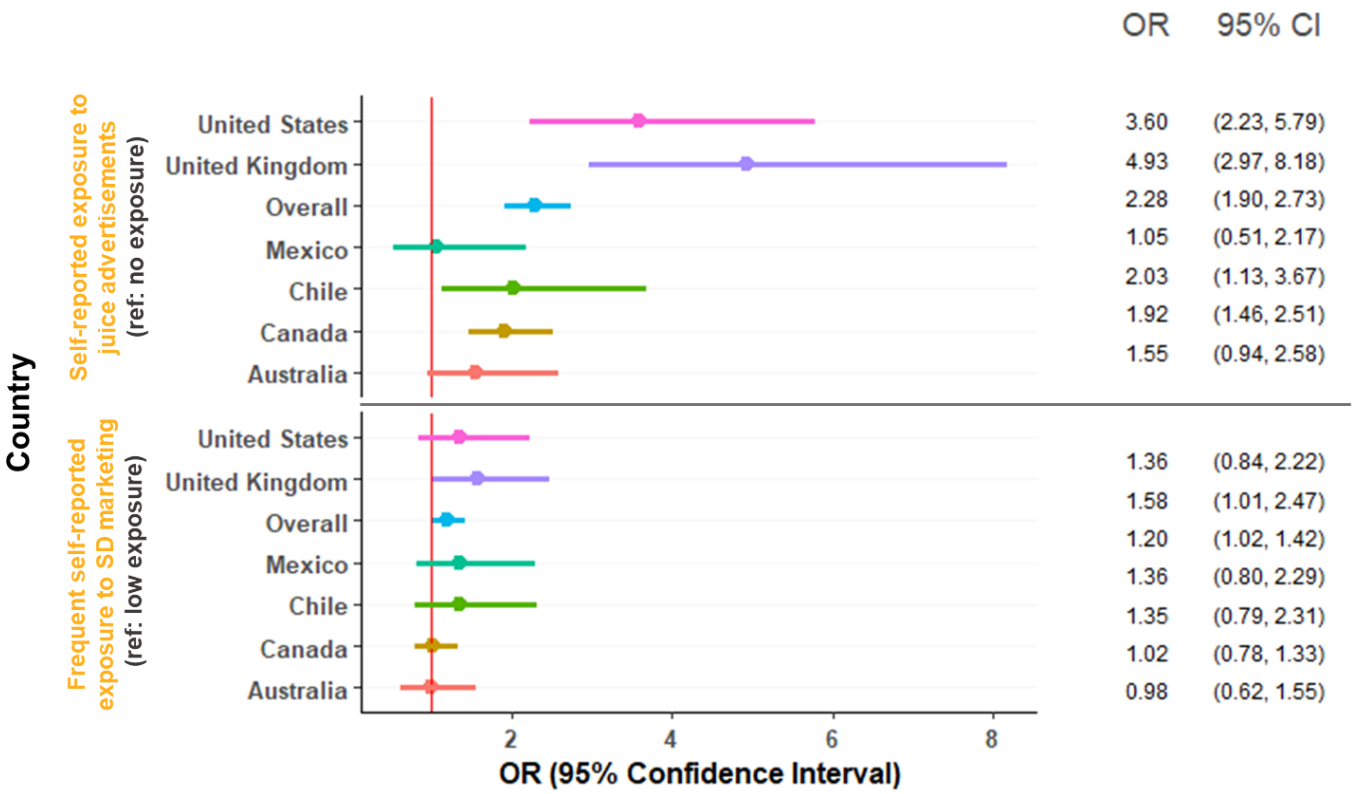
Figure 3. Estimates from separate adjusted multinomial logistic regression models examining the association between exposure to SD marketing and Red Bull ads and Red Bull brand preference among youth in six countries (n=2,817)



*ref: Strongly or somewhat dislike Red Bull

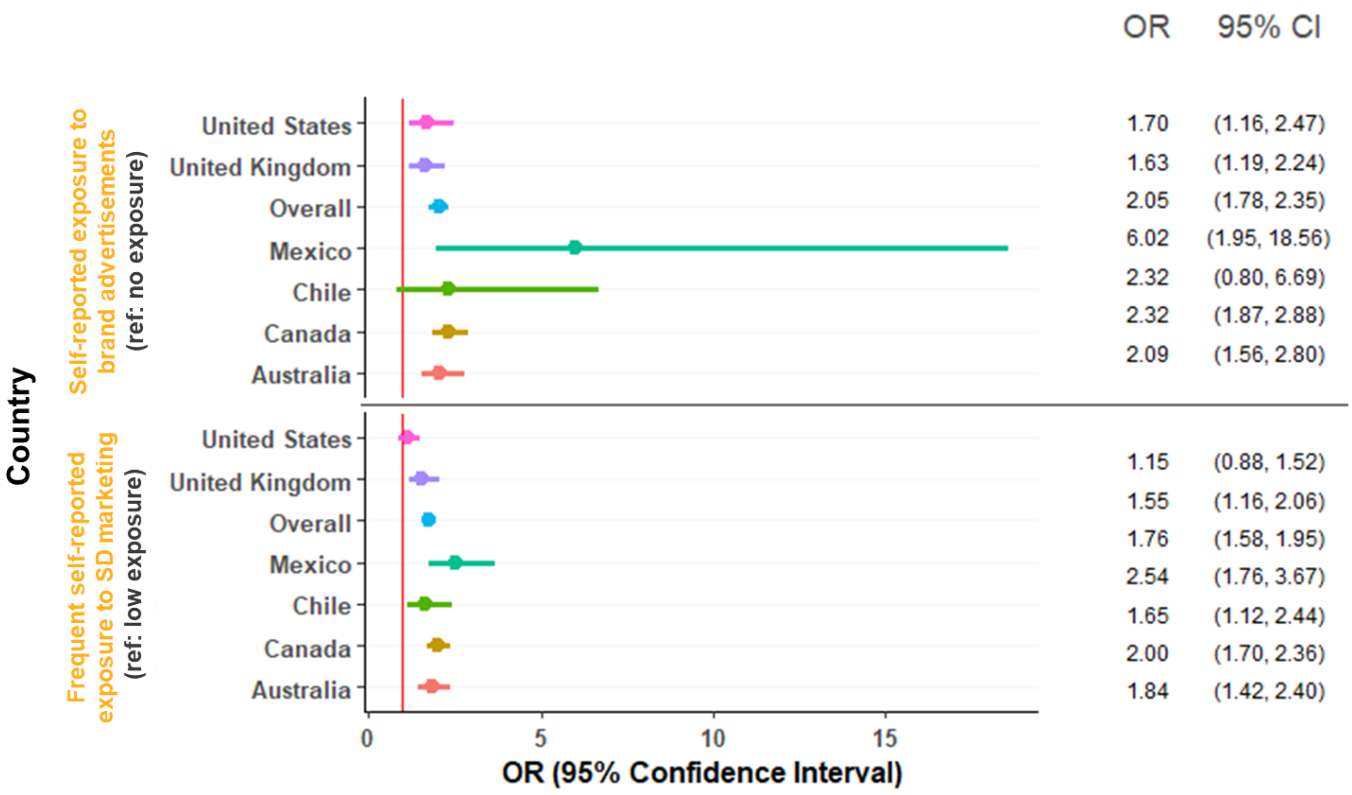
Note: All models adjusted for sex, age, race/ethnicity, and perceived income adequacy. No statistical interaction between country and either exposure predictor was detected (p>0.05). Results from overall models should be interpreted.

