From Instagram to Insta-gratification – The Digital Marketing of Unhealthy Food and Beverages to Adolescents: Does Gender Play a Role?

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Dedication

This dissertation is dedicated to the little girl who, despite all odds, dreamed of moving mountains.

The more that you read, the more things you will know. The more that you learn, the more places you'll go. So be sure when you step, step with care and great tact. And remember that life's a great balancing act. And will you succeed? Yes! You will, indeed! (98 and ¾ percent guaranteed).
Kid, you'll move mountains.
So...
be your name Buxbaum or Bixby or Bray
or Mordecai Ali Van Allen O'Shea,
you're off to great places!
Today is your day!
Your mountain is waiting.
So... get on your way!
- *Dr. Seuss*

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Throughout the course of this PhD, there were many highs and lows, side quests, and unexpected adventures. But amidst all the twists and turns, one thing remained constant - this work. There's something magical about that. As I wrap up this journey, I am reminded of Dr. Seuss' *Oh, the Places You'll Go* - "you're off to great places, today is your day". This dissertation marks the culmination of years of exploration, perseverance, and growth. Though this chapter ends, the adventure continues. Here's to embracing new challenges with curiosity, knowing that the road ahead is filled with exciting possibilities and boundless opportunities. From the bottom of my heart, thank you to those who were part of this incredible journey, whether you were a believer or naysayer, you all played a role in my story.

And to echo the timeless words of Michael Scott, "I knew exactly what to do. But in a much more real sense, I had no idea what to do."

Abstract

This doctoral research explores the relationship between digital food marketing and gender, shedding light on factors that contribute to adolescent consumer behavior and societal norms. In an era dominated by digital platforms, including social media, food marketing strategies have evolved, becoming increasingly sophisticated in their ability to target specific demographic groups. However, while digital food marketing and its impact on adolescents is documented, there remains a gap in understanding how gender intersects with these phenomena. This research seeks to address that gap by examining the differential impacts of digital food marketing on boys and girls, emphasizing the necessity for gender-sensitive policies and interventions.

This research's findings revealed that gender plays a role in the digital marketing of food. The first study uncovered variations in exposures to marketing techniques and the healthfulness of food based on a participant's gender. The second study revealed differences in how adolescent boys and girls interact with digital food marketing. Lastly, in light of the considerable influence of social media influencers, the third study investigated social media influencer posts featuring food, offering valuable insights into the interaction between social media, social media influencers, and potential gender norms impacting adolescents' dietary behaviors. Together, these studies lay the groundwork for understanding the intersection of gender, adolescent dietary patterns, and digital food marketing, emphasizing the need for continued research into gender-specific digital food marketing and its implications for adolescent health. Recognizing these disparities is needed for developing effective strategies to mitigate the influence of digital food marketing on adolescents, ensuring that interventions are sensitive to the unique ways in which boys and girls are targeted.

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Chapter 1: Introduction

In recent years there has been a growing concern about the rising rates of adolescent obesity, which is attributed at least in part to the pervasive influence of digital marketing of unhealthy foods and beverages (henceforth known collectively as food). Recognizing the role that gender can play in consumer behaviours and how gendered marketing has been used with other commodities, this research explores the intersection of digital marketing, food, adolescents, and gender. This research aimed to examine the digital marketing of foods to adolescents from a gender perspective to understand a) if or how gender is being used within digital food marketing and b) if adolescents' exposure to and engagement with digital food marketing differs by gender. These findings will shed light on how gender is being used in digital food marketing and provide insights into how it may impact the dietary choices and well-being of adolescents. By exploring these variables, this research seeks to uncover potential disparities in marketing tactics and inform evidence-based interventions and policies to reduce the harmful effects of unhealthy food marketing on adolescents.

Review of the Literature

The Health Problem

Chronic or non-communicable diseases are long-term conditions characterized by persistent and often incurable symptoms that require ongoing management [1]. These diseases, such as cardiovascular disease, diabetes, hypertension, and obesity can significantly impact an individual's quality of life and may lead to complications if not properly managed [1]. A strategy for mitigating non-communicable diseases involves addressing and mitigating associated risk factors [1].

Obesity, characterized by an abnormal or excessive fat accumulation, poses a health risk to individuals and is a multifaceted public health challenge [2]. Defined in epidemiological and population studies as a body mass index (BMI) greater than or equal to 30, obesity arises from an imbalance between calories consumed and calories expended through physical activity and metabolic processes [3]. Obesity is a progressive, chronic disease with a high risk of relapse and recurrence [4]. Globally, it affects 160 million children and adolescents aged 5-19 and is associated with a higher risk of comorbidities, including cardiovascular disease, type II diabetes, respiratory and joint problems, certain cancers, and psychological and sociological consequences [3].

Further, there is an economic toll associated with treating obesity and obesity-related illnesses, placing a strain on healthcare systems. It is estimated that by the year 2050, annual global obesity-related direct costs are projected to reach $13.6 billion, with indirect costs reaching $49 billion [5]. In Canada, obesity accounts for 10.6% of total health expenditures [6]. The current state and projected costs of obesity underscore the urgent need for effective prevention strategies and interventions to address obesity and its economic burden.

Adolescents

Adolescence, defined in this paper as ages 13-17, is a developmental stage characterized by self-discovery and adaptation, marking the transition from childhood to adulthood [7]. During this time, youth are experimenting, finding their interests, social networks, and gender identities, among other things [7]. This phase of life is crucial for shaping future behaviours and habits, including dietary preferences and consumption patterns [8].

Psychological and Cognitive Development

Adolescents undergo psychological and cognitive development marking a transitional and pivotal phase that includes significant neurobiological growth [9]. Psychologically, adolescents

experience heightened self-awareness, identity exploration, and a range of emotions as they grapple with questions concerning their personal values, beliefs, and aspirations [10]. Adolescence is also characterized by increased autonomy-seeking behaviour and the formation of more complex peer relationships, which can play roles in shaping their sense of self, social identity, and behaviours [10].

Cognitive development during adolescence is marked by advancements in abstract thinking, problem-solving skills, and the ability to consider multiple perspectives [11]. However, this developmental stage is also accompanied by challenges including risk-taking behaviour and susceptibility to peer influences [10]. These challenges are in part due to a lack of inhibitory control, which regulates the ability to refrain from unwanted actions and thoughts [9]. In the case of food, an adolescent may encounter a television advertisement featuring pizza, prompting feelings of hunger and influencing them to succumb to the temptation of ordering a large pizza, despite their awareness of limiting the consumption of unhealthy foods. The inhibitory control of adolescents faces continuous challenges from external influences such as peer interactions, social media, and marketing stimuli [12]. Understanding adolescent psychological and cognitive development can support their growth, fostering resilience, and promoting positive outcomes during this stage of life.

Adolescent Obesity

Adolescent obesity remains a public health concern in Canada [13]. The prevalence of overweight (BMI of 25.0-29.9) and obesity among Canadian adolescents aged 12-17 has risen from 32.6% in 2004 to 36.8% in 2013 [3, 14]. As of 2022, roughly 30% of Canadian youth aged 12 to 17 self-reported as having overweight or obesity, with boys having a higher prevalence than girls (33% vs 27%, respectively) [15]. Similar trends are observed globally, with boys consistently showing a higher rate of obesity compared to girls [14-16].

Youth at risk of having obesity face an elevated likelihood of developing obesity-related health conditions and are more likely to maintain or exacerbate their weight into adulthood [14, 17]. Addressing obesity is important for promoting better health outcomes and reducing healthcare costs. A contributing factor to adolescent obesity is poor dietary patterns [18]. Effective strategies to improve these dietary patterns are crucial in combating obesity and its associated health risks. Moreover, interventions targeting dietary behaviors during adolescence can have long-lasting impacts, potentially mitigating the risk of obesity in adulthood and alleviating the economic strain on healthcare systems [5].

Adolescent Dietary Patterns

Nutrition during adolescence lays the groundwork for optimal growth and development, while also shaping future health outcomes [8]. In recent decades, the dietary patterns of Canadian adolescents have undergone a notable shift marked by an increase in the consumption of processed and packaged foods that are high in salt, sugar, and saturated and/or trans fat [19]. Males aged 14-18 exceed their female counterparts in absolute daily sugar consumption (170g vs. 130g) and daily sodium intake (3320mg vs. 2350mg) [20, 21]. Saturated and/or trans fat consumption follows a similar pattern, with 13.4% of boys and 12.9% of girls aged 14-18 consuming above acceptable total fat intake ranges [22].

Current Canadian adolescent dietary trends often exceed recommended sugar (25g per day), sodium (2300mg), and saturated and/or trans fat intake levels (25-35% of total energy intake) [20, 22, 23]. These dietary changes coincide with a displacement of healthier alternatives like fruits, vegetables, and home-cooked meals [19]. In 2021, there was a notable decline in the consumption of fruits and vegetables among Canadians aged 12 and older, with only 21.8% reporting five or more servings per day, down from 31.5% in 2015. A greater proportion of females (25.5%) met this dietary requirement compared to males (18.0%) [24].

Notably ultra-processed foods, food that has been reformulated through a combination of various ingredients and processing by industry and contains little or no whole foods, have become a prominent feature in adolescent diets [25, 26]. Based on 2015 Canadian data, ultra-processed foods accounted for more than 50% of adolescents' total energy intake [27], with approximately one-third of adolescents having reported consuming fast food within the last 24 hours [27, 28]. Fast-food consumption is linked to obesity [27] and to an elevated likelihood of consuming sugar-sweetened beverages [29]. Insights from the Canadian Community Health Survey on Nutrition indicate that 35% of sugar consumed by adolescents is derived from sugar-sweetened beverages [21].

Global evidence also indicates suboptimal dietary patterns among adolescents [30, 31]. These dietary patterns have increased the prevalence of overweight and obesity worldwide, escalating the risk of premature mortality and non-communicable diseases [8]. These dietary trends are attributed, in part, to a changing food environment that is marked by the intensified promotion of convenient, inexpensive, and energy-dense (e.g., high in salt, sugar, and fat) packaged foods [32-34]. Systematic reviews demonstrate that adolescents' exposure to unhealthy food marketing consistently shapes their food preferences, short-term intake, and food purchases [32-35]. Unfortunately, the majority of food marketing exposures are energy dense, increasing adolescents risk of obesity and other chronic diseases [32].

Foresight Obesity System Map

Obesity is caused by various factors such as genetics, the environment, and behavioural choices [8], which are comprehensively depicted in the *Foresight Obesity System Map*. The 2007 *Foresight Obesity System Map* (Figure 1) is an illustrative representation of the root causes of obesity and their relationship to each other [36]. Crafted by obesity researchers, this map is comprised of 108 variables connected by 300 causal links, which are further categorized into one

of seven thematic clusters including societal influences, food production, food consumption, individual psychology, biology, individual activity, and the activity environment [37].

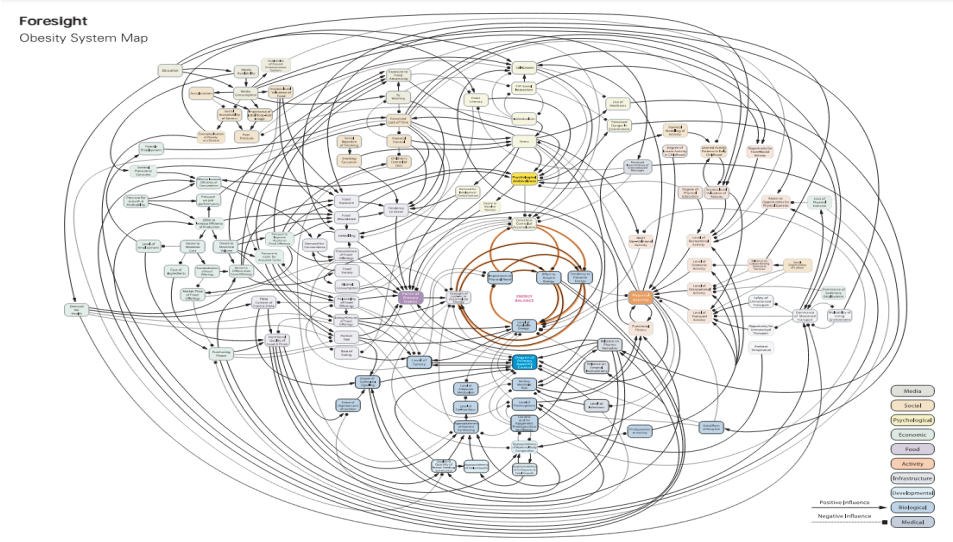

Figure 1. Foresight Obesity System Map [36]. Permission has been granted to use this figure.

Despite garnering recognition for its application of systems science to obesity prevention, the *Foresight Obesity System Map* has encountered criticism with some arguing that its visual complexity may act as a deterrent for viewers seeking to understand its etiology. Nevertheless, the map is a foundational document providing a comprehensive picture of obesogenic factors [36]. A component of the *Foresight Obesity System Map* and the emphasis of this research is exposure to food marketing, which is a factor within the societal influences cluster [36].

The Food Environment

Adolescents' dietary behaviours are shaped by a complex interaction between individual choices and their food environment [38]. A growing body of literature acknowledges the influence of food environments as they encompass physical, economic, policy, and sociocultural elements [39-41]. Shaped by the government, the food industry, and civil society, food environments encompass factors from food promotion to nutritional composition [40].

Youth's (children and adolescent) food environments can consist of obesogenic properties characterized by limited availability of nutritious food choices and pervasive exposure to energy-dense, nutritionally poor options [42]. This is particularly alarming considering the enduring impact of dietary patterns established during adolescence on long-term health outcomes [14]. Addressing food environments requires policies that promote healthier choices that safeguard consumers from harmful influences such as food marketing. By shifting the focus from individual choices to collective environmental factors initiatives can encourage healthier behaviours and ensure that healthy options are both accessible and easy for consumers [43].

To meet global targets in curbing obesity, enhancements in the healthiness of food environments are needed. Swinburn et al., propose an accountability framework, comprising of four steps to address this challenge (Figure 2) [44]. These steps involve taking account of progress through independent assessment and benchmarking; communicating evidence of progress with stakeholders; holding entities accountable by acknowledging achievements and penalizing non-compliance for poor performance; and making improvements by monitoring policies and practices and acting based on evidence [44].

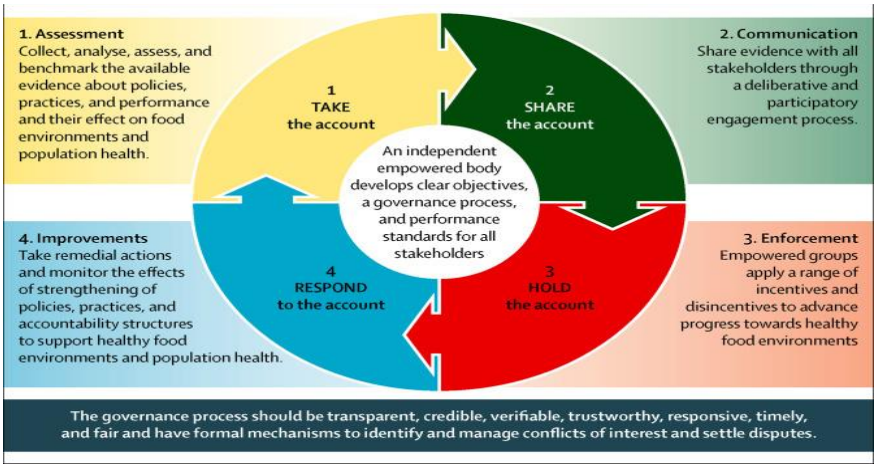

Figure 2. Accountability framework to promote healthy food environments [44]. Permission has been granted to use this figure.

Current Canadian food marketing regulatory mechanisms need strengthening, particularly in holding the food industry accountable for their food marketing practices to adolescents (and children) [43]. Safeguarding adolescents from the influence of vested interests within the processed food industry is vital for promoting healthier dietary habits among this group [43].

Commercial Determinants of Health

The food environment, and subsequently health outcomes, are influenced by corporate activities [45]. The influence of the corporate sector is captured by the commercial determinants of health, which are defined as the "strategies and approaches used by the private sector to promote products and choices that are detrimental to health" [46]. The scope of commercial determinants of health extends to both micro and macro levels (Figure 3) [47].

It recognizes factors at the micro level, such as consumer health and behavior, while simultaneously addressing macro-level elements, including sectoral public policies that reflect commercial sector interests. Additionally, it considers regulatory approaches, upstream policies that enable commercial sector influence, and political and economic systems that increase commercial sector power and sales, ultimately impacting all aspects of society [46]. Included in the micro level is recognizing the role gender plays in product marketing, which leverages gendered stereotypes [48]. These tactics may be especially pertinent for products traditionally linked with masculinity, as companies aim to tap into new markets and stimulate demand among women and girls [49].