Figure 4. Estimates from separate adjusted proportional odds logistic regression models examining the association between exposure to SD marketing and juice ads and juice brand preference among youth in six countries (n=2,774)



Note: All models adjusted for sex, age, race/ethnicity, and perceived income adequacy. Statistically significant interactions between country and self-reported exposure to juice brand advertisements were detected (p=0.001), thus country stratified results should be interpreted for these associations.

Figure 5. Estimates from separate adjusted binary logistic regression models examining the association between exposure to SD marketing and brand-specific ads* and brand recall among youth in six countries (n=8,502)



*Brand-specific ads refers to self-reported exposure to at least one Coca-Cola, Red Bull, or juice brand ad.

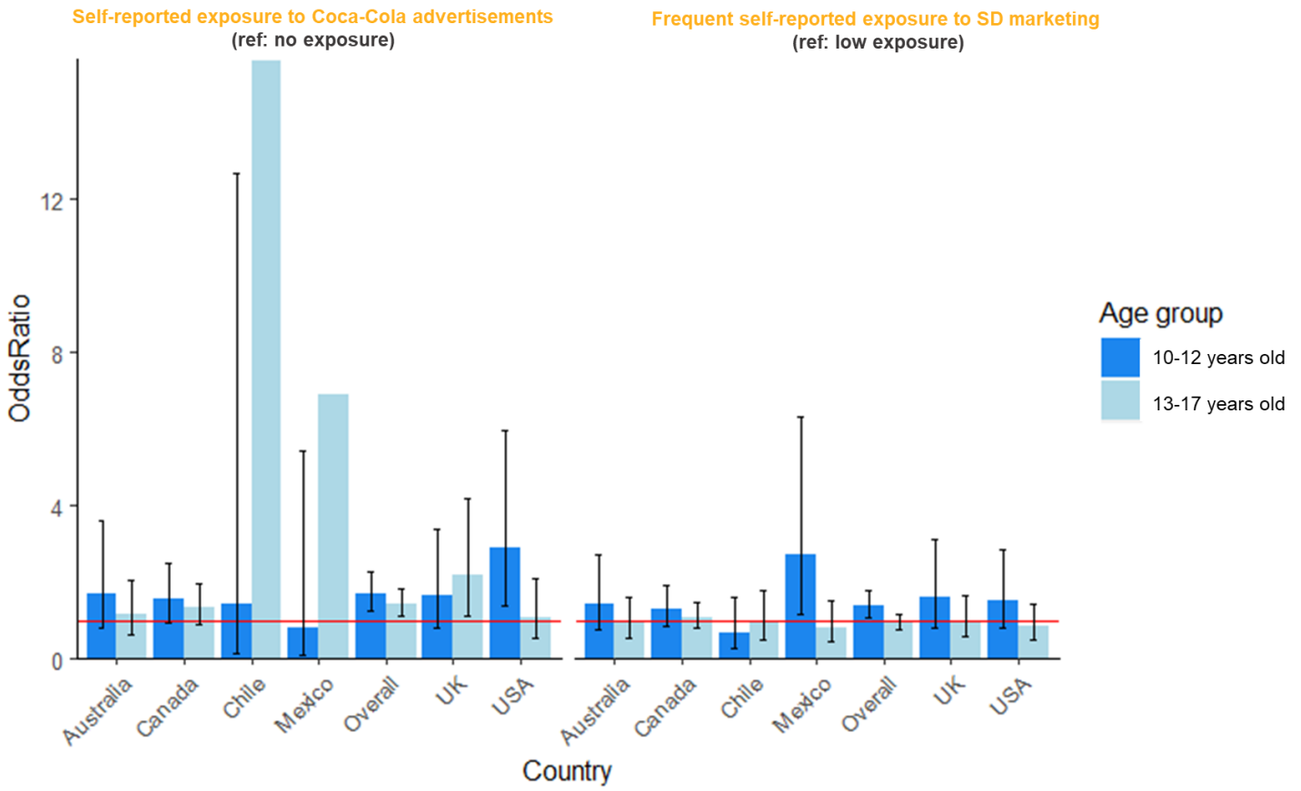
Note: All models adjusted for sex, age, race/ethnicity, and perceived income adequacy. Statistically significant interactions between country and self-reported exposure to SD marketing were detected (p=0.005), thus country stratified results should be interpreted for these associations.

Table 2. Top 10 most frequently recalled sugary drink brands in among youth in six countries (n=8,502)

	Canada Weighted %(n)	Australia Weighted %(n)	United Kingdom Weighted %(n)	United States Weighted %(n)	Mexico Weighted %(n)	Chile Weighted %(n)	Total Weighted %(n)
1	Coca Cola 68% (1803)	Coca Cola 86% (900)	Coca Cola 78% (839)	Coca Cola 62% (753)	Coca Cola 78% (1094)	Coca Cola 91% (991)	Coca Cola 75% (6379)
2	Pepsi 57% (1501)	Pepsi 47% (494)	Pepsi 54% (583)	Pepsi 53% (650)	Pepsi 46% (644)	Fanta 64% (689)	Pepsi 52% (4463)
3	Gatorade 25% (655)	Fanta 45% (466)	Fanta 39% (423)	Sprite 33% (407)	Jumex 34% (482)	Sprite 62% (669)	Sprite 30% (2516)
4	Sprite 22% (572)	Sprite 30% (312)	Sprite 24% (258)	Gatorade 32 %(395)	Del Valle 23% (318)	Pepsi 55% (591)	Fanta 26% (2199)
5	Seven Up 15% (390)	Schweppes 15% (155)	Lucozade 19% (204)	Dr Pepper 24% (289)	Fanta 23% (319)	Bilz Y Pap 44% (473)	Gatorade 18% (1501)
6	Nestea 11% (300)	Solo 11% (113)	Seven Up 18% (195)	Mountain Dew 20% (245)	Gatorade 23% (325)	Canada Dry 23% (248)	Seven Up 11% (899)
7	Oasis 9% (232)	Kirks 9% (96)	Dr Pepper 16% (177)	Powerade 13% (161)	Sprite 21% (297)	Kem 22% (240)	Dr Pepper 8% (655)
8	Crush 10% (256)	Gatorade 9% (91)	Tango 15% (167)	Fanta 10% (119)	Bonafont 19% (271)	Seven Up 10% (113)	Powerade 7% (585)
9	Tropicana 9% (239)	Powerade 9% (91)	Ribena 11% (117)	Kool Aid 5% (65)	Boing 13% (189)	Crush 9% (94)	Mountain Dew 6% (506)
10	Minute Maid 9% (235)	Mountain Dew 8% (84)	Vimto 8% (89)	Sunny D 5% (62)	Ciel 13% (181)	Cachantun 6% (60)	Bilz Y Pap 6% (473)

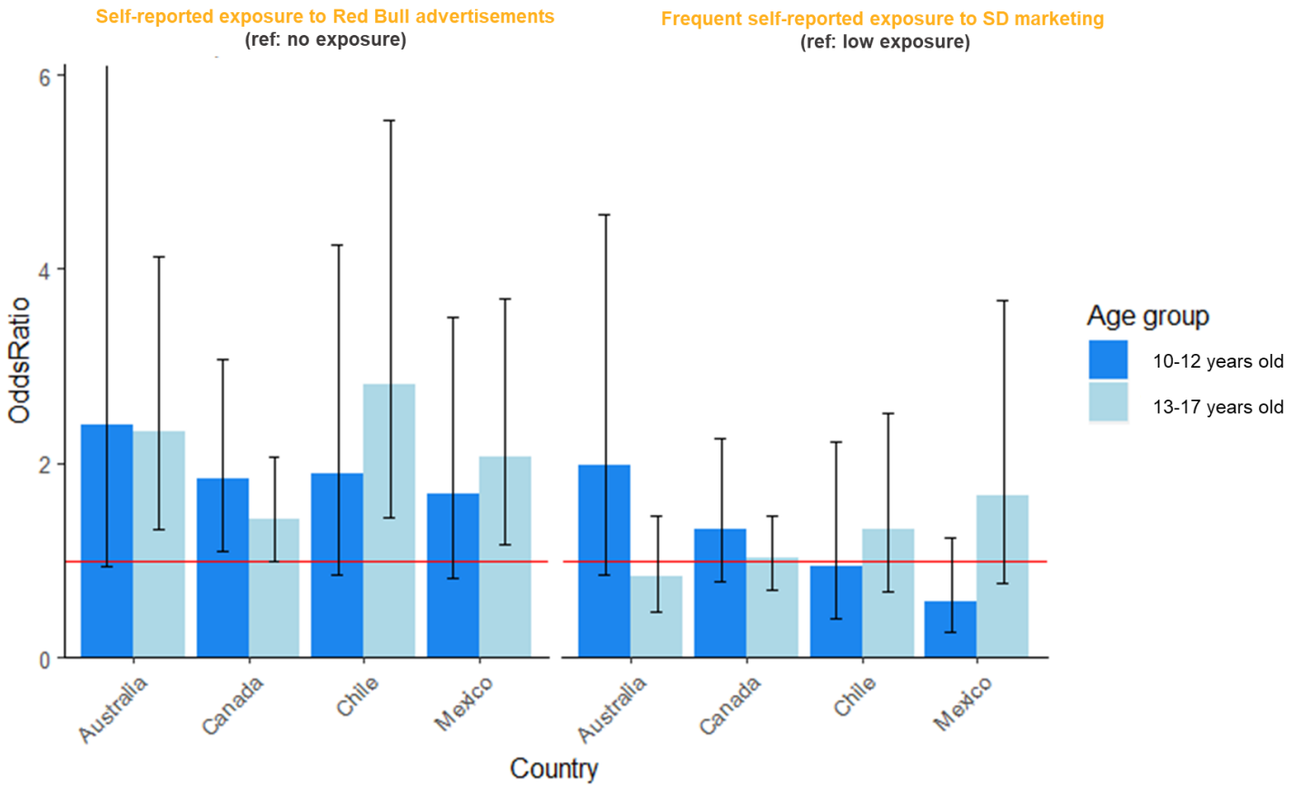
Note: Percentages do not add up to 100 as each respondent could name up to 5 SD brands

Figure 6. Estimates from separate adjusted proportional odds logistic regression models examining the association between exposure to SD marketing and Coca-Cola ads and Coca-Cola brand preference, by age group, among youth in six countries (n=2,913)