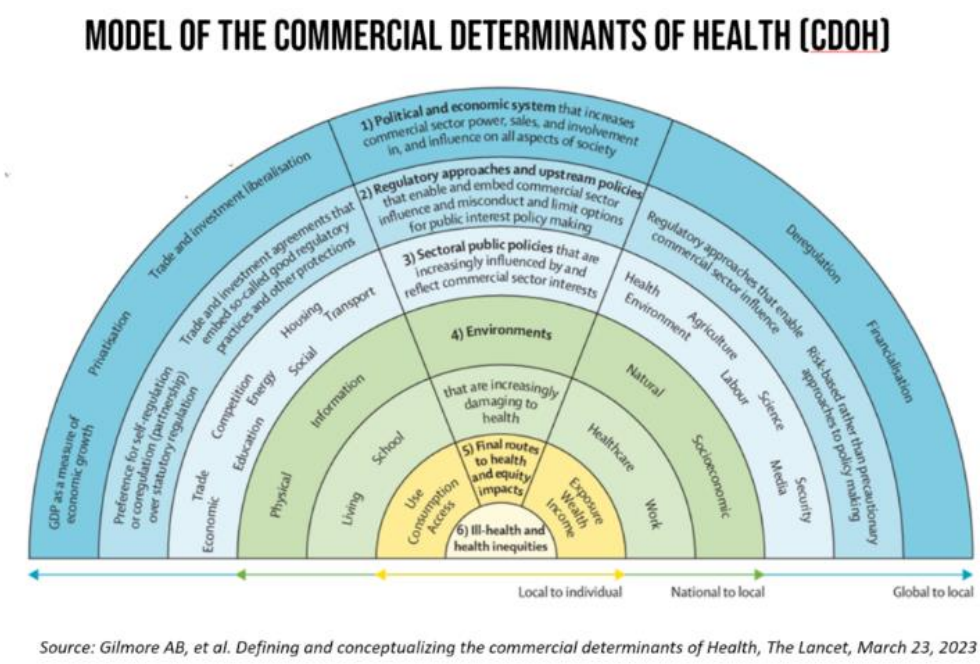

Figure 3. Micro and macro levels of the commercial determinants of health [47]. Permission has been granted to use this figure.

One of the strategies used by the commercial sector that shapes the food environment is food marketing. Marketing, broadly defined as "any form of commercial communication or message designed to, or with the effect of, increasing the recognition, appeal, and/or consumption of particular products and services", plays a role in forming consumer choices [50]. It includes product price, the place it is sold, the actual product, and promotion. While marketing encompasses a broader range of activities aimed at promoting a product or brand, advertising refers specifically to the process of creating and delivering messages to a target audience through various media channels to promote or sell a product, brand, or idea [51]. In essence, advertising is a subset of marketing, focused primarily on communication and persuasion through paid channels such as television, radio, print, digital platforms, and billboards [51].

Corporate activities such as the marketing of harmful goods, including unhealthy foods, can directly impact health [52]. The outcomes of these activities can be viewed as “corporation-

induced diseases resulting in an industrial epidemic" [41, 53]. Collin and Hill describe industrial epidemics as structural drivers of health inequalities [54]. Consequently, understanding and addressing the commercial determinants of health and how they affect the food environment are imperative steps in promoting healthier lifestyles and preventing diet-related health issues. Moreover, considering the role of gender in these dynamics is essential as gendered marketing practices can exacerbate existing health disparities by differentially influencing the dietary behaviours and health outcomes of boys and girls.

Food Marketing

Definition

Food marketing refers to the promotion and advertising of food products and brands to consumers through various channels, including television, online, in print, on billboards, and in settings such as schools [55]. It encompasses a variety of techniques aimed at influencing consumer behaviour, such as product placement, celebrity endorsements, and persuasive messaging [56]. Marketing is motivated by the goal of cultivating brand and product awareness, preference, and loyalty [55].

Considerable financial resources are directed towards food advertising that targets children and adolescents [57]. In 2019, more than $628 million was allocated to advertising platforms, including print, radio, websites, television, and outside channels like billboards or transit shelters, in Canada [57]. Notably, roughly $95 million was dedicated to promoting food products or brands targeted at children, while $115 million was allocated to those aimed at adolescents [57].

Impact, Models, and Theory

Food marketing is a driver of adolescents' dietary habits [58, 59]. Systematic, scoping, and meta-analysis research consistently illustrate that exposure to food marketing significantly influences the dietary behaviours of adolescents, directly impacting their food choices and short-

term food intake [32-34, 40, 60-65]. Repeated exposure to unhealthy foods has fostered favorable attitudes among adolescents, which have contributed to the establishment of societal norms that endorse and increase the consumption of these foods [60]. To help understand the mechanisms and impacts of food marketing, two seminal models, the Reactivity to Embedded Food Cues in Advertising Model (REFCAM) [66] and the Hierarchy of Unhealthy Food Promotion Effects [67], have paved the way for understanding food marketing and its impact.

REFCAM

The REFCAM (Figure 4) illustrates how food marketing influences consumption behaviours and is built on three main ideas [66]. First, it suggests that food cues in advertisements activate physiological (e.g., salivating) and psychological (e.g., thoughts about food) responses, which influence our eating habits. Food cues are reinforced through classical conditioning making a connection between advertisements and palatable foods. An appetitive state is activated creating a cycle where our reactions to unhealthy food cues can lead to an increased consumption of these foods and potential weight gain. Second, RECAM acknowledges that the impact of food cues depends on how well food is integrated into advertisements, as it affects how much a consumer will pay attention. Lastly, REFCAM highlights that a consumer's traits (e.g., impulsivity) plays a role in how susceptible individuals are to food cues within a given advertisement [66].

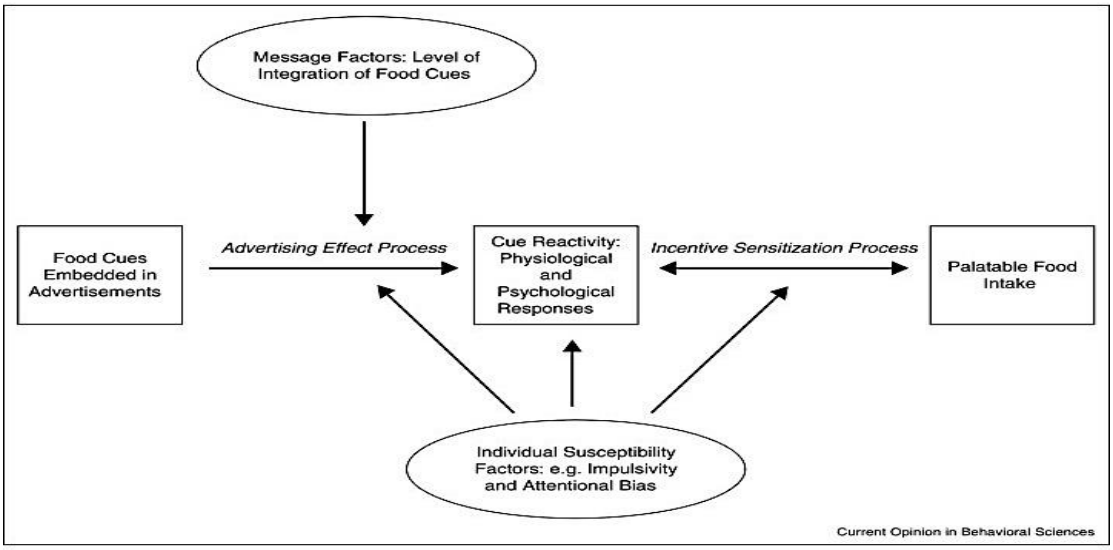

Figure 4. REFCAM [66]. Permission has been granted to use this figure.

Hierarchy of Unhealthy Food Promotion Effects Model

Another model, the Hierarchy of Unhealthy Food Promotion Effects Model (Figure 5), examines the impact of food marketing through a proposed logic model, outlining the sequential links between exposure to advertising, exposure to cues at point of sale (e.g., attitudes, beliefs, intent to purchase) and behavioural responses (e.g., purchase, consumption), and subsequent weight outcomes [67].

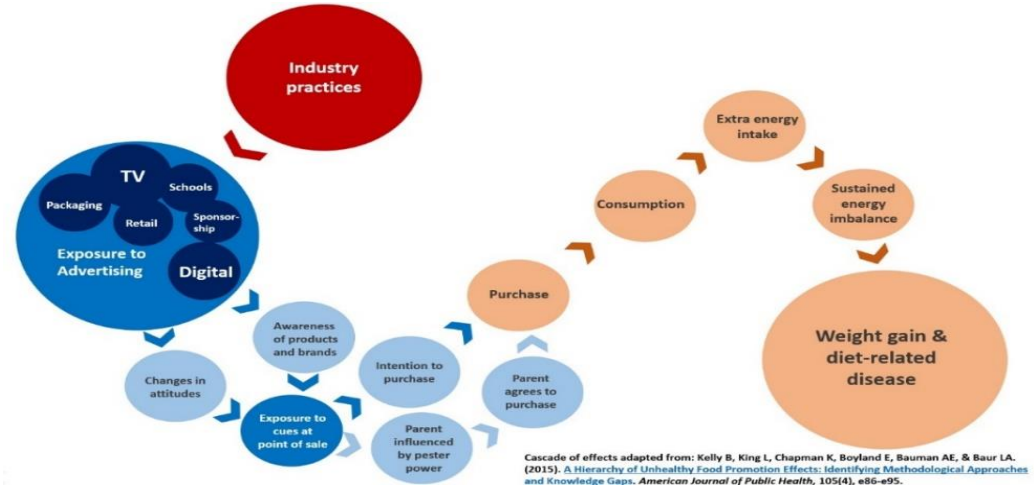

Figure 5. Hierarchy of Unhealthy Food Promotion Effects Model [67]. Permission has been granted to use this figure.

The model suggests a linear progression but acknowledges the likelihood of recurrent levels and positive feedback loops, complicating the causal chain that links marketing exposure to post-consumption effects [67]. The model offers a systematic approach to understanding the factors contributing to the relationship between food marketing and health outcomes. Models like REFCAM and the Hierarchy of Unhealthy Food Promotion Effects have been instrumental in understanding the influence of food marketing on consumption behaviours.

Social Cognitive Theory

The relationship between a model and theory often involves the model embodying or representing the principles, concepts, or behaviours outlined by the theory, thereby illustrating its application or demonstrating its validity [68]. Theories are valuable for understanding health behaviours, their change processes, and external influences [69]. A common theme in models trying to understanding health is the interaction of socioenvironmental and personal factors in shaping behaviour [69].

The Social Cognitive Theory offers insight into how digital influences can shape adolescent food behaviours, emphasizing the relationship of personal, environmental, and behavioural factors [70]. Its tenets include self-efficacy (self-confidence to change behaviour), observational learning (modeling others behaviour), and reciprocal determinism (relationship between personal factors, environmental influences, and individual behaviour, where each factor influences and is influenced by the others in a continuous and mutually reinforcing cycle) [70]. To understand how the Social Cognitive Theory relates to eating behaviour we can apply it alongside the REFCAM and the Hierarchy of Unhealthy Food Promotion Effects Models.

Collectively, the models and theory form a basis for comprehending how food marketing influences adolescents' attitudes and behaviours toward a food product. For example, in a television advertisement for sugary breakfast cereal, the REFCAM explains the initial draw of

how the cereal box is strategically placed in a scene where adolescents enjoy breakfast together, triggering automatic cravings through visual cues of the cereal [66]. The Hierarchy of Unhealthy Food Promotion Effects Model explains how the advertisement highlights the normalization of eating sugary cereal for breakfast and how that exposure could lead to purchasing and consuming said cereal [67]. Finally, the Social Cognitive Theory shows how adolescents observing the characters enjoying the cereal for breakfast could perceive it as desirable and socially acceptable, reinforcing the message to consume sugary cereal for breakfast [69].

Exposure and Power

The influence of marketing hinges on two factors, exposure and power. Exposure, as defined by the World Health Organization (WHO) encompasses the reach (percentage of people in a target market who are exposed to an advertisement) and frequency (the number of times a person is exposed to an advertisement) [71]. Power, the design and execution of an advertisement, refers to marketing techniques that aim to achieve specific objectives such as increasing brand awareness or shaping consumer perceptions. It is the ability of marketing techniques to resonate with target audiences, create engagement, and ultimately, curate behaviours or outcomes [71]. Effectively leveraging both exposure and power forms a potent combination.

Exposure

Frequency, or potential exposure, encompasses all advertisements present on a specific medium that an individual may encounter [64]. Actual exposure refers to the advertisements viewed by an individual measured through self-reported methods or, more precisely, using measured media data or screen capture technology [64]. Increased exposure, whether through longer durations or higher frequencies, correlates with higher likability of advertisements and

products. This can enhance adolescents' recall, potentially increasing their likelihood of purchasing the marketed product [61].

Evidence from a 2022 narrative review illustrates the pervasive nature of food marketing across television, digital media, product packaging, in-store advertising, and marketing in schools, with adolescents being exposed predominantly to products associated with unhealthy dietary patterns [60]. Most of the studies found that the proportion of food marketing that promoted unhealthy foods ranged from 31% to 93% [60]. Sugar-sweetened beverages emerged as the most frequently marketed category, closely followed by sweets (e.g., candy, chocolate), fast foods, and breakfast cereals [60]. Marketing medium variations were evident, with sweets and sugary drinks more commonly advertised on television, while sweets and fast-food restaurants were prominent on Facebook and in outdoor settings [60].

Evidence also shows social disparities in food marketing exposure, with less affluent communities experiencing greater exposure to unhealthy foods on television and on a metropolitan train network [60]. Studies from the United Kingdom (UK) and Australia highlighted higher proportions of advertising in areas of lower socioeconomic status, which suggests deliberate efforts to target vulnerable populations, particularly those residing in socioeconomically deprived areas [72-75]. This pattern implies systematic and predatory practices exist and are used to target specific demographic groups.

Exposure alone is not sufficient for examining the extent to which food marketing impacts adolescents [76]. Exposure is important, but limited, in that volume does not fully capture levels of engagement [76]. Investigating power alongside exposure is essential for gaining a comprehensive understanding of the impact of food marketing on adolescents [77].

Power

Marketing demands a level of engagement and to obtain that engagement marketers use "power" or an array of marketing techniques to capture an audience's attention [78]. Between 2009 and 2020, a total of 100 studies explored the power of food marketing with 25 focusing solely on power and 75 examining both exposure and power [60]. These studies identified various marketing techniques commonly used across marketing mediums including television, digital media, product and instore promotions, magazines, sports sponsorship, restaurants, schools, and outdoor environments. Examples included celebrity endorsements, promotional characters, product promotions, competitions, games, visual imagery, animation, and interactive content [60]. These techniques were found to be more prevalent in marketing directed at youth compared to adults, were more frequently used to promote less healthy products, and were more prominent during school holidays [60].

Studies also noted differences in marketing techniques across media. For instance, one study discovered that outdoor advertising relied more heavily on using competition, whereas television advertising frequently featured family bonding themes [79]. Understanding these variances in marketing strategies across different platforms can reveal how adolescents are targeted based on their media consumption habits. Analyzing both exposure and the power of marketing techniques is essential for comprehending the effects of food marketing content on adolescents' dietary choices and behaviors, allowing researchers to better assess the overall impact and develop more effective interventions to mitigate its influence on unhealthy eating patterns among young people.

Food Marketing Regulations

Food marketing has garnered significant political attention both internationally and in Canada. Leading health organizations such as the WHO and other public health advocates have urged for the creation of governmental policies aimed at restricting the promotion of unhealthy foods to youth [71, 80]. For instance, the WHO recommends adopting policies that restrict the marketing of foods containing high levels of saturated and trans fats, sugars, and/or salt. These recommendations include being mandatory versus voluntary, to protect all children (aged 0-19), use government-led nutrient profile models to classify foods for marketing restrictions, be comprehensive to prevent marketing migration to other media or age groups, and aim to limit the persuasive power of food marketing techniques [71].

Canadian Food Marketing Regulations

Child Health Protection Act

To address food marketing to youth in Canada, *Bill S-228*, known as *the Child Health Protection Act (*the Act), was introduced in the Senate of Canada in September 2016 to federally regulate child targeted marketing [81]. The Act was drafted to safeguard youth up to the age of 17 from the harmful effects of food marketing. However, it was later amended to include only those under 13, ultimately excluding adolescents from its scope [81]. The Act's primary objective was to address concerns regarding childhood obesity and related health issues by regulating marketing practices targeting young consumers. Despite apparent support from parliamentarians and the public and a perceived policy window for change, it encountered resistance and lobbying from the food and beverage industry, leading to its stagnation in the Senate and eventual failure to pass into law [81].