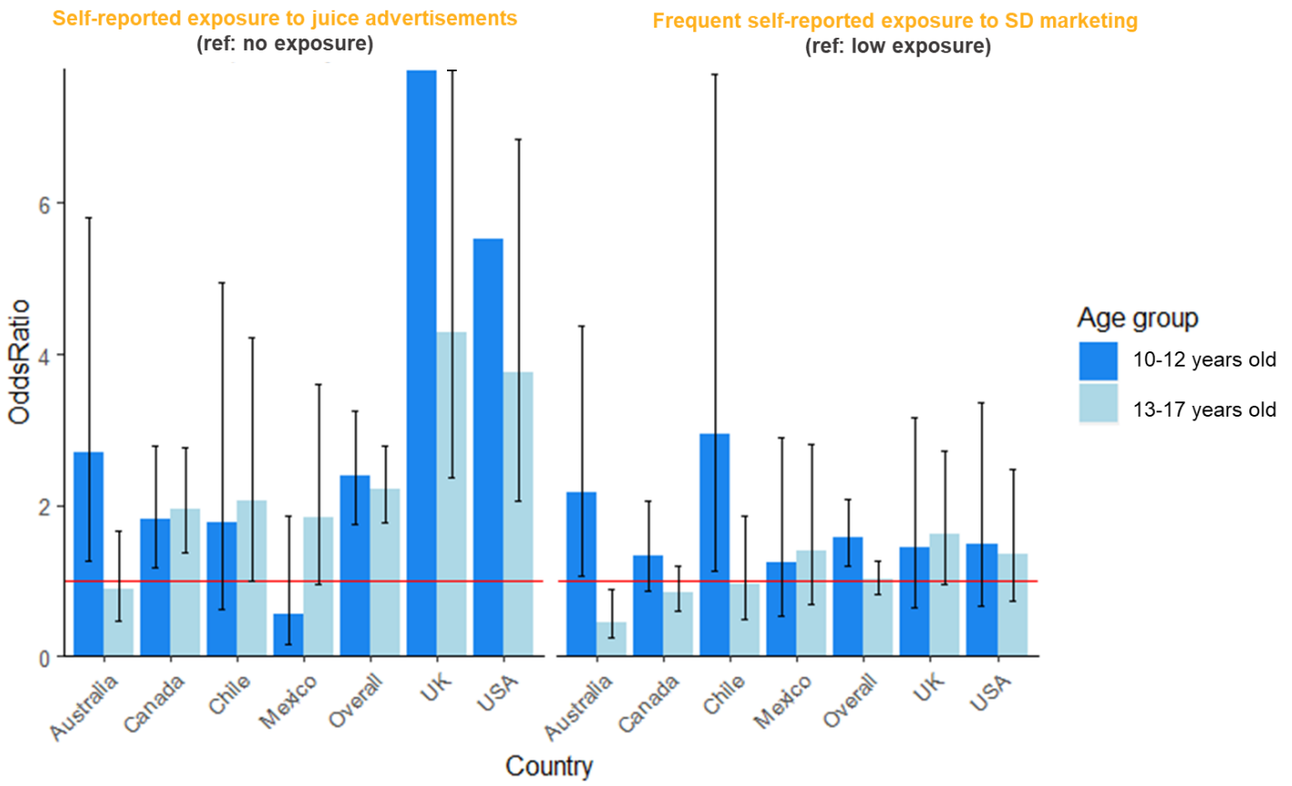
Note: Extremely large confidence intervals for Chile (95%CI: 1.90, 128.63) and Mexico (95%CI: 1.56, 30.51) under 13-17 year old subgroup are not presented. No statistically significant interactions were detected between youth age group, country, and the predictors of interest (i.e., self-reported exposure to Coca-Cola ads or SD marketing).

Figure 7. Estimates from separate adjusted proportional odds logistic regression models examining the association between exposure to SD marketing and Red Bull ads and Red Bull brand preference, by age group, among youth in six countries (n=2,817)



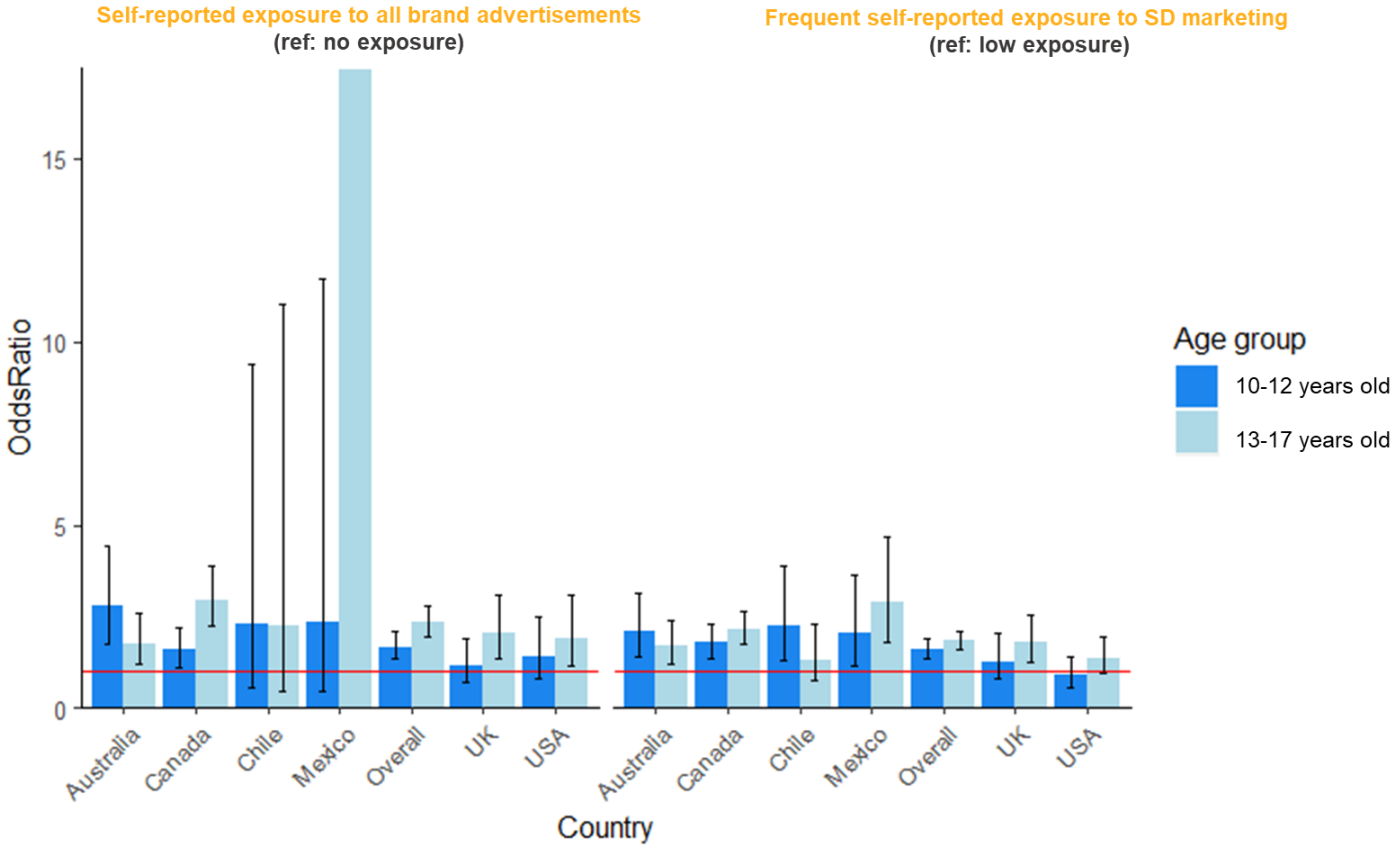
Note: Multinomial subgroup estimates for UK, USA, and overall are not presented. No statistically significant interactions were detected between youth age group, country, and the predictors of interest (i.e., self-reported exposure to Red Bull ads or SD marketing).