A study examining lobbying regarding the Act revealed a disparity in engagement levels between industry and non-industry lobbyists [82]. Industry representatives had a significantly higher degree of activity, with five times more communications overall and approximately ten

times more with key governmental entities [82]. Over 90% of communications with top government offices, such as the Prime Minister's Office predominantly originated from industry lobbyists, and all meetings within the Health Canada Deputy Minister's office were exclusively with industry stakeholders [82]. This overwhelming presence of industry stakeholders, coupled with the constrained resources of non-industry stakeholders emerged as barriers to effecting nutrition policy change, likely contributing to the outcome of the Act [82].

Despite this failure, the commitment to restrict food marketing to children in Canada has been listed as a Minister of Health mandate since 2015 [64]. The Minister of Health's Mandate Letter issued in December 2021 reaffirmed this commitment, emphasizing the imperative of advancing the Healthy Eating Strategy, including the support for measures to restrict food marketing directed at children [83]. As part of Health Canada's Healthy Eating Strategy, Health Canada also proposed amendments to the *Food and Drug Regulations* [84]. One of the amendments is a targeted approach that prioritizes the implementation of restrictions of food marketing on television and digital media platforms. These proposed regulations are expected to be published in Canada's Gazette in June 2024. Currently in Canada, the regulation of food advertising to children operates through two mechanisms. One is the statutory regulation in Quebec under the *Consumer Protection Act* [85] and the other is a new self-regulatory Food Advertising Code, which has replaced the Children's Food and Beverage Advertising Initiative [86].

Quebec Consumer Protection Act

The Quebec *Consumer Protection Act* includes provisions that extend to the regulation of commercial advertising to children [85]. The Quebec *Consumer Protection Act* mandates that commercial advertising cannot directly target children under the age of 13. This is determined by assessing the nature and intended purpose of the good advertised, the manner of presenting the

advertisement, and the time and place it is shown [87]. More specifically, the *Consumer Protection Act* asks who the target audience is (e.g., is it intended for children), is the advertisement crafted to capture children's attention, and are children specifically targeted or exposed to the advertisement [87]. This includes restrictions on the use of persuasive techniques, such as promotional characters or engaging visuals that may unduly influence children [85].

A recent study compared televised food advertising in Ontario and Quebec revealing stark differences in each policy environment [88]. Children in Quebec were exposed less to unhealthy food advertising compared to Ontario, where industry self-regulation is the norm [88]. However, French-speaking children in Montreal, Quebec, were still exposed to high levels of unhealthy advertising, albeit with fewer child-appealing techniques [88]. Despite some positive impacts, particularly on child-appealing television stations, Quebec's *Consumer Protection Act* still falls short of fully protecting all children in the province [88]. Although focused on children, these findings emphasize the need for strengthened regulations at the federal level to effectively safeguard not only children but also adolescents across Canada from the harmful effects of unhealthy food marketing.

Self-regulatory Food Advertising Code

Canada's new self-regulatory food advertising code, the *Food and Beverage Advertising Code* (the Code), was established by four industry associations (the Association of Canadian Advertisers, the Canadian Beverage Association, Food, Health & Consumer Products of Canada, and Restaurants Canada) and came into effect in June 2023 [89]. The Code aims to enhance the regulation of food advertising practices that target children under 13 years of age [86]. It replaces the previous *Canadian Children's Food and Beverage Advertising Initiative* and complements existing legislative and regulatory frameworks in Canada without superseding any laws, regulations, guidelines, or self-regulatory codes already in place [89].

The Code states that advertising a food or beverage product cannot primarily target individuals under 13 years of age unless the product meets its child advertising nutrition criteria [89]. These criteria include limits on saturated fat, sodium, and sugars. For saturated fat, the threshold is set at over 2 grams per serving or over 15% of energy from saturated fat. The sodium threshold is over 140 milligrams per serving, and for sugars, it is over 5 grams per serving [89]. If a food or beverage product does not meet the nutrition criteria outlined above, the context of the advertisement is reviewed, such as the nature and intended purpose of the product, the advertisement's presentation, and when and where it is shown [89].

While the Code aims to promote healthier dietary choices among children, its voluntary nature and exceptions raise concerns about its effectiveness in curbing unhealthy food marketing practices. Within the guidelines, it states “advertisers are encouraged to submit advertising for preclearance under this Code” [89]. This statement implies that companies can voluntarily have their advertising reviewed as opposed to it being mandatory [89]. This approach could lead to inconsistencies in adherence and limited effectiveness, particularly if some companies choose not to comply.

There are also several exceptions within the Code. For example, the Code says it applies to all advertisements featuring food or beverage products intended for residents of Canada, across any media platform [89]. However, social media, packaging, labels, wrappers, containers, and product shapes are excluded from this definition [89]. In-store displays, posters, menus, and other on-premises communications about food or beverage products are also exempt. Additionally, the advertisement must prominently feature the actual food or beverage product to be considered food or beverage advertising. Simply mentioning a brand name or logo associated with the product does not constitute food or beverage advertising unless the logo prominently

includes the product itself. For instance, a youth sports program sponsored by a restaurant can acknowledge the sponsor using its corporate name or associated brand, such as McDonald's or Coca-Cola. Only if the advertising prominently showcases a specific food or beverage product (e.g., a Big Mac or can of Coke), does it fall under the regulations of the Code.

Further, if a food or beverage product appears incidentally in an ad (not as the primary focus) it is not considered "featured" in the ad. For example, a recruitment ad for a restaurant showing employees handling food or beverage products would not be categorized as featuring a food or beverage product. While the Code attempts to regulate food advertising to children, its criteria and exemptions reveal significant loopholes that could undermine its effectiveness in adequately restricting such advertising practices and although this new code has yet to be evaluated, self-regulatory measures have been repeatedly shown to be ineffective in reducing children's exposure to food advertisements [90]. Also of note, neither the Quebec *Consumer Protection Act* nor the Code extend to protecting adolescents [34].

Digital Food Marketing

Definition of Digital Marketing

Digital marketing refers to promotional activities that are delivered through digital platforms (e.g., the internet, social media, advergames). These activities leverage data analytics and targeted strategies to enhance engagement and optimize marketing outcomes [91]. Digital media functions within a network of information sharing and gathering offering marketers a platform for promoting their products. It is inexpensive, has the capacity for audience segmentation (dividing a larger target audience into smaller, more homogeneous groups based on shared characteristics or behaviours), facilitates user-generated content (text, images, or videos shared using company content rather than the brand or organization sharing themselves), and provides widespread accessibility, making it advantageous for marketers [92]. It also uses

engaging visuals, interactive content, and personalized messaging to capture audiences' attention and influence their purchasing decisions [93]. These digital marketing techniques can operate alone or in concert with one another to create a broadly reaching, enticing advertisement. This dynamic environment offers companies unprecedented opportunities to engage with consumers and promote their products effectively [94].

Definition of Digital Food Marketing

Digital food marketing refers to the promotion and advertisement of food products and brands through digital platforms [95]. To promote food products, increase brand visibility, and engage consumers with the food sector, digital food marketing is promoted via social media (e.g., YouTube, TikTok, Instagram), video games, and streaming television applications (e.g., Netflix) [93]. The digital marketing of unhealthy foods is a powerful determinant of adolescent dietary behaviours that has contributed to increased rates of obesity and obesity comorbidities [33].

Uniqueness

Food companies are increasingly redirecting their attention towards digital marketing, leveraging the widespread use of technology and internet access to reach a broad audience, including adolescents who are active users of digital platforms [93, 96]. From a commercial standpoint, adolescents are an ideal population to target for marketing due not only to their cognitive development but also because of their high rates of cellphone ownership and use.

In 2022, a significant portion (93%) of Canadian adolescents aged 14–17, owned a smartphone [97]. Adolescents increasingly immersed in their smartphones are avid users of social media platforms (e.g., TikTok, Facebook, Instagram) [97]. Roughly 45% of girls and 36% of boys aged 14-15 reported intensive (online contact almost all the time throughout the day) social media use [98]. Canadian data shows that boys in grades 7–11 use Discord (an instant

messaging app) (22% vs 13%) and Twitch (21% vs 8%) more than girls, while girls use TikTok, Instagram, and Snapchat more than boys (61% vs 46%; 57% vs 44%; 45% vs 35%) [97]. As adolescents increasingly engage with social media platforms, it is unsurprising that major food corporations have pivoted their marketing strategies to focus on these avenues [33].

Within digital spaces, marketers capitalize on three primary marketing strategies - paid media marketing (the promotion of products through purchased advertising space on various platforms like social media); owned media marketing (the promotion of products through channels that a company owns, like Coca-Cola's website or social media page); and earned media marketing, also referred to as peer-to-peer marketing [99]. This strategy relies on consumers promoting products or brands without any monetary compensation [99]. Earned media marketing may prove more impactful in fostering positive brand attitudes compared to conventional television advertising or overt promotional messages directly from companies due to adolescents susceptibility to peer influence [94].

Digital food marketing differs significantly from traditional forms of food marketing such as television and billboards due to its interactive nature, precise targeting capabilities, real-time feedback mechanisms, and lack of regulation [100]. Marketing activities on social media platforms actively encourage engagement with their content by endorsing (e.g., liking and commenting) and sharing posts with peers (i.e., earned media) [94, 101]. Compared to traditional television advertisements where consumers are passively exposed, digital marketing allows for and encourages users to actively participate in promoting brand content virally among their social circles [101].

Additionally, digital marketing allows for highly specific audience targeting based on demographics, interests, online behaviours, and geographic location, enabling marketers to reach

their desired audience with unprecedented precision [102]. Digital platforms also provide instant feedback on the effectiveness of marketing campaigns, allowing for rapid adjustments and optimization strategies [102]. This differs from traditional media, where feedback is often delayed and less actionable.

In contrast to traditional television advertising where regulatory bodies like the Canadian Radio-television and Telecommunications Commission impose restrictions on the frequency of advertisements within specific time frames, digital marketing lacks such regulatory oversight allowing for potentially unlimited exposure to marketing content [103, 104]. This absence of maximum exposure thresholds for digital marketing poses unique challenges, particularly concerning the saturation of advertising messages. Unlike the structured limitations imposed by broadcast regulations, the unbounded nature of digital marketing permits advertisers to target consumers more frequently and across various online platforms, intensifying the influence of marketing messages [104]. As a consequence, users navigating digital spaces are inundated with promotional content, rendering them susceptible to heightened levels of commercial persuasion, which shapes their consumption choices and behaviours in significant ways [104]. Overall, digital marketing offers a unique blend of interactivity, targeting precision, and agility while also being difficult to monitor setting it apart from traditional marketing channels.

Expenditures

In 2019, $628 million was dedicated to food marketing expenditures with roughly $493 million or 87.2% to promote products and brands categorized as "unhealthy" [57]. Of the total food marketing expenditures, $74.1 million or 11.8% was allocated to digital food marketing across 57 selected food categories in Canada [57]. This investment in digital food marketing highlights the growing influence of online marketing towards shaping consumer behaviours. Comparatively, estimates for healthy food marketing expenditures are correspondingly low with

fruit and vegetable marketing estimated at only 2% of all food marketing expenditures in Canada [57].

Canadian adolescents are also exposed to food marketing via non-Canadian sources. Global expenditures on food marketing are similarly high. Based on 2017 data, food companies in the United States spend over $14 billion annually on food advertisements [105], while companies in the UK spend over 143 million pounds annually [106]. Given these extensive marketing efforts, it is critical to evaluate and regulate digital food marketing practices to mitigate their impact on adolescents' dietary habits and overall health.

Impact of Digital Food Marketing

Adolescents exhibit heightened susceptibility to digital food marketing due to several factors [33]. First, their avid engagement with social media platforms wields considerable influence over their identity, emotional regulation, cognitive development, and overall well-being [107]. Second, the developmental stage of adolescence is characterized by amplified responsiveness to rewards, impulsive decision-making tendencies, and diminished inhibitory control, all of which can predispose them to adopt unhealthy dietary practices [108]. Lastly, the pursuit of autonomy, agency, and a sense of identity during this transitional period fosters a desire for both differentiation and social belonging, factors that may inadvertently contribute to the adoption of less nutritious dietary choices [31].

While existing literature has predominantly focused on the susceptibility of children to food marketing, it is imperative to recognize adolescents as a distinct subgroup as they also exhibit vulnerability to marketing influences [34, 63]. Adolescents are also prime targets for digital food marketers due to their frequent online presence, purchasing capacity compared to younger children, and their potential as the future market [55]. Their aptitude with technology

and influential role in setting and following trends further amplify their appeal as a target population [109].

As "digital natives" [110], digital devices constitute an integral aspect of adolescent daily lives rendering them particularly susceptible to online influences [33]. Social media plays a pivotal role in adolescents' social identity development, with a strong emphasis on peer approval and conformity [78]. Sharing social media content among peers serves various psychological motives, such as facilitating self-expression and fostering interpersonal connections [111]. Adolescents are motivated to interact with peers on social media, seeking connection while carefully curating their online image to align with social norms and acceptance [94].

Consequently, social media platforms serve as powerful channels for transmitting norms, ideas, and behaviours, including eating habits, which become intertwined with adolescent identity expression online [94]. Based on a United States survey, adolescents were found to be more inclined to share posts related to junk food compared to healthier options [63]. Moreover, adolescents exhibited a heightened engagement with food posts from peers compared to those from celebrities or companies, with a preference for peers who posted unhealthy foods [94].

Adolescence is also characterized by heightened sensitivity to reward, complicating resistance to marketing tactics [94]. Unique features of digital marketing, such as interactive content and integration into social networks, may weaken adolescents' cognitive defenses against marketing effects [78]. Brands on social media platforms often blur the lines between marketing and non-marketing content (e.g., advertainment, social media influencers), challenging adolescents' ability to discern advertising messages [112]. Online marketing strategies frequently utilize adolescents' social networks presenting brands as endorsed by friends and encouraging interaction with brands as if they were individuals [94].

Adolescents often possess increased autonomy in purchasing decisions, are becoming more independent from their parents, and exercise more control over their choices, despite still being highly impressionable and prone to impulsive decisions [31, 33, 108]. Adolescents also have limited media literacy, which can support the comprehension of marketing techniques, discernment of persuasive intent, and cultivation of critical thinking skills regarding marketing content [113]. Further, even if an adolescent grasps the persuasive intent of advertising, they could still lack the motivation and cognitive ability to effectively resist its influence [94]. Research on alcohol and tobacco advertising suggests that the extent to which advertising affects viewers depends on their level of self-control, a trait still developing during adolescence [114].

While adolescents face significant challenges in navigating the landscape of digital food marketing, this developmental stage also presents unique opportunities for intervention [115]. Adolescence is a critical juncture for implementing effective interventions. Research suggests that well-designed interventions during adolescence can have an enduring impact, redirecting individuals' developmental trajectories in lasting ways [115]. Collaborative efforts to develop and implement interventions tailored to adolescents' needs and vulnerabilities are essential for promoting healthy dietary behaviours and mitigating the negative effects of digital food marketing. Leveraging this pivotal stage of development with purposeful interventions can foster positive habits and empower adolescents to make informed choices about their dietary habits, laying the foundation for lifelong health and well-being.

The Food and Beverage Cues in Digital Marketing Model (FBCDM)

Previous food marketing models have been developed but the distinct characteristics of digital media necessitated the development of a new model to understand the uniqueness of digital food marketing [116]. The Food and Beverage Cues in Digital Marketing Model

(FBCDM) (Figure 6) integrates elements from aforementioned models (i.e., REFCAM) while considering various levels of marketing integration on digital platforms.

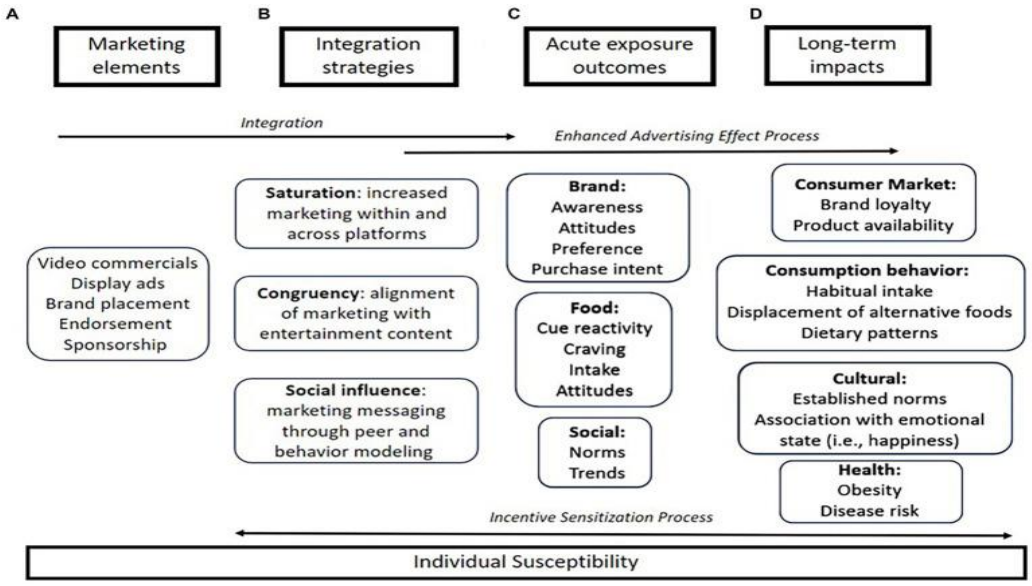

Figure 6. The Food and Beverage Cues in Digital Marketing Model [116]. Permission has been granted to use this figure.