Figure 8. Estimates from separate adjusted proportional odds logistic regression models examining the association between exposure to SD marketing and juice ads and juice brand preference, by age group, among youth in six countries (n=2,774)



Note: Extremely large confidence intervals for UK (95%CI: 3.12, 19.34) and USA (95%CI: 2.25, 13.60) under 10–12-year-old subgroup are not shown. No statistically significant interactions were detected between youth age group, country, and the predictors of interest (i.e., self-reported exposure to juice ads or SD marketing).

Figure 9. Estimates from separate adjusted binary logistic regression models examining the association between exposure to SD marketing and brand-specific ads* and brand recall, by age group, among youth in six countries (n=8,502)



*Brand-specific ads refers to self-reported exposure to one or more of the following ads: Coca-Cola, Red Bull, or juice.

Note: Extremely large confidence intervals for Mexico (95%CI: 4.77, 63.84) under 13–17-year-old subgroup are not shown. No statistically significant interactions were detected between youth age group, country, and the predictors of interest (i.e., self-reported exposure to brand ads or SD marketing).

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Chapter 4: Discussion

4.1 Overall Findings

The World Health Organization has sanctioned a push for increased global action regarding food marketing to children and adolescents.[89] Sugary drinks are highlighted as a specific area of concern. Among these recommendations is the call for greater monitoring of exposure to unhealthy food and beverage advertising and a greater understanding of the impact of such advertising on children's health, to form the evidence base upon which policies are developed. As predicted, the overall results of the current study demonstrated a positive association between exposure to SD marketing and brand preference and recall among children and adolescents who reported exposure to either general SD marketing within the past 30 days or brand-specific SD advertising. In terms of brand preference, the magnitude of association was strongest between self-reported exposure to Coca-Cola or juice advertisements and the corresponding brand preference. Youth who reported exposure to SD marketing within the past 30 days were also more likely to prefer Red Bull or juice compared to those not exposed. Recall of SD brands was strongly associated with both exposure to generic SD marketing and branded SD advertising among youth, with the most frequently recalled beverage types including soft drinks, sports drinks, and juices. It was found that the associations related to juice preference and brand recall differed by country. However, contrary to our hypothesis, notable differences in the magnitude of these associations were observed within the UK and USA for juice preference and within Mexico for brand recall, compared the rest of the examined countries. No associations were found to vary significantly by country for other preference outcomes such as Coca-Cola or Red Bull preference. Although it was hypothesized that these associations would differ by youth

age group, no statistically significant differences between children and adolescents were observed.

4.2 Impact of Sugary Drink Marketing on Youth Brand Preference and Recall

Findings from this study demonstrate that SD marketing may be linked with youth dietary behaviours. These findings support the wealth of food marketing literature which has established the influential role of food marketing on proximal and distal health outcomes in children and adolescents.[50,54,55,58] Much of the current evidence supporting a link between food marketing and children's health falls within the middle of the hierarchical spectrum.[54] In particular, consumption is well documented by quantitative and experimental evidence, demonstrating an increase in youth intake of advertised and/or unhealthy foods and beverages after exposure unhealthy food advertisements on television and in digital media.[50,54,55,58] The range of proximal outcomes explored in the literature are narrower in scope, with most studies to date focusing on food preference or choice.[56,85] The results of multiple systematic reviews have concluded that the proximal effects of food marketing, such as food attitudes, preferences, and recall, are an important area of investigation due to their role as determinants in non-communicable disease risk.[56,85]

Youth frequently exposed to juice or Coca-Cola brand advertisements were almost twice as likely to prefer the respective SD brand compared to youth who were less exposed to such advertisements in this study. These results align with existing research which has demonstrated that children are more likely to select branded food and beverage products compared to unbranded products.[103,104] Branding is fundamental in shaping youth product preferences and is a critical strategy employed by advertisers to appeal to their younger consumer base.[11] Indeed, in one study comparing child and adult fast food commercials in the United States, advertisements

on children's television channels placed a greater emphasis on visual branding elements, such as brands and logos, compared to adult advertisements.[48] Although the cross-sectional nature of this study does not permit causal inferences, the positive association observed between exposure to brand advertisements and preference suggests that SD brands such as Coca-Cola, Red Bull, or juice brands, are especially effective at influencing children. Television is considered to be one of the most powerful platforms for developing strong brand loyalty.[105] Food and beverages are one of the most branded commodities and some research has shown that brand advertisements (i.e., do not feature products at all) are frequently promoted in various media.[30,53,106] Food and beverage marketers frequently use characters and celebrities in advertisement as a way of fostering brand equity relationships with children and adolescents. For instance, licensed or spokes characters were present in 73% of television advertisements targeted at children aged 7 or older in the United States in 2013.[107] While recent shifts in media consumption habits indicate that older children and adolescents may spending more time online,[108] marketing practices on digital media appear to follow a similar branding approach as traditional marketing.[109,110] Content analyses of food marketing on Instagram and YouTube found a high level of branding present in advertisements, among tactics specific to digital media such as promoting peer engagement or emotional and entertaining engagement with food marketing content, or social media influencers.[109,111] Children's characters were also featured heavily, especially in Coca-Cola's Instagram posts.[109] Branding activity is a concerning marketing strategy because research has demonstrated that brand loyalty can be generated in children as young as 2-3 years old, creating lifelong brand consumers.[112,113]

Implicit effects of food marketing are relatively under-researched.[57] The general consensus from experimental studies is that food marketing exposure is positively correlated

with increased top of mind or aided recall among adolescents.[57] However, these observed effects were modest. Interestingly, the present study observed a significantly greater likelihood of SD brand recall among youth who reported frequent exposure to general SD marketing (compared to low reported exposure) within the past 30 days or exposure to at least one or more brand advertisements overall (compared to no exposure). According to the hierarchy of promotional effects outlined by Kelly et al., recall is an especially important health outcome to consider as it is the first step along the pathway and indicates the potential effectiveness of food marketing in biasing long term effects, such as purchases and consumption, towards branded food and beverage products.[54] In the food marketing literature, brand recall is typically operationalized under experimental conditions where children are asked to recall brands immediately after exposure to either food advertisements or brand logos (as a proxy for food marketing exposure), or to recall brands associated with sponsorships. One example of this is demonstrated in a study by Turner et al., where 97% of Australian children 7 to 12 years old recalled Subway and McDonald's brands when presented with modified version of the brand logo.[114] Similar results were noted among a sample of children aged 3 to 10 years old in Mexico.[115] The few existing studies examining unaided or free recall corroborate the overall link between SD marketing exposure and youth recall found in this present study.[71] Social media also magnifies the effects of food marketing on youth brand recall.[54,86] Youth in this study most commonly recalled soft drink brands. More specifically, Coca-Cola and Pepsi dominated the majority of overall recall responses. These findings are supported by global advertising expenditures, where Coca-Cola and Pepsi are responsible for the greatest share of beverage advertising spending.[116]