The FBCDM categorizes the effects of digital marketing into measurable outcomes across brand, food, and social domains, while also accounting for long-term impacts on consumer behaviour, cultural norms, and health [116]. Individual susceptibility is hypothesized to influence the perception of marketing and its resulting impacts. This conceptual framework aims to guide future hypothesis testing on the complexities of digital food marketing [116]. This research concerns itself with social influence and norms and trends for acute exposure outcomes.

Digital Exposure and Power

Exposure

Analyzing the exposure and power of digital food marketing viewed by adolescents is critical for comprehending the complex digital landscape they navigate. Adolescents encounter instances of digital food marketing across various online platforms with increasing frequency [117]. A 2019 Canadian study that used screen capture technology estimated that adolescents

aged 12-17 were exposed to over 9000 social media food marketing exposures annually, six times more than children [117]. This is concerning, as research indicates that exposure to and interaction with unhealthy food posts on social media is linked to increased consumption of such foods among adolescents [118]. For example, data from 8708 Australian students aged 12-17 revealed that exposure to food or drink marketing on social media once a week was associated with higher consumption of unhealthy drinks, while liking or sharing food or drink posts in the last month was linked to increased intake of unhealthy food and drinks (all $p < 0.01$) [118].

Repeated exposure to unhealthy food marketing can shape adolescents' normative beliefs [96]. Extensive exposure to unhealthy food images can influence perceptions of what foods others typically consume (descriptive norms) and what foods individuals should consume (injunctive norms) [119]. Unfortunately, the predominant food messages adolescents encounter online pertain to energy-dense and nutrient-poor foods [119]. These social media messages might be shaping adolescents' perceptions, perpetuating normative beliefs, convincing them that overconsumption of unhealthy foods is both common and bars no consequences.

Power

The power of digital food marketing in determining adolescent's dietary choices is increasingly recognized as a significant influence [60, 76, 77]. Digital marketing is often camouflaged, masquerading as personalized recommendations, entertainment, guidance from influencers, or targeted "made for you" advertising thereby making identification of marketing more difficult [101]. The hallmark of digital marketing lies in its individualized approach.

Personalization

Personalization allows marketers to modify their efforts, adapting to the nuances of individual preferences and behaviours. Companies collect consumer data by using advanced data analytics that draws from users' social media interactions and browsing history. This information

is then used to develop techniques designed to capture users' attention and influence their behavior [102, 120]. This tailored approach enables marketers to create content that resonates with specific demographics, fostering deeper connections, and increasing the likelihood of engagement [121]. By leveraging personalized strategies, companies can effectively target their desired audience segments, resulting in more impactful marketing campaigns and a greater consumer base [121].

Advertainment

Another common tactic that marketers use is advertainment [122]. This technique embeds marketed products within entertaining media content such as movies, television shows, or video games, and encourages youth to share these features with peers [123]. Advertainment blurs the line between marketing and original content making it hard for consumers to distinguish the difference between marketing and entertainment [124]. Snapchat, for example, uses corporate advertising filters enabling users to share photos resembling them as fast-food items (e.g., McDonald’s French fries). These filters may also include game-like elements, such as adver-trivia or adver-games [125]. Integrating advertainment into media platforms is manipulative and further complicates adolescents' ability to distinguish between marketing and entertainment content.

Social Media Influencers (SMIs)

Social media influencers (SMIs), are individuals who have established credibility and a significant following on social media platforms [126]. They leverage their reach and influence to shape the opinions, behaviors, and purchasing decisions of their audience through content creation, often collaborating with brands to promote products and services. Influencers typically specialize in specific niches such as fashion, beauty, fitness, travel, or food, and their perceived authenticity and relatability make them effective in engaging their followers [127]. Leveraging

their extensive reach, familiarity, and popularity, SMIs effectively capture the attention of adolescents and exert influence over their eating behaviours [94, 128, 129].

SMIs frequently endorse unhealthy food products, with as much as a quarter of endorsements promoting foods that are high in fat, sugar, and salt [94]. A study investigating adolescents' interactions with digital food marketing found that participants often recalled encountering SMIs promoting food products on platforms like YouTube, TikTok, and Instagram [112]. Among the frequently mentioned product categories were energy drinks, fast-food chains, soft drinks, and flavored water [112]. The extent of trust placed in SMIs poses a concern, as their influence has been linked to heightened recollection and consumption of unhealthy foods [94]. Moreover, the consumption of unhealthy snacks such as chocolate chip cookies, candy, and chocolate, as well as overall caloric intake, increased among adolescents who viewed videos featuring SMIs endorsing these products [130]. Adolescents tend to preferentially choose marketed products when they feel a connection with the individual promoting them. This phenomenon can be explained through Social Cognitive Theory, which posits that adolescents acquire behaviours by observing and emulating individuals they admire, such as SMIs [131, 132].

Targeted Food Marketing

Targeted food marketing tailors advertising content specifically to individual demographics, maximizing its impact on consumer engagement and purchasing decisions [72]. Marketing strategies that specifically target racial and ethnic groups are well-documented, with Black adolescents being exposed to a higher prevalence of nutritionally poor foods compared to their white counterparts [133]. These targeted marketing efforts disproportionately pursue youth of color, exacerbating health disparities within these populations [72].

Food brands that cater to Black adolescents exhibit an imbalanced social media following, with a higher proportion of Black followers compared to their White counterparts [134]. This skewed representation demonstrates a troubling trend in racially tailored marketing strategies, wherein companies capitalize on the cultural influence of communities of color to gain their consumer base. While recognizing the purchasing power and cultural sway of these communities, such targeted marketing initiatives pose significant public health concerns when they promote products contributing to disparities in diet-related health outcomes [134].

The debate over restricting marketing based on race or ethnicity is complicated. Promoting unhealthy food products to communities with high rates of diet-related diseases necessitates intervention. However, limiting targeted marketing could inadvertently suggest that certain communities of color are less capable of navigating marketing exposures independently [135]. Given these complexities, the prevailing public health approach is to empower affected communities to resist and advocate for changes in marketing practices [133]. As we delve deeper into understanding the impact of marketing on health disparities, there is a pressing need to assess digital food marketing from a gender perspective to determine if marketing practices are targeting genders differently.

Gender and Marketing

Differences Between Gender and Sex

The distinction between sex and gender represents a fundamental aspect of social and biological sciences, constituting a paradigm within the study of human identity and behaviour. Sex refers to the biologically determined attributes distinguishing individuals as male, female, or intersex, primarily focusing on physiological characteristics such as reproductive organs and chromosomes [136]. Gender is a complex and dynamic social construct encompassing the roles,

behaviours, expectations, and identities associated with being a boy/man, girl/woman, or gender diverse [137].

While sex is often perceived as a binary concept (male/female) rooted in biological markers, gender is recognized as a spectrum, acknowledging the diversity of gender identities beyond the traditional man-woman binary [138]. The conceptualization of sex and gender as distinct but interconnected constructs is pivotal for a comprehensive understanding of human identity [139]. Within this dissertation, sex-based data is used for health condition rates and food consumption patterns as gender-based data is not collected or available for these metrics. The results and discussion portion of this research, along with data where available, use gender as it describes socially constructed concepts and interpretations.

Gender: A Social Determinant of Health

Gender, a social determinant of health, can effect health and behavioural outcomes [137]. Gender intersects with social class, occupation, age, and geography to perpetuate and strengthen both beneficial and harmful behaviours [140]. It plays a role in shaping individuals' identities, experiences, and interactions within society. Understanding how gender is connected to marketing is needed to comprehend how consumer behaviours, preferences, and perceptions are shaped, thereby influencing their responses to marketing efforts. Numerous studies on tobacco and alcohol have investigated the impacts of customized marketing strategies based on gender [141-148].

Gender and Tobacco and Alcohol Marketing

Tobacco

Smoking was not viewed through a gender lens until researchers sought to understand the rise in smoking rates among women [147]. Research conducted by the WHO identified factors that influenced women's tobacco use [147]. One of the driving forces was tobacco companies targeting women via gendered marketing, which led to increasing their market share among

women [147]. Men historically smoked more than women and because of this, the tobacco industry put in a concerted effort to increase the female consumer base by creating advertisements that drew women's attention [143, 144].

Decision-making processes surrounding tobacco purchases are intertwined with cultural, psychosocial, and socioeconomic considerations, all of which intersect and are influenced by gender norms [148]. Recognizing this, tobacco marketing strategies crafted advertisements to resonate with gender stereotypes, appealing to gendered expectations and preferences such as beauty and being slim [149]. This expansion saw women featured prominently smoking in movies and advertisements for brands like Virginia Slims, alongside iconic figures such as the Marlboro Man [149].

For decades afterward, the tobacco industry perpetuated the misleading notion that smoking is synonymous with women's empowerment, insinuating that cigarette smoking represents elements of high fashion, freedom, modernity, and promises of weight reduction [147]. Advertising and media undoubtedly shaped attitudes and behaviours surrounding tobacco use making it increasingly important to scrutinize how gender is represented or utilized in all forms of marketing, including food [150]. The marketing dynamics within the alcohol industry bear resemblance to those within the tobacco sector, with deliberate strategies aimed at differentiating products, targeting demographics, and crafting marketing campaigns tailored to gender distinctions [141].

Alcohol

Alcohol marketing has shaped and perpetuated the perceptions of gender roles and relationships as well as influenced gendered patterns of drinking behaviour [142]. Alcohol companies use techniques like targeted segmentation, which tailor advertisements to resonate with specific gender demographics [145]. For example, marketing techniques were designed to

appeal to women through narratives that promote empowerment and traditional stereotypes associated with femininity, such as makeup, using the colour pink, and shopping [141]. There have been notable transformations in how women are portrayed and targeted in alcohol advertising, reflecting broader shifts in societal attitudes toward gender inequality and stereotypes [141]. Research indicates that targeted, gender-based approaches prove more effective in influencing purchasing behaviours compared to generalized strategies [145].

The exploitation of gendered stereotypes and ideals in marketing has yielded substantial benefits for tobacco and alcohol companies. By specifically targeting women in product design and marketing techniques these companies have succeeded in normalizing and increasing rates of female smoking and drinking, leading to comparable representation with men in cigarette and alcohol markets [49]. Given the success and proliferation of gender-based marketing strategies in the tobacco and alcohol industries, it is reasonable to hypothesize that the food industry may be utilizing similar tactics.

Gender and Dietary Choices

Gender influences individuals' dietary choices, preferences, and nutritional behaviours [151]. Social norms and expectations related to gender roles can also contribute to the construction of food preferences, often reinforcing stereotypical ideals of masculinity and femininity [151, 152]. For example, men often follow less healthy dietary patterns compared to women, partly due to societal perceptions that associate nutritional health and dieting with femininity [151, 152]. These dynamics are further complicated by the pervasiveness of marketing that can exploit and perpetuate gender norms [145, 146]. Unraveling the connection between gender and digital food marketing is essential for understanding how gendered food marketing collectively shapes dietary behaviours and health disparities.

Current State – Gender and Food Marketing

There is limited research that exclusively investigates exposure rates or marketing techniques of digital food marketing by gender. Historical studies have explored gender's moderating effects on children's television advertising [153] and children's preferences for branded versus unbranded products [154], while recent studies have investigated the power and exposure of digital media marketing to adolescents [101, 155-157]. Given the life-long impacts of dietary behaviour and gender's influence on dietary choices, the current literature can be considered thin.

Chernin's research revealed that boys were more susceptible to television advertising of Tang and pringles compared to girls [153]. The author found the findings to be unexpected, given that the products were not associated with a particular gender and both boys and girls were prominently featured in the commercials [153]. It was suggested that boys exhibited a higher level of engagement with the commercials compared to girls, leading to a greater susceptibility to the persuasive messaging [153]. Another study focused on preschoolers' preferences for branded versus unbranded products and found that girls exhibited higher preferences for heavily advertised and branded items compared to boys [154]. The authors suggested that this difference could be attributed to greater socialization and trendsetting among girls. However, both these studies did not involve adolescents and were limited to traditional media (television) rather than digital platforms.

Current research has shown patterns of how gender is tied to adolescents' engagement with and reactions to food marketing across various digital platforms [101, 155-157]. Adolescents exhibit distinct preferences for specific platforms, with girls preferring Instagram, TikTok, and Snapchat, while boys favour YouTube [155, 156]. Moreover, girls generally spend more time on social media, have higher engagement with multiple brands, and react more

positively to food advertisements than boys [158]. Conversely, boys tend to express greater trust in food advertising compared to girls, aligning with previous research that explored trust in alcohol advertising [157]. These findings demonstrate the significance of needing to further unpack gender in understanding adolescents' interactions and exposure to food marketing across digital platforms.

Most relevant is a recent scoping review that examined studies that explored the influence of gender on food marketing on children and adolescent behaviours [62]. The study included 37 articles, of which 23 found gender-based differences [62]. Similar to findings from tobacco and alcohol marketing, this review highlights the pervasive influence of marketing in perpetuating traditional gender norms and stereotypes, which in turn can shape food preferences and choices among children and adolescents [62].

Notably, the review found that boys tend to exhibit a higher susceptibility to food marketing compared to girls, as evidenced by their increased preference for advertised products and higher frequency of purchase requests [62]. Boys were also more exposed to food marketing, and their preferences were more affected by this exposure. This could be due to the advertising content, which often had a male-dominant focus. Interestingly, the impact of food marketing on boys and girls' consumption of unhealthy foods was similar [62]. Support for food marketing regulation was found to be higher among girls, indicating gender-based differences in perceptions regarding the need for regulatory interventions in marketing practices [62].

The study did have limitations, including most studies conflated sex and gender, making it difficult to report consistent findings. Further, there was a lack of studies examining digital platforms as most of the research centered on television [62]. Overall, the existing body of literature is not robust or comprehensive, providing the impetus for this current research. Despite

insights from current research, gaps remain in understanding the nuanced interactions between digital food marketing viewed by adolescents and gender.

Gaps and Research Questions

Gaps

Currently, there is a dearth of research dedicated to exploring the role of gender in digital food marketing viewed by adolescents and the impacts of digital food marketing on adolescents. As such, this research aims to address this gap by investigating how gender is being used within digital food marketing and how adolescents perceive and respond to gendered digital food marketing. Despite a body of literature examining adolescent exposure to digital food marketing [59, 76, 101, 117, 155, 159, 160] few studies have applied a gender analysis to these exposures. Some have considered gender as a data point, collecting it on surveys and providing comparisons between boys, girls, and gender non-conforming people, but these studies do not elaborate on how gender may impact results [77, 155-157, 161]. Said otherwise, gender is not the focal point of these studies, but a byproduct of demographic questions. The only exception is the recent scoping review [62]. Additionally, qualitative inquiries into adolescents' social media habits regarding digital food marketing remain limited [112, 133, 162], with none explicitly asking about gender. Further, in the ever-evolving realm of social media, SMIs exert significant influence on adolescent trends, opinions, and lifestyles, yet the frequency of food marketing content posted by SMIs, particularly in a Canadian context and through a gender lens, remains unexplored.

Research Questions

Given the above, this research aimed to answer:

1. Do food marketing exposures differ between adolescent boys and girls in terms of the frequency of digital food marketing including the types of food categories, the healthfulness of food products, and the marketing techniques used to promote foods on

their favourite social media applications? It was hypothesized that marketing techniques used to promote food and beverages would differ by gender.

2. How does gender influence the way adolescents interpret and engage in unhealthy digital food marketing messages?
3. What is the frequency of social media posts containing instances of food product/brand content including the most promoted food categories, the healthfulness of featured food products, and the marketing techniques being used by SMIs popular with male and female adolescents? It was hypothesized that the frequency of posts and marketing techniques used to promote food and beverages would differ between those SMIs popular with males versus females.

Chapter 2: Methodology and Results

Methodology Summary and Research Sequence

This thesis consists of three studies that collectively demonstrate the effects of digital food marketing and how it impacts adolescents of different genders. This section will introduce the overall methodological approach, the researcher's involvement in the study, knowledge translation activities, and the methodology, results, and discussion of each article. A multimethodology approach was used to answer three research questions (RQs). RQs 1 and 3 were quantitative, whereas RQ 2 was qualitative. Sequentially aligned, each RQ builds upon the findings of the preceding one.

A multimethodology approach was chosen as it facilitated data collection from different perspectives and sources. By combining quantitative and qualitative methods, more comprehensive insights were gained. The two quantitative studies (RQ 1 and 3) provided statistical data on the prevalence and trends of marketing techniques and food categories viewed by adolescents while the qualitative study (RQ 2) offered deeper insights into adolescents' attitudes, perceptions, and behaviours related to digital food marketing. This holistic approach enabled the triangulation of findings, enhancing the validity of results, and generating more nuanced conclusions that can inform effective policy and intervention efforts.

The three studies were designed to address shortcomings and gaps in the literature by (a) applying a gendered analysis to instances of digital food marketing (All), (b) eliciting firsthand accounts of adolescents' digital food marketing encounters and experiences (RQ 2), and (c) assessing social media influencer's online food posts, from a gender perspective (RQ 3).

Study 1: Adolescent Exposure to Food and Beverage Marketing on Social Media by Gender: A Pilot Study

Approach

The first study, *Adolescent Exposure to Food and Beverage Marketing on Social Media by Gender: A Pilot Study,* investigated the gender-based differences in adolescents' exposure to instances of digital food marketing across social media platforms. The study exposed differences in marketing techniques, highlighting significant distinctions between those viewed by boys and girls. Recognizing these gender differences is needed for understanding variations in food choices and subsequent health disparities between boys and girls. These findings can inform the development of programs and policies aimed at safeguarding adolescents of different genders from targeted marketing tactics. Further, the exploratory nature of this research can support the generation of new hypotheses for future research and supply data for more rigorous experimental studies involving larger sample sizes.

Author's Contribution

My contribution included the development of the research question, analysis, and interpretation of the data, statistical analysis with help from a lab member, and drafting of the tables and manuscript.

Knowledge Translation

This research was published in the *Journal of Public Health Nutrition* in 2023. The study was also presented at the 2022 *International Society of Behaviour Nutrition and Physical Activity* conference in Phoenix, Arizona.

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Adolescent exposure to food and beverage marketing on social media by gender: a pilot study

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Abstract

Objective: The objective of this research was to determine if, based on gender, adolescents were exposed to different marketing techniques that promoted food and beverages over social media.

Design: A secondary analysis of adolescent boy (n 26) and girl (n 36) exposures (n 139) to food and beverage marketing was conducted. Mann–Whitney U and Fisher's exact tests were conducted to compare the number, healthfulness and the marketing techniques of exposures viewed by boys and girls.

Setting: Ottawa, Ontario, Canada.

Participants: Sixty-two adolescents aged 12–16 years.

Results: Boys and girls were exposed to similar volumes of food marketing instances (median = 2 for both boys and girls, Mann–Whitney $U = 237$, $P = 0{\cdot}51$) per 10-min period of social media use. More girls viewed products that were excessive in total fat compared to boys (67 % *v.* 35 %, $P = 0{\cdot}02$). Boys were more likely to view instances of food marketing featuring a male as the dominant user (50 % *v.* 22 %, $P = 0{\cdot}03$), appeals to achievement (42 % *v.* 17 %, $P = 0{\cdot}04$), an influencer (42 % *v.* 14 %, $P = 0{\cdot}02$) and appeals to athleticism (35 % *v.* 11 %, $P = 0{\cdot}03$), whereas girls were more likely to view instances of food marketing featuring quizzes, surveys or polls (25 % *v.* 0 %, $P = 0{\cdot}01$).

Conclusions: Food and beverage companies utilise marketing techniques that differ based on gender. More research examining the relationship between digital food and beverage marketing and gender is required to inform the development of gender-sensitive policies aimed at protecting adolescents from unhealthy food marketing.

Keywords: Adolescents, Gender, Food marketing, Marketing techniques, Social media

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Obesity is a pervasive public health concern, increasing an individual's risk of CVD, type II diabetes and poor self-esteem[1]. In 2019, roughly 25 % of all Canadian adolescents aged 12–17 years were classified as being overweight or having obesity, with higher rates of obesity in males (28·5 %) compared with females (20·2 %) based on self-reported anthropometric data[2]. In the last few decades, the diets of Canadian adolescents have shifted to include more processed and packaged foods that are high in sugar, salt and/or saturated fat[3]. In 2015, 64 % of Canadian adolescents exceeded the recommended daily intake of added sugar, with males aged 6 to 17 years consuming more than their female counterparts (84 g *v*. 76 g)[4]. Similarly, males aged 14 to 18 years consumed more sodium per d than females (3320 mg *v*. 2350 mg)[5]. These dietary habits can be attributed to several environmental factors including the digital marketing of cheap, highly processed, palatable, nutrient-poor food viewed on smartphones, tablets and computers[6]. Differential exposures to digital marketing, as viewed by male and female adolescents, may be contributing to dietary disparities between these groups.

Digital media operates in a complex, interactive web of sharing and collecting information, providing a unique space for companies to advertise their products as it is low cost, and it can be tailored to specific audiences[7]. As 'digital natives'[8] adolescents are born and raised in a media-driven world, where digital devices are a staple of their daily lives. As of 2014, 85 % of Canadians in grade 11 owned a cellphone[9]. In 2017, 20 % of Canadian adolescents spent 5 or more hours a day on social media with most adolescents cycling through one to three social media applications (apps) daily[9]. Gender differences exist in social media and online use amongst those in grades 7–11. YouTube is used by a larger share of Canadian boys compared with girls (83 % *v*. 77 %). Conversely, Facebook and Twitter are more popular among girls than boys (77 % *v*. 72 % and 43 % *v*. 24 %, respectively)[9]. Further, boys are more likely to play online games (71 % *v*. 47 %), while girls are more likely to use social media to connect with others (45 % *v*. 36 %) and to follow celebrities (26 % *v*. 14 %)[9]. Overall, young Canadian girls have a stronger presence on social media sites than their male counterparts[9].

Adolescents are a unique sub-population that have not garnered the same attention as children when it comes to the marketing of unhealthy food or beverages, yet they are similarly impacted[10]. Research demonstrates that unhealthy food and beverage marketing targeting adolescents directly affects their food preferences, purchasing habits and short-term food intake[10]. Corporations target adolescents as they often have greater flexibility to make their own purchases, have increased agency over their decisions and display greater brand loyalty than other age groups, while being impressionable and impulsive[11]. Adolescents are also overlooked when it comes to regulatory policies[10,12] , leaving them in a more precarious position than children[12]. The combination of these factors amplified by adolescents' extensive use of social media makes them an ideal target population for food and beverage companies. One area that requires attention is the role gender plays in the digital marketing of food and beverages (henceforth collectively referred to as food) to adolescents.

Gender is the social construction of behaviours, roles and activities that are deemed socially appropriate for men and women, boys and girls, and gender-diverse people[13]. Gender is also a social determinant of health that can influence health status and reinforce social and cultural norms[14]. These norms can change food and dietary choices, which can lead to the adoption of unfavourable health behaviours such as the excessive consumption of unhealthy foods[14]. There is a paucity of research examining how food marketing impacts people based on their gender.

A recent scoping review suggests that there is a relationship between gender and food marketing[15]. Some of the key findings from the review indicate that: male and female children and adolescents respond differently to food marketing techniques; food marketing has a greater effect on boy's food choices and preferences compared to girls; and food advertisements on television contain more male characters[15]. The results of this scoping review suggest that research is needed to explore socially built stereotypes and how these may be leveraged in marketing to impact the food preferences of girls and boys. A noted limitation of the scoping review was the lack of evidence regarding digital marketing[15]. These results beg the question – are noted differences in both the amount and content of food marketing exposures contributing to gender-based health and diet disparities?

The gender dimension of health is a key analytical and explanatory variable in research. If gender is overlooked, our understanding of prevailing health issues will be incomplete and potentially biased, which may limit our ability to develop effective interventions and policies[13]. Compared with other commodities, such as alcohol and tobacco[16] that have successfully utilised gender-based marketing strategies to draw in and maintain consumers, there is little research on the role gender plays in the design and impact of the digital marketing of unhealthy food.

Given that differences exist between boys and girls in obesity rates, dietary choices, and social media use, and that research indicates there are gender-based differences in responses to food marketing, it is critical to examine the digital marketing environment given the amount of time adolescents spend on social media and online. Such research is important to assess the messages that are shaping food attitudes among adolescent boys and girls, to provide insights as to whether gender differences in digital food marketing exposures play a role in overall dietary patterns and obesity prevalence, and to help inform digital marketing policies and interventions that are equitable and protective of youth. Recognising that targeted marketing techniques by gender may play a part in observed dietary differences and obesity prevalence among adolescents it is imperative that policies and interventions are gender-sensitive to curb gender-based targeting attempts from food companies and to ensure boys and girls are equally protected.

The objectives of this pilot study were to determine if adolescent boys and girls were exposed to different amounts of food marketing including the types of food categories, the healthfulness of food products and the marketing techniques used to promote foods on their favourite social media applications. It was hypothesised that marketing techniques used to promote food and beverages would differ by gender based on results from a recent scoping review.

Methods

Data source

This study is a secondary analysis of a cross-sectional study that was conducted by Potvin Kent *et al*., in 2018[17], which sought to compare the frequency and healthfulness of food marketing exposures viewed by children and adolescents on their two preferred social media apps. Apps included Facebook, Instagram, Snapchat, Twitter and YouTube. The original study asked participants to fill out a self-administered questionnaire that requested sociodemographic characteristics, including gender. Participants were asked to identify their gender with the following response options: (1) boy; (2) girl; or (3) I do not identify as a boy or a girl. Those who chose option three were provided the option to self-identify. Participants were then asked to login to their two favourite social media apps for 5 min per application (10 min total) on the smartphone or tablet they usually use during their

leisure time. Participants wore eye-tracking Tobii Pro Glasses while using a social media application, which recorded everything that participants viewed while browsing.

Research assistants then identified all food marketing exposures in the video footage. Food marketing exposures were defined as any content in which food or beverage brand logos or branded products were featured and included food advertisements (display and video ads as well as companies' posts on social media shared by their corporate account or other users), celebrity-generated content (when food products or brand logos appear in content produced and shared by celebrities or well-known figures on social media that have a large following) and food marketing embedded in other web content (branded food products, logos or product placements seen in recipe videos, art and craft videos, media articles or programmes, videos of sport highlights, streamed television content and Snapchat subscription articles, among others). User-generated content, content uploaded and shared by a social media user that intentionally or unintentionally promoted a food brand or product, whether it was encouraged by food companies or not (e.g. Snapchat photo posted by a private account featuring a McDonald's McFlurry) were excluded from the sample as this study was interested on the targeting nature of food companies and affiliates. Exposures were then classified by food categories including cold cereal, cakes, cookies, and ice cream, candy and chocolate, snacks, 100 % fruit juice, sugar-sweetened beverages (including regular soft drinks, sports drinks, fruit drinks, energy drinks and iced tea), hot beverages (tea or coffee), fast-food restaurants, non-fast-food restaurants, cheese, grocery store items, condiments, and other (items not categorised, such as beef broth). Food marketing exposures were also identified by food company and their healthfulness. A registered dietitian (EP) assessed each promoted food item displayed in an advertisement using the products nutritional data and the Pan American Health Organization Nutrient Profile Model (PAHO NPM)[18]. Nutritional data, including energy and nutrient content of promoted food items, were sourced from the following in order of priority: the Canadian company website, a products Nutrition Facts table, the American company website, or the Canadian Nutrient File. Information taken from these sources included serving size, total calories, total fat, saturated fat, trans-fat, sugar, carbohydrates, fibre, sodium and protein per serving size. The PAHO NPM classifies foods based on their level of processing and content in terms of 'negative' nutrients that are a public health concern (e.g. free sugars, sodium and fats)[18]. All food items, regardless of their level of processing, were coded as being excessive or not in total fat (if total fat accounted for ≥30 % of calories), saturated fat (≥10 % of calories), trans-fat (≥1 % of calories), sodium (mg: kcal ratio ≥ 1) and free sugars (≥10 % of calories)[18]. Marketing exposures were coded as either minimally processed or processed, or ultra-processed according to PAHO definitions[18].

Characteristics of participants and marketing exposures

The original study consisted of 101 participants of which, thirty-eight were children aged 7–11 years and sixty-three were adolescents aged 12–16 years[17]. This study included sixty-two adolescents (twenty-six boys and thirty-six girls). One adolescent was excluded because they did not identify as a boy or girl. Adolescents were selected as there is little research that has focused on this age group.

Assessment of food marketing exposures for marketing techniques

A content analysis of each participant's food and beverage marketing exposures was conducted to identify the presence of the marketing techniques described in Table 1.