4.3 International Patterns in the Associations Between SD Marketing and Youth Health Outcomes

The current study provides insight into trends of brand preference and recall across six countries. Although the failure to detect a significant interaction between country and advertising exposure precludes the direct interpretation of country-stratified results for most models, these findings may be used within the context of other research to offer a snapshot of food marketing effects on an international scale. Youth across all six countries who reported frequent exposure to SD marketing within the past 30 days had a greater preference for Coca-Cola, Red Bull, or juice brands. A similar trend was observed among youth who reported exposure to brand advertisements. Country was found to be a significant interaction in the association between juice brand advertising and preference for juice. Of these results, youth in the UK were most likely (OR=4.9, 95%CI=2.97, 8.18) to prefer juice in comparison to the associations observed among youth in other countries. There are a number of possible explanations for these results including the differences in food environments, youth media consumption habits, as well as differences in the policy landscape between countries, which drive consumption and preference trends among children and adolescents.

Youth media habits and exposure to unhealthy food advertising are known to differ by country. While most adolescents in Chile (60%), Mexico (69%), and the USA (58%) have reported exposure to fast food or sugary drink advertisements on television, less than half of respondents in Australia, Canada, and the UK reported exposure to television advertisements (43-49%).[117] Lower rates of self-reported exposure among Canadian adolescents may be in part due to a decrease in beverage advertising on children's television programming, however this does not discount television as a major source of advertising.[118] Similarly, only 27% of youth in

the UK reported viewing unhealthy food advertisements on websites or social media while between 54-60% of youth in Chile and Mexico reported having viewed these types of advertisements online.[117] The UK has implemented a number of measures aimed at reducing children's consumption of sugary drinks. With regard to marketing, restrictions have been in place on television and on digital media in the UK since 2007 and evidence has shown that these policies are highly effective at reducing children's exposure to unhealthy beverage marketing.[119] The UK has also implemented a tax on specific soft drinks to further target and reduce consumption. However, an important loophole in this taxation is the exemption of fruit juices, among other beverages such as milk-based drinks and alcohol.[91,120,121] Fruit juices are a substantial source of free sugar in children and adolescent's diets.[120] In the UK, adolescents aged 10 to 18 years old drink approximately 83 grams amount of fruit juices alone per day.[122] A common misconception among parents and youth is that 100% fruit juices and fruit drinks are a healthy alternative[123,124] and while pure fruit juices are less sugary than traditional sugary drinks such as soda, fruit juices can exceed recommended free sugar intakes.[125] With these added restrictions, major beverage companies, such as Coca-Cola, which own several subsidiaries of beverage types (e.g., fruit juices, dairy, etc.) may shift focus towards promoting fruit juices to youth to circumvent sugary drink marketing and taxation policies.

Coca-Cola and Pepsi were the most frequently recalled brands by youth respondents across all countries except for Chile, where Fanta replaced Pepsi. Interestingly, the greatest proportion of respondents who recalled these brands were observed in the UK and Chile – countries with the most comprehensive set of sugary drink public health policies. Greater recall of these brands in the UK and Chile may be driven by the popularity of these brands in these countries.[126,127] These trends are not seen in higher-income and Nordic countries including

Finland, Iceland, and Sweden, where the most popular beverages are largely comprised of milk and other dairy products.[128] Both the UK and Chile have implemented sugary drink taxation policies which have been shown to effectively reduce purchases and consumption[121] but the globalization of large beverage brands may encourage youth SD brand recognition and awareness.[129] Globalization refers to the incorporation and adoption of elements of American culture, such as food brands, into local culture of other countries.[129] This phenomenon has been particularly observed in Latin American countries.[130] In fact, South America has become an area of significant retail growth for the beverage industry and the parent company of beverage brands such as Coca-Cola and Fanta (Coca-Cola Femsa) make up almost half (48%) of the share in the Latin American beverage market.[131,132] Large transnational beverage manufacturers solidify their stronghold on the beverage market in these areas by acquiring local companies which simultaneously provides them with greater power to challenge and obstruct SD-related regulatory action.[131,133] Additionally, the physical environment of some Latin American regions may also be a contributor to the familiarity of such brands among youth as ultra-processed foods and beverages are more readily accessible and cheaper compared to healthier options in some areas.[131,134]

4.4 Differences in Associations by Youth Age Groups

This study did not find statistically significant evidence of age group differences in any of the examined associations between SD marketing exposure and youth brand preference or recall. Nevertheless, trends were observed among children and adolescents exposed to some form of SD marketing (i.e., general marketing or brand specific advertisements) from the exploratory subgroup analysis conducted. Exposed children were more likely to prefer Coca-Cola compared to their unexposed counterparts, while the opposite was true for exposed compared to unexposed

adolescents. Preference for Red Bull appeared to be higher among exposed adolescents compared to unexposed adolescents in all countries, while results differed by country among children. This preference among adolescents likely exists as a result of Red Bull marketing which is present on websites targeted towards youth and due to youth-appealing promotions for Red Bull through user- and company-generated content on social media (Potvin Kent et al., unpublished; Ayoub et al., unpublished). In general, SD brand preference appeared to be greater among children and adolescents exposed to brand advertisements. Positive attitudes towards country-specific juice brands were observed among children and adolescents exposed to SD marketing within the past 30 days and juice brand advertisements. Finally, children and adolescents who reported exposure to marketing were generally more likely to recall SD brands overall and within all countries.