Table 1 Marketing techniques descriptions and examples

Marketing technique	Description	Example
Presence of a character, superhero, cartoon, etc.	A cartoon, character, superhero, animal, creature, etc. (e.g. fictional or unspecified) is used to market the product.	Using batman to advertise string cheese.
Presence of an influencer	An influencer is considered a celebrity, popular vlogger and/or athlete that has the ability to influence others into buying a product.	Mr. Beast (an influencer) endorses Coca-Cola in his posts.
Presence of an influencer – Athlete	An athlete influencer is a subform of influencer marketing that uses an individual associated with sports to endorse or sell a product.	An athlete (e.g. Lebron James) is seen consuming or interacting with a food or beverage product (e.g. Lebron James shoots some hoops and then drinks a Gatorade).
Presence of an influencer – Celebrity	A celebrity is seen consuming or interacting with a food or beverage product.	Britney Spears is seen shooting a dance video and drinks a Pepsi afterwards.
Presence of an influencer – Vlogger	A vlogger (a person who regularly posts short videos to a vlog, like YouTube, is seen consuming or interacting with a food or beverage product).	PewDiePie is taping a streaming of himself playing online while eating M&M's.
Presence of a branded character	A branded character is a fictional/cartoon character that is defined by a set of human attributes and characteristics to give the brand a unique personality.	Tony the Tiger, Pillsbury Doughboy, etc.
Presence of a licensed character	A license character involves licensing the rights from the owner of the cartoon character to place images on a product. For example, Using Spiderman on a luncheables package	Spiderman is used to market a product.
Presence of adolescents	Adolescents are present in the advertisement either in the form of a cartoon or real-life actors.	Adolescents are clearly visible interacting with the product.
Depiction of the product as a character	A food or beverage product in the advertisement is either animated or talking.	Talking cupcake or dancing pretzel.
Presence of adults	Adults are present in the advertisement either in the form of a cartoon or real-life actors. Adults can also be depicted as parents.	Adults are clearly present interacting with the product.
Gender of dominant product user is a woman or girl	The main person in the advertisement is a woman or girl.	The main person interacting with the product (e.g. holding it, consuming it, etc.) is a woman or girl.
Gender of dominant product user is man or boy	The main person in the advertisement is a man or boy.	The main person interacting with the product (e.g. holding it, consuming it, etc.) is a man or boy.
Presence of multiple genders	The advertisement showcases both genders being present in the advertisement either consuming or interacting with the product.	Both man/boy and woman/girl are present in the ad.
Promotion of product palatability	The advertisement highlights the products palatability through descriptors like taste, smell, texture, etc.	Starbucks coffee that describes its roast as bold, subtly sweet and smooth.
Promotion of product novelty	The advertisement highlights the products uniqueness by indicating it is trendy or a limited edition.	Limited edition Oreos.
Unconventional product	The advertisement highlights the products unconventional shape, colour, taste or combination of those characteristics.	Bundt cake full of cheese.
Appeals to convenience	The advertisement highlights the products convenience by indicating that it is easy to make or pack.	'This trendy dessert is easier to make than you think'.
Appeals to affordability	The advertisement highlights the product's affordability by indicating its product price or value for money.	'$5 off any two chubby chicken burgers'.
Suggested users	The advertisement highlights suggested users for the product.	'This product is great for your active teenager'.
Promotion of product quality	The advertisement highlights the product's quality which can come in the form of its ingredients.	Tropicana – made with the freshest oranges.
Reference to energy	The advertisement specifically references how the product provides energy.	This product is great for energy or a quick pick-me-up.
Promotion of product desirability	The advertisement highlights the product's desirability.	'You can't live without it!'
Appeals to hunger/thirst satisfaction	The advertisement highlights the product's ability to satiate your hunger or quench your thirst.	Snickers commercial – 'you're not you when you're hungry'.
Appeals to joy	The advertisement highlights the product in a way that appeals to fun, playfulness, happiness, humour or pleasure.	M&M commercials use humour to advertise their product.
Appeals to fantasy	The advertisement highlights the product in a way that appeals to fantasy, imagination or adventure.	Products that come alive and animations.
Appeals to social enhancement	The advertisement highlights the product's ability to enhance making friends, peer acceptance or being social with others.	The Coca-Cola advertisement that features people giving friends Coke's with their names on them.
Appeals to achievement	The advertisement highlights the product's ability to help with achievement or accomplishment.	Mento's that show problem-solving or achievement because of consuming the product. Grey Poupon showing status or achievement.
Appeals to coolness	The advertisement uses people that exhibit cool or hipness to market a product.	Using an individual leaning up against a wall holding a McDonald's burger.
Appeals to athleticism	The advertisement highlights the products attributes to athleticism, referring to its ability to boost one's strength, speed or sports performance or features individual(s) doing athletic activities with the product.	People snowboarding while drinking Mountain Dew.
Appeals to sex	The advertisement includes aspects of romance, sex or sexuality to market a product.	Paris Hilton wearing a bikini while eating a Carl's Jr Burger.
Appeals to beauty	The advertisement includes aspects of beauty or attractiveness to market the product.	An influencer doing their make-up while consuming a drink or food product.
Appeals curiosity	The advertisement peeks a consumer's interest by stimulating curiosity or asking questions that leave the viewer wondering.	Dorito's 'what happens when you open these snacks?'
Appeals to healthfulness	The advertised product appeals to healthfulness.	Displays a product that is healthy, or how the product will affect your health.
Women are specifically referenced	The advertisement specifically mentions either in writing or verbally that the product is more appealing to women.	'This low-fat yogurt is great for any mom on the go'.
Men are specifically referenced	The advertisement specifically mentions either in writing or verbally that the product is more appealing to men.	'Are you man enough for this steak?'
Nutrition-related claims	The advertisement specifically references or showcases a nutrient claim.	Fat-free, low Na, etc.
Health appeal claims	The advertisement specifically references or showcases a health appeal claim.	References or showcases a health appeal claim such as health symbols (e.g. hearts, checks), it references 'natural/pure', promotion of improved health outcomes (e.g. growth, weight loss), depicting 'healthy' people.
Association with healthy foods	The product is advertised to be composed of healthy foods such as whole grains, fruits and vegetables, etc.	Tropicana orange juice using only real Florida oranges.
Eating information	Eating information is made clearly visible in the advertisement.	Serving suggestions, eating guidelines, etc.
Featuring or reference to health professionals, health institutions, etc.	The advertisement specifically references health professional or institutions when marketing the product.	Doctor approved, etc.
Reference to unhealthy eating	The advertisement references aspects of unhealthy eating.	This product is high in calories or sugar or fat, etc.
Visual effects	Visual effects are used to market the product.	Animations that are fast cutting, slow motion or dynamic images are used.
Graphic imagery	Graphic imagery is used to enhance the display of the product.	Bright colours, eye-catching backgrounds, etc.
Direct reference to and/or use of word 'teen(ager)'	The word or similar words to 'teenager' are used either verbally or visually to market the product.	'Great for teens, your teen will love it'.
Use of slang	Slang terms are used throughout the advertisement.	'Restaurants were too damn extra', 'treat yo self'.
Use of music	Music is used to market the product.	Songs, jingles, sound effects, etc.
Giveaways to be redeemed later	The product is advertised with an associated giveaway that can be redeemed later.	A contest, competition, coupon, special order items or product sample.
Price-related premiums	The product is advertised with a price-related premium or rebate.	A bonus offer or calls to action to encourage purchase.
Giveaways included with purchase	The product is advertised with a giveaway that is included with purchase.	Gifts, toys or collectibles (e.g. Happy Meals).
Other purchase incentives	The product is advertised with a purchase incentive.	Access to different areas of a website or the ability to move to a higher level of a game.
Presence of quizzes, surveys or polls	A quiz, survey or poll is included in the advertisement.	The viewer is provided two food options and is asked what product has more calories in the form of a poll.
Prompts to communicate with brand	The advertisement encourages further communication with the brand.	The viewer is encouraged to sign up for a newsletter, provide contact info, or an opportunity to communicate with a branded character.
Reference to entertainment	The advertisement ties in movies, TV, toys or pop culture references to market the product.	Danny Devito dressed up as an M&M for super bowl teaser.
Promotion of links	The advertisement includes links to the company or product website/apps.	Provides additional ways to access the product.
Promotion of links to other food/non-food websites	The advertisement promotes links to other foods or non-food websites within the advertisement.	Coca-Cola will link its other products within its coke ad.
Crossover with other brands	The advertisement displays or promotes other brands.	A tweet that says, 'You be my dairy queen and I'll be your burger king'.
Presence of a brand	The product logo or name and tagline is clearly displayed within the advertisement.	Tim Hortons – always fresh – is clearly displayed in the post.

These techniques were adapted from Mulligan *et al*. (2020)[19]. All food marketing exposures (*n* 139) and their marketing techniques were coded by a master coder. In this approach, one researcher (AA) served as the standard, while a second reviewer (MP) was used as a reliability coder. The reliability coder coded a subset of the total data set to establish inter-rater reliability with the master coder. In our study, the second reviewer (MP) coded a random 25 % sample[20]. Each reviewer identified the presence (or lack thereof) of marketing techniques for every food marketing exposure. The coding of marketing techniques between the two reviewers was compared, and inter-rater reliability was calculated using Cohen's κ. The overall inter-rater reliability was found to be 0·71. According to McHugh's (2012), 0·61–0·80 can be interpreted as having a substantial level of agreement[21].

Data analysis

Participants were classified as being exposed or not to elements of food marketing content (e.g. food category, PAHO classification, food marketing techniques, etc.). Descriptive statistics were then tabulated. Gender differences in the frequency and content of exposures were tested using a Mann–Whitney *U* test and Fisher's exact tests, as appropriate, on 2 × 2 tables. Data were analysed using IBM SPSS v.27.0., 2020[22].

Results

Overall, there were sixty-two participants (*n* 36 girls, *n* 26 boys) in this study. Those who identified as a girl accounted for 58 % of participants, with 53 % being 12 or 13 years old. Boys accounted for 42 % of participants, with 38 % being 15 years of age. As shown in Table 2, 65 % of all participants were White, and over half (52 %) were from households whose annual income was $100 000 or more. Instagram (47 %) followed by Snapchat (44 %) were the preferred social media apps for girls, whereas boys most frequently used Instagram (35 %), followed by YouTube (31 %).

Table 2 Sociodemographic characteristics and social media use of all participants (*n* 62)

	Boys (*n* 26)		Girls (*n* 36)		Total (*n* 62)	
	n	%*	*n*	%*	*n*	%*
Age (years)						
12	6	23	10	28	16	26
13	5	19	9	25	14	23
14	4	15	8	22	12	19
15	10	38	7	19	17	27
16	1	4	2	6	3	5
Race						
White	15	58	25	69	40	65
Other	11	42	11	31	22	35
Income†						
Less than $50 k	2	8	5	14	7	11
$50 k to less than $100 k	7	27	2	6	9	15
$100 k to less than $150 k	5	19	8	22	13	21
Over $150 k	5	19	14	39	19	31
Refuse to answer	7	27	7	19	14	23
Social media app use						
Facebook	4	15	1	3	5	8
Instagram	9	35	17	47	26	42
Snapchat	3	12	16	44	19	31
Twitter	1	4	2	6	3	5
YouTube	8	31	2	6	10	16

* Note that the sum of %'s do not add up to 100 due to rounding.
† Income before taxes and deductions.

Exposures to food marketing

Of the sixty-two participants in this study, forty-seven (76 %) were exposed to an instance of food and beverage marketing. The number of exposures viewed by participants did not differ significantly between boys and girls (median = 2 for boys and girls, respectively, Mann–Whitney $U = 237$, $P = 0{\cdot}51$) (data not shown). As shown in Table 3, the source of food marketing exposure viewed most by participants was food advertisements (50 %) followed by food marketing embedded in other web content (40 %). More boys viewed food advertising (54 % *v*. 47 %) and celebrity-generated content (15 % *v*. 6 %) compared to girls, whereas a greater share of girls viewed instances of food marketing embedded in other web content (47 % *v*. 31 %) compared to boys. Gender differences in exposure to food marketing sources were not statistically significant.

Table 3 Participant's exposure source to food marketing in 10 min of social media use, by gender

	Boys (*n* 26)		Girls (*n* 36)		Total (*n* 62)		Fisher's exact test
Type of food marketing	*n*	%	*n*	%	*n*	%	*P*-value
Food advertisements	14	54	17	47	31	50	0·8
Celebrity-generated content	4	15	2	6	6	10	0·23
Food marketing embedded in other web content	8	31	17	47	25	40	0·29

Food categories

As shown in Table 4, the food categories most viewed by participants were fast foods (50 % of participants), cakes, cookies, and ice cream (19 %), sugar-sweetened beverages (19 %) and candy and chocolate (16 %). Half (50 %) of all boys viewed instances of marketing promoting fast foods, followed by sugar-sweetened beverages (27 %), non-fast-food restaurants (12 %) and condiments (12 %), while half of girls (50 %) viewed instances of marketing promoting fast foods, followed by cakes, cookies, and ice cream (28 %), candy and chocolate (22 %), and snacks (17 %). Gender differences in exposure to food categories were not statistically significant.

Table 4 Participants exposures to food categories in 10 min of social media use, by gender

	Boys (*n* 26)		Girls (*n* 36)		Total (*n* 62)		Fisher's exact test
Food categories	*n*	%*	*n*	%*	*n*	%*	*P*-value
Fast-food restaurants	13	50	18	50	31	50	1
Cakes, cookies and ice cream	2	8	10	28	12	19	0·06
Sugar-sweetened beverages	7	27	5	14	12	19	0·5
Candy and chocolate	2	8	8	22	10	16	0·17
Snacks	1	4	6	17	7	11	0·22
Non fast-food restaurants	3	12	4	11	7	11	1
Condiments	3	12	2	6	5	8	0·64
100 % fruit juice	2	8	1	3	3	5	0·57
Grocery store items	2	8	0	0	2	3	–
Cold cereal	1	4	0	0	1	2	–
Hot beverages	1	4	0	0	1	2	–
Cheese	1	4	0	0	1	2	–
Other†	4	15	4	11	8	13	0·71

* It is possible for more than one food item to be present in a single ad; therefore, percentages will be higher than 100.
† Items not categorised in the above, such as beef broth.

Healthfulness

As shown in Fig. 1, 64 % of girls viewed instances of food marketing exposures containing ultra-processed food items compared with 50 % of boys, whereas 27 % of boys viewed instances of minimally processed/processed items compared with 17 % of girls. Gender differences in exposure to food healthfulness were not statistically significant.

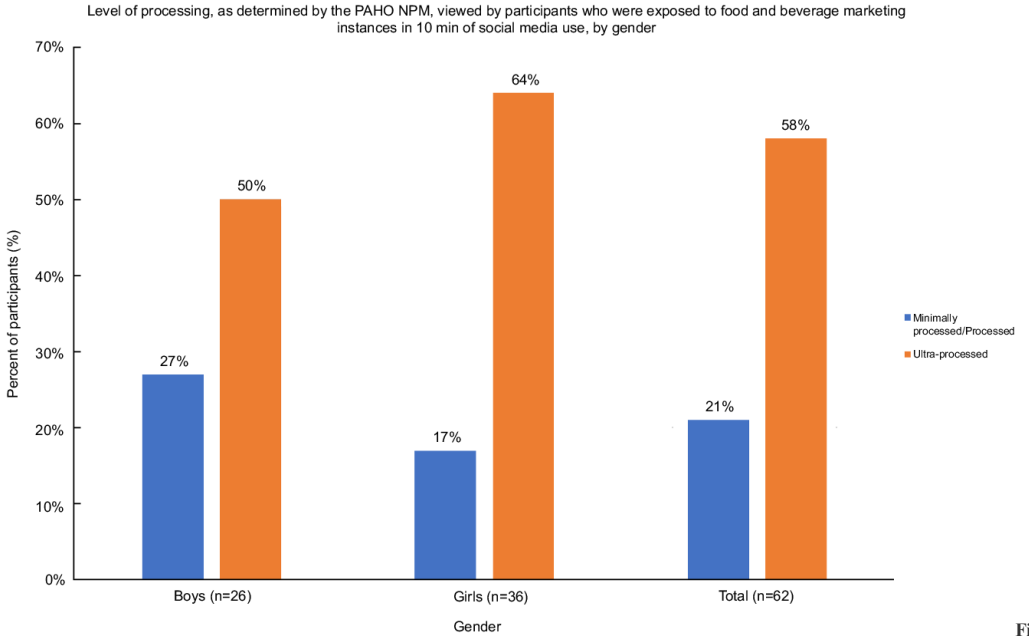

Fig. 1 Percentage of participants exposed to products classified as minimally processed/processed and ultra-processed, as determined by the PAHO NPM, in instances of food marketing viewed during 10 min of social media use, by gender

Over half of participants (63 %) viewed products that contained excessive amounts of at least one nutrient. As shown in Table 5, 53 % of participants viewed instances of marketing containing total fat, followed by saturated fat (52 %) and free sugars (44 %). More girls viewed products that were excessive in total fat compared to boys (67 % *v.* 35 %, $P = 0{\cdot}02$). Overall, girls were more likely to view marketing instances containing greater amounts of each nutrient compared to boys. With the exception of total fat, none were found to be statistically significant.

Table 5 Participants exposure to healthfulness of products, as determined by the PAHO NPM, viewed by participants in 10 min of social media use, by gender

	Boys (*n* 26)		Girls (*n* 36)		Total (*n* 62)		Fisher's exact test
PAHO nutrient profiling	*n*	%	*n*	%	*n*	%	*P*-value
Excessive in total fat	9	35	24	67	33	53	0·02
Excessive in saturated fat	11	42	21	58	32	52	0·3
Excessive in trans-fat	5	19	8	22	13	21	1
Excessive in Na	10	38	16	44	26	42	0·8
Excessive in free sugars	11	42	16	44	27	44	1
Excessive in at least one nutrient	14	54	25	69	39	63	0·29

Marketing techniques

As demonstrated in Table 6, overall, the presence of a brand (68 % of participants), graphic imagery (56 %) and appeals to joy (53 %) were the most viewed marketing techniques by all participants. Boys were significantly more likely to view instances of food marketing where the gender of the dominant product user was a man or boy (50 % *v*. 22 %, $P = 0{\cdot}03$), exposures appealed to achievement (42 % *v*. 17 %, $P = 0{\cdot}04$) or athleticism (35 % *v*. 11 %, $P = 0{\cdot}03$), and exposures featured an influencer (42 % *v*. 14 %, $P = 0{\cdot}02$). Girls were significantly more likely to view instances of food marketing featuring quizzes, surveys or polls (25 % *v*. 0 %, $P = 0{\cdot}01$).

Table 6 *Participant exposures to marketing techniques in 10 min of social media use, by gender

	Boys (*n* 26)		Girls (*n* 36)		Total (*n* 62)		Fisher's exact test
Marketing techniques	*n*	%†	*n*	%†	*n*	%†	*P*-value
Presence of a brand	18	69	24	67	42	68	1
Graphic imagery	14	54	21	58	35	56	0·8
Appeals to joy	14	54	19	53	33	53	1
Appeals to hunger/thirst satisfaction	10	38	22	61	32	52	0·12
Presence of adults	14	54	15	42	29	47	0·44
Appeals to coolness	12	46	14	39	26	42	0·61
Visual effects	8	31	18	50	26	42	0·19
Appeals to social enhancement	12	46	13	36	25	40	0·45
Gender of dominant product user is man or boy	13	50	8	22	21	34	0·03
Promotion of product novelty	7	27	10	28	17	27	1
Promotion of product desirability	5	19	12	33	17	27	0·26
Appeals to achievement	11	42	6	17	17	27	0·04
Appeals to curiosity	7	27	10	28	17	27	1
Crossover with other brands	6	23	11	31	17	27	0·58
Presence of an influencer	11	42	5	14	16	26	0·02
Gender of dominant product user is a woman or girl	4	15	12	33	16	26	0·15
Appeals to healthfulness	6	23	10	28	16	26	0·77
Reference to unhealthy eating	6	23	9	25	15	24	1
Presence of a character, superhero and cartoon	3	12	10	28	13	21	0·21
Unconventional product	3	12	10	28	13	21	0·21
Appeals to athleticism	9	35	4	11	13	21	0·03
Promotion of product palatability	3	12	9	25	12	19	0·21
Use of slang	3	12	8	22	11	18	0·33
Promotion of links	6	23	5	14	11	18	0·5
Association with healthy foods	4	15	6	17	10	16	1
Presence of an influencer – Celebrity	6	23	3	8	9	15	0·15
Presence of quizzes, surveys or polls	0	0	9	25	9	15	0·01
Presence of multiple genders	3	12	5	14	8	13	1
Appeals to sex	3	12	5	14	8	13	1
Promotion of product quality	4	15	3	8	7	11	0·44
Reference to entertainment	3	12	4	11	7	11	1
Presence of an influencer – Athlete	5	19	1	3	6	10	0·07
Appeals to affordability	3	12	3	8	6	10	0·69
Appeals to fantasy	1	4	5	14	6	10	0·39
Depiction of the product as a character	1	4	4	11	5	8	0·39
Appeals to convenience	1	4	4	11	5	8	0·39
Nutrition-related claims	2	8	2	6	4	6	1
Use of music	2	8	2	6	4	6	1
Giveaways to be redeemed later	3	12	1	3	4	6	0·3
Presence of an influencer – Vlogger	2	8	1	3	3	5	0·57
Presence of adolescents	1	4	2	6	3	5	1
Suggested users	1	4	2	6	3	5	1
Appeals to beauty	1	4	2	6	3	5	1
Health appeal claims	1	4	2	6	3	5	1
Eating information	0	0	2	6	2	3	–
Other purchase incentives	0	0	2	6	2	3	–
Promotion of links to other food/non-food websites	0	0	2	6	2	3	–
Presence of a licensed character	1	4	0	0	1	2	–
Reference to energy	1	4	0	0	1	2	–
Price-related premiums	1	4	0	0	1	2	–
Prompts to communicate with brand	1	4	0	0	1	2	–

* Any technique not listed above was not viewed within an exposure by participants.† It is possible for more than one technique to be present in a single ad; therefore, percentages will be higher than 100.

Discussion

This study provides preliminary insights into the content adolescent boys and girls viewed on their two favourite social media apps according to source of marketing exposure, the healthfulness and food category of viewed food products, and marketing techniques. As hypothesised, marketing techniques used to promote food and beverages differed by gender. Our results also suggest that gender differences may exist with respect to healthfulness of promoted foods.

Differences in food categories

Fast foods were the most frequently viewed food category in our study, with half of participants having viewed a food marketing instance containing a fast-food item. This is to be expected, as fast foods are regularly one of the most marketed food products to adolescents, highlighting a universal pattern[10,11,23,24] . The ubiquity of fast-food marketing is problematic as there is a demonstrated relationship between marketing exposures, food choice and increased consumption of unhealthy foods after social media use[25]. The volume of online fast-food marketing is concerning as excessive consumption of these items are associated with an increased risk of obesity, CVD and diabetes[26].

Differences in healthfullness

The results of our content analysis also revealed that 64 % of girls viewed marketing exposures that contained ultra-processed foods. Like this study, a small, exploratory study examining the food messages Flemish adolescents were exposed to on social media found that ultra-processed foods, such as fast foods, made up 67 % of the messages they viewed[27]. Food items that are ultra-processed have low nutritional quality, are highly palatable and typically require little culinary preparation making them convenient and appealing to adolescents[26]. In 2015, nearly 50 % of daily caloric intake for Canadian females aged 13–18 years and 53 % of daily caloric intake for males aged 13–18 years were composed of ultra-processed foods[28].

Marketing is powerfully influential in not only reflecting norms and gender perceptions, but in shaping them[29]. Social and cultural norms are a key component in the formation of food preferences[30] and as youth seek independence from family and conform to the norms of their surroundings, including what is viewed on social media, they are at risk of adopting unfavourable health behaviours, such as the excessive consumption of ultra-processed foods. The frequency at which food marketing is displayed can create normative views regarding diet[27]. High frequencies of marketing containing ultra-processed foods can easily influence attitudes about diet and eating behaviours. Food and beverage companies may be using marketing techniques that are more appealing to girls and women in attempts to increase consumption of ultra-processed foods to a group that is traditionally health conscious[31]. This type of targeting may be an effort to rewrite existing social norms where girls are more concerned with dieting and weight loss by exposing them to greater amounts of unhealthy food in attempts to increase consumption.

The emerging picture of digital marketing is one of an environment that heavily promotes and normalises the overconsumption of ultra-processed food[27]. For this reason, it is imperative that researchers explore the methods that companies use to target consumers based on gender to develop specific food marketing restrictions. Although the diets of women and girls have historically been healthier[32] as they are generally more health conscious than boys, the propagation of ultra-processed food products through social media could be shaping a new reality. If continued unabated, digital

marketers may rewrite the norms of dietary habits for young girls, resulting in an increase of obesity and other chronic disease rates.

Gender differences in exposure to various marketing techniques

One of the most significant findings of this study was that exposures to marketing techniques, as hypothesised, differed by gender. An interesting result was that boys viewed food marketing instances where the dominant product user was a man or boy. These findings are congruent from Ogle *et al.*'s experimental study where they found children preferred food products where the packaging depicted a licensed cartoon character that represented their gender[33]. Using gender and gender stereotypes creates relatability, which helps establish a sense of connection to the product, translating into increased awareness and sales[34]. A study conducted by Higgins *et al.* (2018) concluded that advertising campaigns that used age and gender data were able to achieve statistically significant boosts in engagement by using gender-specific marketing strategies[35]. This suggests that the use of gender in marketing is deliberate and can be used to entice a viewer based on their gender and is evidence of individualised, gender-specific, curated marketing. Further, evidence from alcohol and tobacco studies suggests that people can be influenced by marketing that models qualities, such as gender, that consumers find relatable[36,37] . When an adolescent positively identifies with the person promoting a food product, an individual's gender in this case, their food choices and consumption habits favour the product regardless of healthfulness[11]. Taking a page from tobacco and alcohol, food marketers, therefore, could be leveraging existing sex and/or gender differences to impact behaviour, resulting in the reinforcement of sex-/gender-based differences and deepening sex-/gender-based preferences for particular foods[32].

Our study also found that boys were significantly more likely to view instances of food marketing that featured appeals to achievement and athleticism and include the presence of an influencer. Achievement, athleticism and the utilisation of masculinity were themes uncovered in a study that explored how sugar-sweetened beverages were marketed to Australian youth through branded Facebook pages[39]. Showcasing achievement and athleticism in food and beverage marketing strategically aligns a product within sociocultural values and practices found important to the male demographic[39]. In doing so, food and beverage companies portray their products as having a regular place within the consumers' everyday life. This type of manipulation is concerning given the impressionable nature of adolescents[11] and the associations that can be developed between male stereotypes and unhealthy food.

Influencers, including athletes and celebrities, are often used to market products[7]. A study that investigated pre-adolescent children's responses to child-oriented front-of-pack food promotions found that sports celebrity endorsements of unhealthy food products persuaded participants preferences for those items over healthy food or non-food options[40]. Boys favoured packages that focused on athletics, which traditionally demonstrates stereotypical masculine characteristics like athleticism and strength[38,40] . Using an influencer, like a famous athlete, to market food and beverages also creates the added appeal of achievement, which can result in the viewer forming an association between consuming the product and being successful. Using influencers like sports figures to market unhealthy food and beverages can create a 'health halo', deceiving adolescents into false impressions of these items being healthy[41]. These findings are troubling as celebrities and influencers were found to promote unhealthy foods significantly more often than healthy foods[11].

Conversely, a significantly greater proportion of girls viewed food marketing exposures that used polls, surveys or questionnaires. This could be due to the platforms used by this study's participants, as polls, surveys and questionnaires are often found on Snapchat Discover[42]. Research supports that there is a difference in how females and males respond to online surveys[43]. Gender can shape behaviour with females being more likely to engage in online activity characterised by communication and exchanging of information (surveys), whereas males are more likely to engage in online activity characterised by seeking information[44]. Companies may use the tactic of surveys, polls and questionnaires as hooks to entice women to interact with their products. Young women interacting with food and beverage company surveys, polls and questionnaires may be less aware of the promotional intent of the marketing as it is being veiled as interactive content[44]. Further, adolescents who are more engaged with online content are more likely to share and create similar content of their own, which can reinforce and/or establish food and diet social norms[7].

Targeted marketing

Half of all participants in this study were exposed to food advertisements. Digital marketing creates unique challenges in restricting youth's exposure to unhealthy foods. Unlike television, each social media user views a different set of food marketing instances depending on their food preferences and previous interactions with a brand or other content[45]. Research conducted by the *UConn Rudd Center for Food Policy and Obesity* in 2019 documented the increasing amount of unhealthy food advertising that targets Hispanic and Black youths[46]. The report highlighted that multicultural food marketing, marketing that is designed to appeal to individuals of different racial and/or ethnic groups, continues to disproportionately target youth of colour and contributes to health disparities affecting these populations, the impetus of which should be applied to gender. Multicultural targeting raises public health concerns and perpetuates negative diet-related health disparities affecting ethnic populations[46] . Conclusions drawn from multicultural food marketing and results from our research highlight the importance of evaluating how companies and affiliates are targeting specific demographics, potentially perpetuating health disparities.

The marketing of other commodities, such as tobacco and alcohol, have regularly and successfully used gender-targeted marketing. Alcohol and tobacco companies have long been attracting new consumers by developing marketing strategies that exploit gender norms and stereotypes[36]. For example, the tobacco industry put in a concerted effort towards increasing the female consumer base by creating advertisements that use beauty to draw women's attention[36]. Slim cigarettes advertised as feminine are one example of this approach. Alcohol advertisements have used targeted segmentation, which is a strategy used for isolating gender differences to make advertisements more appealing to an intended audience[37]. Examples of segmentation techniques include using imagery and emotional connections, which have been shown to effect men and women differently[37]. Being cognizant of targeting strategies that utilise gender stereotypes is important for informing polices that are protective of the targeted audience.

Food products become gendered as a result of marketing strategies that are tailored towards a specific gender. Branding and promotional techniques are utilised in a way where a product essentially becomes 'food for boys' or 'food for girls'. Overall, a greater share of boys in this study viewed instances of targeted marketing techniques, compared with girls. An explanation for these observed differences might be the proportion of males used in marketing, and that marketing tends to focus on boys because they are more susceptible to food advertisements[47].

Our study suggests that gender differences may be playing a role in the design of marketing strategies, which could be leading to the perpetuation of unhealthy eating behaviours, creating gender disparities in food choices and overall health. Gender bias may exist, underscoring the need for solutions and future research that emphasise the role gender plays in food marketing. Additional research that directly tests promotional strategies designed to elicit gendered engagement would allow for more conclusive results and would eliminate attentional or consumption bias.

Strengths and limitations

To our knowledge, this is the first study that examines the digital marketing techniques adolescents viewed, according to their gender. Given the exploratory nature of this research, there are several limitations. Participants' exposure to food marketing on their favourite social media sites were only captured over a 10-min period. The short duration of the viewing time is not representative of the average viewing time adolescents spend on social media applications. Further, newer social media apps like TikTok and Twitch were not captured in this study but have been shown to impact attitudes and behaviours in relation to food and beverage marketing[48]. Additionally, this study only included a small convenience sample of participants, where 65 % of participants were White, and over half were from households whose annual income was $100 000 or more. Participants were also only recruited from Ottawa, and as a result, findings may not be generalisable to the Canadian population. This study did not consider confounding variables, and as such observed differences between gender groups could be attributable to other factors such as differences in age. Lastly, the full scope of marketing exposures including both food and non-food marketing instances was not captured. Insights into the proportion of digital food and beverage content adolescents are exposed to compared with non-food content would provide a more fulsome picture of the online food environment.

Despite this, the results of our research provide preliminary insights into gender targeting being used to digitally market unhealthy food and beverage products to adolescents. Awareness of these differences is important for understanding food choices and subsequent health differences between boys and girls. The results of this study can provide insights into programmes and policies that protect adolescents of different genders from targeted marketing techniques. Determining how to better identify gender-specific marketing appeals will allow for the monitoring of message content that can inform regulatory policies on food marketing to adolescents. Given the paucity of research that explores digital food and beverage gender-based marketing techniques directed at adolescents, a broad range of research is required. Future research would benefit from using a larger sample size and investigating how adolescents, based on gender, perceive the food marketing exposures they are engaging with over social media applications. This exploration would provide valuable insights into how adolescents personally interact with food and beverage companies, helping draft regulations that are informed by those most impacted.

Conclusion

To address the growing obesity epidemic, the World Health Organisation (WHO) recommends restricting unhealthy food advertising to youth, compelling states to implement policies and regulations that limit child and adolescent's exposure to the marketing of unhealthy, nutrient-poor foods[49]. Stringent regulation is needed to address the persuasive tactics used by food and beverage companies that target adolescents and children. Just as marketing is most effective when it targets specific groups or individuals, so too is the creation of public health policies and regulations. Gender

is a determinant of health and therefore must be considered in digital food and beverage marketing research and future policies that address obesogenic environments.

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Conflicts of interest:

There are no conflicts of interest.

Supplementary material

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Study 2: Examining Gender Differences in Adolescent Exposure to Food and Beverage Marketing Through Go-along Interviews

Approach

The second study, *Examining Gender Differences in Adolescent Exposure to Food and Beverage Marketing Through Go-along Interviews,* used findings from the first study to populate interview questions (see Appendix A). Using a qualitative approach, this study asked adolescents to provide their perspectives and understandings of digital food marketing, particularly exploring the impact of gender as they navigated their social media feeds. The significance of this research lies in its approach. Go-along interviews allowed for the real-time capture of adolescents engaging with food related posts on their social media providing a more authentic understanding of how digital food marketing impacts their food perceptions, choices, and behaviours.

As social norms for adolescents continue to evolve, the influence of digital marketing remains significant. Investigating adolescent perspectives of food marketing from a gender standpoint not only illustrates a crucial aspect of adolescent health but also provides insights into marketing techniques, informs public health initiatives and policy, and empowers adolescents to recognize online influences that may impact their dietary habits. Moreover, this study contributes to the broader literature on gender and marketing by offering a qualitative exploration of gender differences in digital food marketing exposure, complementing existing quantitative research in the field.

Author’s Contribution

My contribution to this research included conceptualizing the research question and methodology, creating the interview questions, conducting the interviews, transcribing the interviews, analyzing, and validating the data, and drafting the manuscript.

Knowledge Translation

This research was published in *Appetite* in 2024 and a lay summary was provided to all participants in the study.

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Appetite

Examining gender differences in adolescent exposure to food and beverage marketing through go-along interviews

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ABSTRACT

This study explores how adolescents engage with unhealthy food and beverage marketing in online settings, from a gender perspective. Employing an online ethnography approach and using go-along interviews, we explored the experiences of adolescent boys and girls aged 13–17 as they navigated their online experiences with digital food and beverage marketing. Notable themes emerged, including the identification of predatory actions by food companies, the role of protective factors such as family, and the influence of social media influencers in shaping adolescent dietary preferences. Importantly, this research unearthed gender disparities in the participants' responses. Girls, in particular, exhibited a heightened awareness of the protective role played by their families, emphasized the influence of color in marketing strategies, recognized the significance of gender in marketing, and reported exposure to alcohol advertisements—findings that boys less frequently echoed. The study underscores the importance of adolescence as a critical phase in development, during which food companies target these impressionable individuals, driven by their independence and potential for brand loyalty. Moreover, it highlights the potential avenue of gender-specific marketing, offering valuable insights into the gendered dimensions of adolescents' food marketing experiences. By examining the interplay between digital food marketing and gender, this research addresses a critical gap in the literature, shedding light on how gender influences adolescents' perceptions, responses, and behaviours in the context of food marketing strategies. These findings have the potential to inform adolescents of the marketing techniques that target them and guide policymakers in developing and implementing evidence-based regulations aimed at safeguarding adolescents from exposure to unhealthy food marketing.

1. Introduction

The food environment is composed of a myriad of factors that can shape food choices and health outcomes (Swinburn et al., 2013). The digital marketing of unhealthy food and beverages (henceforth

known collectively as 'food') is a component of the food environment that can influence the dietary patterns of adolescents (Boyland et al., 2020).

Research has consistently demonstrated that exposure to food marketing directly affects adolescents' dietary behaviours by influencing their food preferences, immediate food intake, and food purchases (Boyland et al., 2022; Critchlow et al., 2020; Qutteina, De Backer, & Smits, 2019). Marketed foods are predominantly energy dense and nutrient poor, containing excessive levels of added salt, sugar, and/or saturated fat (Truman & Elliott, 2019). The marketing of these foods has been linked to obesity and other chronic diseases (Lane et al., 2021). Obesity amongst adolescents remains a public health concern in Canada and worldwide (GBD 2017 Diet Collaborators, 2019).