Adolescents (12-17 years old) have previously been identified as an age group of priority for food marketing research due to their unique vulnerabilities to advertising and their exclusion from much of the current research.[47] As a result, food and beverage companies aggressively target adolescents in ways that differ to children. For instance, child-targeted food marketing heavily relies on promotional characters or health or emotional appeals to reach younger audiences while adolescents may be targeted by techniques which are more reliant on encompassing peer acceptance (e.g., viral marketing) and social status, and attaching symbolic meaning to food and are less effective with young children.[47,135,136] The traditional perspective held among researchers and public health officials is that children (i.e., <13 years old) face increased susceptibility to the promotional effects of marketing, so much so that in many countries, including Canada, USA, Mexico, and Australia, food marketing policies are exclusively aimed at protecting children under 13. The mechanism through which food

marketing influences children's brains is similar to adolescents,[137,138] however no direct comparisons of the impact between exposure to food marketing and diet-related outcomes between children and adolescents have been made. Preliminary findings suggest that food marketing effects may be more pronounced in adolescents due to differences in their neurodevelopment compared to children.[137–139] The justification for examining different age groups is that the impact of marketing will differ by age group due to differences in developmental stage, duration of exposure, and power of beverage promotions (i.e., brands target teens and children differently).

The present findings do not support this premise. The lack of significant interaction between child age group and exposure suggests that both age groups are equally impacted by sugary drink advertisements. These results are comparable to other research. Age was not found to moderate the effect between exposure to television advertisements and product preference among children aged 5 to 11 years old in the USA.[140] Despite this, exposure to food marketing among children and adolescents is known to differ. For instance, adolescents in Canada viewed an average of 2.6 ads per 10 minutes of social media use while children viewed an average of 1.4 ads during the same period.[53] Children and adolescents are also frequently targeted by different types of food and beverage brands. A significantly greater proportion of television advertisements in 2018 in Canada targeted adolescents compared to other child age groups.[59] Energy drinks are a typical example of age-group targeted brand advertisements. A content analysis of energy drink advertisements on social media revealed the frequent use of viral marketing (e.g., hashtags, encouraging users to tag friends, etc.) and teen related themes such as video games, extreme sports, pop culture, and socializing (Ayoub et al. 2022, unpublished).

4.5 Policy Implications

Overall, this study contributes to the growing support for consistent and comprehensive food marketing policies both within and across countries. Despite differences in the scope and duration of food and beverage marketing policy across countries, this study indicates that children and adolescents may be impacted similarly. This is also particularly interesting given the mix of mandatory and self-regulatory policies in the examined countries. The UK and Quebec have had statutory policies in place since 2007 and 1980 respectively, while mandatory marketing restrictions in Mexico and Chile are relatively recent. The regulatory approaches in the UK and Quebec are often considered to be a model for policies around the world[141] yet Quebec's policy only applies to children under 13 years old. There have been several identified gaps in these policies based on food marketing research.[142] Of particular note is the lack of coverage on digital media, which is growing in children and adolescents' sources of exposure to unhealthy food marketing. Until recently, food marketing regulations applying to non-broadcast media in the UK (e.g., print, online, etc.) was set by the advertising industry however new measures for regulating online marketing are set to be implemented by the UK government in 2023 and would ban all forms of paid advertising on digital media platforms.[143] These regulatory measures would not prohibit brand advertising online or limit the content promoted on company owned social media accounts. This is worrisome as a high percentage of adolescents are known to follow major food and beverage brands on social media[144] and brand advertising is a powerful strategy to build brand loyalty.[66,113] User-generated or social media influencer advertising content, which make up a substantial portion of children and adolescent's online exposure to food marketing, is also not included.[66,145] New regulations recently proposed in Canada appear to

be promising.[146] These proposed regulations will recognize the importance of monitoring exposure to food marketing among older children.

Many countries have yet to develop sugary drink specific policies. It is important to explicitly address sugary drinks in public health policies and marketing restrictions given their pervasiveness in the everyday lives of youth and children[147,148] and high consumption rates among these age groups.[17,19,22] Mexico, Chile, and the UK have enacted taxes on SSBs over the past 10 years.[149] These taxations vary in terms of strictness however Mexico's 10% excise tax on sugary drinks appears to be one of the most rigorous. All three have successfully reduced SD purchases and sales after implementation.[150] Energy drinks are also an important area of focus for public health efforts and marketing policies. As observed in this current study, energy drinks are popular among older adolescents. Energy drink companies likely attempt to appeal to adolescents through advertisement placement and design (Ayoub et al. unpublished).[151] Evidence suggests that energy drinks are harmful to children and adolescents yet a greater understanding of the long-term risks associated with regular consumption is needed. Most contemporary marketing regulations do not specifically ban energy drink marketing despite the unknown consequences among youth. In the UK, energy drink advertisements are only restricted if the product exceeds set nutrient thresholds. The Canadian government has proposed a set of regulations related to caffeinated energy drinks but failed to suggest limiting marketing of these beverages to youth.[152] Marketing legislation that is inclusive of all types of sugary drinks are needed to limit children and adolescent's exposure and the influence of marketing on child health.

4.6 Strengths and Limitations

A major strength of this study was the use of IFPS data which provided a large sample size and multi-country design. This facilitated a cross-country examination of associations when possible and the inclusion relevant covariates, as well as enabled the exploratory age subgroup analysis. Youth brand preference was measured on an emoji scale, a relatively novel technique which has been previously validated in the literature.[75,153] The use of emojis to measure emotional associations in children is growing and is considered a more accurate tool in which to gauge food choices and preferences.[75,153] Moreover, the self-reported measures of SD marketing used in this study are emerging as a suitable proxy measure of objective exposure.[154–156] However, these measures are subject to recall bias and likely underestimate exposure given that children may not always be aware or be able to distinguish all forms of advertisements (e.g., products promoted by social media influencers, product placement, etc.).[157]

Other limitations were present in this study. Firstly, the non-probability based sampling strategy employed by the IFPS does not offer nationally representative estimates. Lack of statistical power to detect interactions between country and with age groups due to small subgroup sample sizes should also be noted. Future research should seek to explore these age group differences among a larger sample size to validate these study findings. Thirdly, self-reported measures of exposure may be subject to social desirability bias, however previous research has demonstrated that this type of bias is mitigated in surveys conducted online.[158] Finally, a causal relationship between exposure to SD marketing and youth brand preference or recall cannot be established due to the cross-sectional nature of this study.

4.7 Future Research

This research highlights multiple avenues and knowledge gaps for future work involving the IFPS Youth Survey to examine the impact of SD marketing in youth internationally. Future research involving youth respondents should assess the media channels and platforms in addition to youth exposure to SD marketing to determine the media of priority as some media and settings are known to be more powerful vehicles of food marketing than others[19,20] and to better inform global SD policy action. This information would be valuable as youth media habits have exponentially shifted from traditional to digital media as a result of the COVID-19 pandemic.[159] Moreover, the IFPS Youth Survey collects data on children and adolescent's self-reported exposure to marketing techniques such as licensed or spokes characters, celebrities, branded merchandise, or sports sponsorship. This provides another opportunity for future research, which would be to combine the exposure and response variables examined in this study with an evaluation of the marketing techniques most often associated with SD marketing and the impact of these technique on SD brand attitudes.

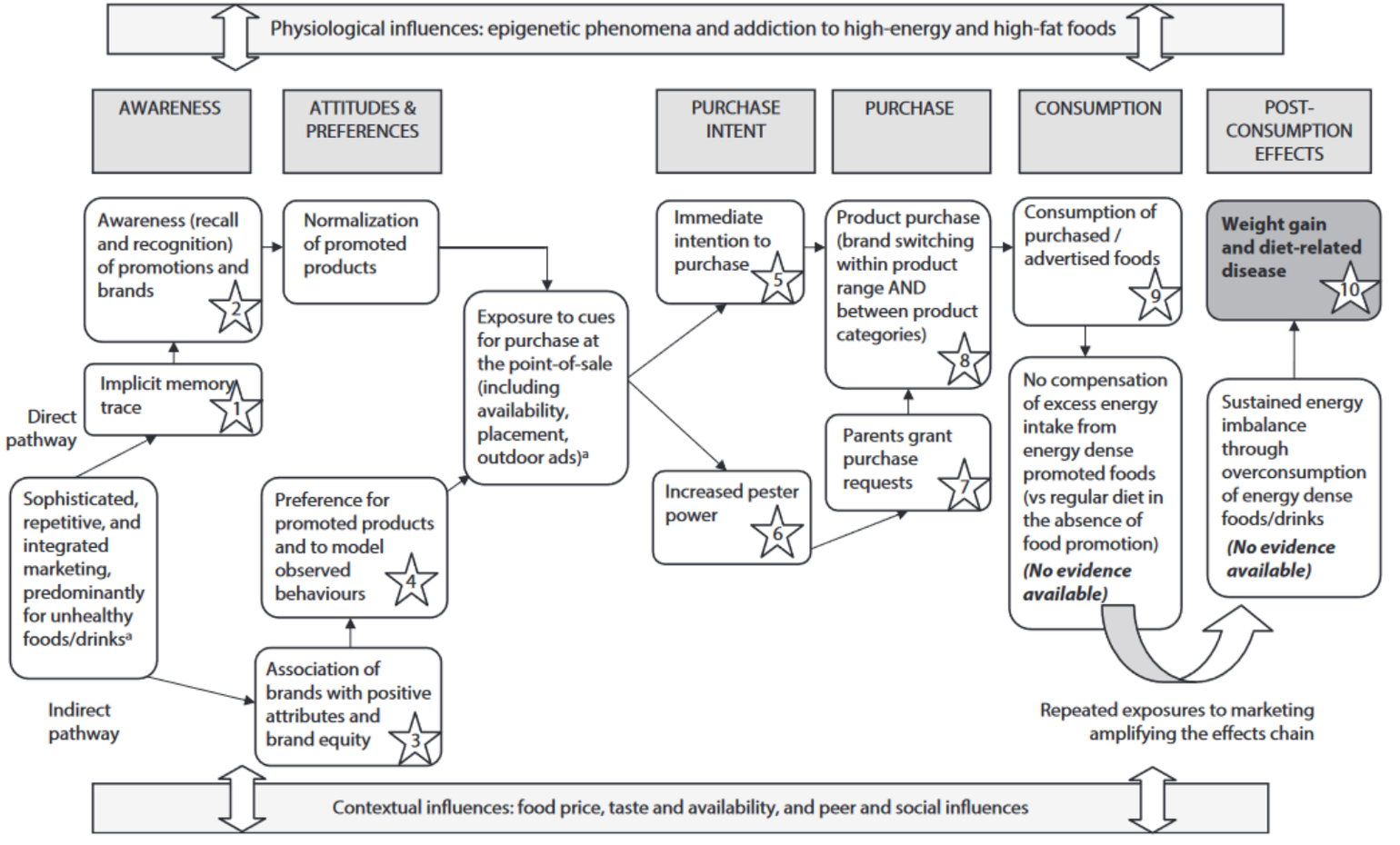
4.8 Conclusion

In conclusion, this study showed that youth frequently exposed to SD marketing across six countries are more likely to prefer and recall SD compared to those are less exposed. These associations were not found to differ significantly by youth age group. The types of SD brands frequently recalled by youth in this study correlate to those which are known to monopolize global beverage advertising expenditures including soft drinks, fruit juices, and sports drinks. These results contribute to the weight of evidence supporting the development of cohesive and

comprehensive food and beverage marketing policies globally which will help support child health.

Appendix A – Hierarchy of Food Marketing Effects Model

Figure 1. Hierarchical Model[54]



Note. Stars indicate that studies are available to assess response indicators (see Table 1).
[a]Assessed in studies measuring extent and nature of exposure to marketing.

Appendix B – Summary of Global Food Marketing Policies

Table 1. Summary of food and beverage marketing policies in Canada, UK, USA, Chile, Mexico, and Australia[91]

Country	Child Age Group	Platform	Policy Type (statutory, self-regulatory)	Year Implemented	Description
Canada (excluding Quebec)	<13 years	TV	Self-regulatory	2007	Participating companies voluntarily pledge not to advertise to children under 12 or only advertise food products that comply with their self-imposed nutrition criteria.[31]
Quebec	<13 years	TV, broadcast media, digital media	Statutory	1980	Prohibits the marketing of all child-appealing products.[31]
United Kingdom	<16 years	TV and radio	Statutory	2007	Banned all HFSS advertising during child-directed programs and prohibited the use of all marketing techniques effective with primary school children.[91,142,160]

United States of America	<12 years	TV, broadcast media	Self-regulatory	2006	Participating companies pledge to promote "healthier" choices when 35% or more of the audience is comprised of children.[91]
Mexico	<13 years	TV	Statutory	2014	Restricted all advertising of foods/beverages high in sugar, fat, or sodium between 2:30am – 7:30pm on weekdays and 7:00am – 7:00pm on weekends.[142]
Chile	<14 years	TV and radio	Statutory	2016	Prohibits marketing of all HFSS products targeting children between 6am-10pm and any child appealing packaging.[161]
Australia	<12 years	TV, broadcast media	Self-regulatory	2009	Restricts child-directed marketing on any platform and food companies must promote "healthier choices".[162]

*HFSS = high fat, sugar, or sodium food and beverage products

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