The dietary patterns of Canadian adolescents need improvement. The most recent Canadian data indicates that in 2015, ultra-processed foods accounted for roughly 50% of children and adolescents' diets, with males consuming slightly more than females (Polsky, Moubarac, & Garriguet, 2020). Ultra-processed foods are appealing to youth, as they are convenient, cheap, and highly palatable (Vandevijvere et al., 2019). The characteristics of these foods, coupled with attractive packaging and extensive marketing, are a contributing factor to youths' consumption of these foods (Boyland et al., 2022). This is worrisome, as dietary patterns developed in childhood can impact long-term health outcomes such as the development of chronic diseases and psychosocial problems (e.g., poor self esteem and body-image) (Rao et al., 2020).

The potential for exposure to food marketing is high amongst adolescents, particularly on digital media as they use digital devices such as smartphones, tablets, laptops, and computers regularly. In Canada, 93% of adolescents aged 14–17 own a smartphone (MediaSmarts, 2022) and adolescents aged 14–15 spend up to 3 hours or more a day on digital devices (Brisson-Boivin, 2018). Food companies dedicate significant portions of their marketing budgets to target adolescents, due to their high screen use, flexibility to make their own purchases, and increased agency over their decisions (Potvin Kent, Pauz´e, et al., 2023; van der Bend, Jakstas, van Kleef, Shrewsbury, & Bucher, 2022). The possibility of developing lifelong brand loyalty is another factor motivating the food industry to target adolescents (Lutfeali et al., 2020). While factors influencing dietary decisions are multifaceted and complex, individuals across diverse gender identities may develop varying dietary patterns due to their social media use and resultant exposures to food marketing. Unfortunately, data are not currently available for all genders, such as those identifying as non-binary, underscoring the need for increased attention to gender diverse experiences. Data on digital use has been published for binary populations. For instance, Canadian boys in grades 7–11 use Discord (instant messaging app) (22% vs 13%) and Twitch (21% vs 8%) more often than girls. On the other hand, TikTok, Instagram, and Snapchat are more popular among girls than boys (61% vs 46%; 57% vs 44%; 45% vs 35%, respectively) (MediaSmarts, 2022).

Gender, a social construct and social determinant of health, can produce and reinforce protective or detrimental behaviours as well as social and cultural norms, all of which can influence diet (Spencer, Rehman, & Kirk, 2015). Gender encompasses the socially constructed roles, behaviours, and identities of men, women, and gender-diverse people. It plays a role in shaping self-perceptions, interactions, and the distribution of power and resources within society. While commonly misconceived as a binary concept (man/woman), gender exists along a spectrum, incorporating a diverse range of identities and expressions through which individuals define and express their gender (Heidari, Babor, De Castro, Tort, & Curno, 2016). Conversely, sex is biological and is primarily attributed to physical and physiological features including chromosomes and reproductive anatomy (CIHR, 2023). Given the frequency at which adolescents use their digital devices and social media, and that gender differences exist in social media

use and dietary patterns, it is imperative to examine the exposure and effect of digital marketing of unhealthy foods through a gender lens.

Though a growing body of research has examined adolescent exposure to food marketing (Bragg, Lutfeali, Greene, Osterman, & Dalton, 2021; Elliott, Truman, & Aponte-Hao, 2022; Fleming-Milici & Harris, 2020; Kidd, Mackay, Swinburn, Lutteroth, & Vandevijvere, 2021; Potvin Kent, Pauz´e, Roy, de Billy, & Czoli, 2019; Qutteina, Hallez, Mennes, De Backer, & Smits, 2019) very little research uses a qualitative analysis or explores gender differences. A recent scoping review examining the impacts of food marketing and gender on children and adolescents found that gender based differences exist when it comes to responses to specific marketing, perceptions and attitudes towards food marketing, exposure to food marketing advertising, and gender marketing content (Castronuovo, Guarnieri, Tiscornia, & Allemandi, 2021). Though comprehensive, this review did not account for adolescent experiences, was primarily focused on televised food advertising, and noted that many of the reviewed studies conflated sex with gender and excluded the potential exploration of other gender identities (Castronuovo et al., 2021). Another study examining whether adolescent exposure to digital food marketing differed by gender indicated that boys were more likely to view instances of food marketing that featured a male as the dominant product user, appeals to achievement or athleticism, or included an influencer whereas girls were more likely to view marketing that contained quizzes, surveys, or polls (Amson, Pauz´e, Remedios, Pritchard, & Potvin Kent, 2023). This pilot study examined adolescent exposure to food marketing considering gender, but it did not account for adolescent insights (Amson et al., 2023).
Qualitative studies that investigate adolescent's social media habits with respect to food marketing incorporating a gendered perspective, remain limited. Given this gap, this qualitative, exploratory study was undertaken to understand how adolescents interact with and are impacted by the food marketing they view on their social media accounts and whether gender plays a role in this interaction and/or influence. This research aimed to answer the following question - does gender influence the way adolescents interpret and engage with digital marketing messages for unhealthy foods.

Methods

2.1. Positionality statement

The researcher (AA), a cisgender female and PhD candidate, presents this positionality statement to contextualize her role. With previous experience in qualitative interviews, focusing on First Nation elders and dementia, and a background in teaching and coaching adolescents, she brings a unique perspective. While her direct experience in gender- related research is limited, her interest stems from curiosity about how social media algorithms tailor information, anticipating gender- based differences in exposure to food and beverage marketing. She openly acknowledges her experiences as a cisgender female may influence interpretations and understanding of gender dynamics, committing to an inclusive mindset in this research. This positionality statement serves as a transparent declaration of her background, experiences, and potential influences in the research process. She was dedicated to conducting this study with sensitivity, ethical rigor, and a commitment to understanding the nuances of gender dynamics as they relate to social media and food exposure.

2.2. Study design

In this study, an online ethnography approach was used. Online ethnography, a qualitative approach that collects data from virtual communities, is used to observe and analyze specific people and technologies (Skågeby, 2011). Go-along interviews, a hybrid of participant observation and interviewing, were used to investigate adolescents' perspectives and exposures to the digital marketing of unhealthy foods. Go-along

interviews are an interactive approach to collecting contextualized perspectives in which the participant acts as a navigational guide to their virtual experiences (Garcia, Eisenberg, Frerich, Lechner, & Lust, 2012). The meaning that participants ascribe to their online content provides first-hand insights into the processes by which youth engage with, and are engaged by, food marketing on social media. These interviews allowed the researcher to actively explore participants' online experiences while they scrolled through their chosen social media account(s), elaborating on food marketing exposures. This study was approved by the University of Ottawa's Health Sciences and Science Research Ethics Board H-09-21-6152.

2.3. Recruitment and participants

Convenience sampling was used to recruit $N = 16$ adolescent participants, ($n = 8$ who identified as a boy and $n = 8$ who identified as a girl). Participants were recruited between January and June 2022 through social media posts of the lead researcher's social media accounts (Facebook and Instagram) and more broadly through Reddit, as well as by word of mouth. Social media was used for recruiting as it has the widest reach. There were difficulties recruiting participants through social media either due to a lack of interest or time, or lack of reach through the lead researcher's personal social media accounts, so snowball sampling, whereby participants can recruit their friends or other research participants, was also encouraged by the researcher at the end of the interview process. Attempts were made to recruit those who identified along the gender spectrum (e.g., non-binary, transgender, etc.), but we were unsuccessful due to a lack of participant interest. These attempts included requesting the Canadian Center for Gender and Sexual Diversity and the Pride Center of Edmonton to include this research study in their newsletter and display a research poster in their centers. Individuals were eligible to participate if they met the following criteria: (a) were between the ages of 13–17; (b) were able to read, speak, and understand English; (c) owned a smartphone (Android, Apple, Google, etc.); (d) had access to a laptop, a tablet or desktop computer; (e) had a social media account (Facebook, Twitter, Snapchat, Instagram, TikTok, etc.); (f) lived in Canada; and (g) had a parent or guardian's and participants signed permission to participate.

2.4. Procedure

The purpose of the study was outlined to participants notifying them that the researcher was interested to explore if youth of different genders interact and engage differently with unhealthy food and beverage marketing in online settings. Participants expressed their interest by contacting the researcher via email. Those who emailed were asked for a parent or guardian's email. A follow up email was sent to both the parent or guardian and participant detailing the study objectives and procedures. The email also included a consent and assent form. Participants and their parents or guardians were notified that to proceed with an interview, both parent or guardian and participant's signatures were required. Once signed, the participant was asked to complete a brief questionnaire. Items included in the questionnaire were: province of residence, age, sex, gender identity, race and ethnicity, and approximate household income. After receiving signed consent and assent forms, the next step was the interview.

Online interviews were held over Zoom. Online interviews were chosen to adhere to COVID-19 restrictions and to accommodate those not in the same province as the researcher. At the start of the interview, the participant received a reminder of the purpose of the study and process, was requested their verbal consent, was assured confidentiality, that their participation was voluntary, and that they could withdraw at any time without consequences. Participants were then asked to cast their phone screen onto their computer and share their screen over Zoom. This allowed the researcher to be involved as participants navigated their smartphones and described the images, favoured sites, texts and/or videos of

branded food they encountered while online. While casting, participants were notified that the interview process would begin.

A semi-structured interview guide was developed using constructs from Montgomery et al.'s *Food Marketing in the Digital Age* conceptual framework (Montgomery & Chester, 2009). Montgomery et al.'s framework uses six concepts; however, this study focused on three including engagement (the participatory nature of interactive media such as social media), user-generated content (whereby a consumer creates and distributes brand-related content), and personalization (digital marketers create personalized marketing through ongoing data collection and tracking) as guiding principles. The constructs of ubiquitous connectivity, social graph, and immersive environments were not incorporated as they pertain to more of the online environment as opposed to the individual. Gender is not incorporated within these constructs. Instead, gender specific questions were asked during the interview. A total of 17 open-ended questions were asked (see Supplemental Material). The interview questions revolved around the participant's perception of digital marketing techniques and of promoted foods; whether the individuals promoting the foods influenced them; and the participant's perception of the commercial intentions behind these various forms of food marketing, while considering gender. Cues and probing questions were also used to clarify and gain additional information where the researcher felt appropriate. As proposed by Fook and Gardner, hand-written notes were made at the end of each interview to record the researcher's thoughts and overall impressions of the interview and whether questions should be asked differently for better clarity (Fook & Gardner, 2007). Interviews lasted between 20 and 40 min. Each participant was compensated with a $20 gift card of their choice.

2.5. Data analysis

All interviews were recorded and transcribed using the Zoom platform. A video recording of the participants' exploration of their social media accounts, while also capturing their discussion was documented. After each recording, a transcript was generated by Zoom. The lead researcher (AA) reviewed the transcript while watching the video to ensure accuracy. Transcripts were analyzed thematically by one researcher (AA), and real-time screen capture of participants' smartphone activity was reviewed to aid in the analysis. A second researcher (EP) coded a subset of interview transcripts and discussed potential codes for consideration. The analysis followed the guidelines developed by Braun and Clarke (Braun & Clarke, 2021). The process of analysis began with data familiarisation, whereby the primary researcher (AA) listened to audio recordings of each interview. After transcription, NVivo version 12 (Lumivero, 2017) was used to organize the data. Initial codes were developed inductively by the lead researcher (AA) and continuously refined while analysing each transcript. Similar concepts were clustered into one main code and all codes were analyzed and broadly placed into subsequent themes. Each theme was then reviewed and refined, ensuring each theme contained a coherent pattern, supported by coded data. Themes were then defined and described with consideration to the research question, the degree of overlap and relationships with other themes. To ensure integrity and consistency of themes, a second researcher (EP) discussed and reviewed a selection of codes and themes.

Results

3.1. Sociodemographic

Table 1 presents each participants sociodemographic information.
Overall, there were $N = 16$ participants ($n = 8$ boys, $n = 8$ girls) aged 13–17, who were interviewed. Most participants were 15 years old (43.75%), White (68.75%), and their annual household income was $150,000 or more (43.75%). Participants primarily resided in Ontario (56%).

3.2. Go-along interview themes

Go-along interviews provided insights into how adolescents perceived digital food marketing on social media. Major themes that emerged from the data were: (i) predatory marketing practices, (ii) possible moderating or protective factors, (iii) types of engagement, and (iv) marketing technique identification. Examples of quotes for each theme are below.

Table 1
Sociodemographic information of study participants (N = 16).

Variable	Boys *n* (%)	Girls *n* (%)	Total *n* (%)
Age (years) 13			
	0	1 (12.5)	1 (6.25)
14	0	2 (25)	2 (12.5)
15	4 (50)	3 (37.5)	7 (43.75)
16	2 (25)	1 (12.5)	3 (18.75)
17	2 (25)	1 (12.5)	3 (18.75)
Sex assigned at birth Male			
	8 (100)	0	8 (100)
Female	0	8 (100)	8 (100)
Race and ethnicity White			
	5 (62.5)	6 (75)	11 (68.75)
Black or African Canadian	3 (37.5)	0	3 (18.75)
Indigenous (First Nation, Metis, or Inuit)	0	1 (12.5)	1 (6.25)
Asian	0	1 (12.5)	1 (6.25)
Approximate household income[b]			
Less than $50k	0	1 (12.5)	1 (6.25)
$50k to less than $100k	2 (25)	0	2 (12.5)
$100k to less than $150k	3 (27.5)	1 (12.5)	4 (25)
Over $150k	2 (25)	5 (62.5)	7 (43.75)
Refuse to answer	1 (12.5)	1 (12.5)	2 (12.5)
Province of residence Alberta			
	1 (12.5)	3 (37.5)	4 (25)
Manitoba	2 (25)	0	2 (13)
Ontario	4 (50)	5 (62.5)	9 (56)
Newfoundland	1 (12.5)	0	1 (6)

3.3. Predatory marketing practices

Participants were not asked about alcohol marketing; however, upon scrolling through their social media there were several instances where alcohol advertising was present. Only girls during the interviews were exposed to alcohol marketing. They expressed confusion as to why they were receiving this kind of marketing, with one participant noting:

> "But yeah, it's I just find it quite odd that like these are, this is something that's illegal for me to drink. So why is it being advertised to me? Because some people could be very well tempted to buy it." (Girl, 16)

When the participant was asked why they think they'd be receiving alcohol ads they responded with:

> "I would think it is because a lot of teenagers do drink. So, if they can hit their kind of target consumers then they're kind of getting what they want out of an ad. They're making it worthwhile." (Girl, 16)

Both genders noted that after searching for or buying a food product, they received advertisements for that product. These instances were deemed as "collecting data". For example:

> "I got some diet Coke and made reviews. After purchasing it they had my data. So, from now, I've been getting notifications from them." (Boy, 16)

> "I haven't ordered food off my phone. But I noticed if I searched it up, I searched something up about it then stuff would start popping up from for it. One day I was searching Gatorade flavors, and then I got a whole bunch of Gatorade ads on my social media." (Girl, 16)

3.4. Possible moderating or protective factors

During the interviews familial influence emerged as a potential protective factor when it came to moderating the effects of food marketing. It was more common for girls to report that their family had an influence on their dietary patterns, with parents encouraging their children to pay attention to food choices and to have some level of moderation with unhealthy food. Participants were aware of their parents' views on healthy food with one participant noting:

> "Oh, oh! Is this a healthy cereal? My mom would love that." (Girl, 14)

Participants also noted their parents' role in moderating food choices in the home:

> "Yeah, so we do sports. So, we always try and eat a balanced meal, and my dad's a paramedic, so he always makes sure that we have a balanced meal with everything we eat. So that we're healthy and we're keeping up with our intakes and everything." (Girl, 17)

3.5. Types of engagement

Various forms of engagement were mentioned including following food companies, reasons why adolescents liked, shared, followed, or commented on marketing content, and user-generated posts. Boys followed food companies based on their enjoyment of the product and/or brand, whereas girls were more interested in being made aware of new or special products, sales, or deals. For example:

> "Because I love Coca Cola. I love the brand and the taste and it's something that gives me energy." (Boy, 15)

> "Well, I like to try the seasonal drinks at Starbucks, and it's a good way to find out what they are." (Girl, 15)

Liking or commenting on a food post was used to express adolescents' positive opinion or experience with the product. None of the participants indicated any inclination to provide negative reviews or feedback.

> "Sometimes I like ads. If it's a nice food or nice reviews about the food, then I like it. I also like to see the comments that come in. I will also support those comments." (Boy, 15)

> "When I order, and I am pleased with their products and services I will comment or like the advert." (Boy, 15)

Girls were the only ones to mention creating user-generated posts. Reasons for creating user-generated content include finding the content funny, being proud of the created content, or because it was trendy: For example:

> **"**I've like just sent a video of me and my McDonald's bag to someone like recently. Because there were two quarter pounders in it, and I felt like I had to, I was just making fun of myself." (Girl, 17)

Both genders commented on sharing food posts with their friends, noting they did not share often. The main reasons for sharing were mutual interests among friends or to encourage their friends to go consume the product. For example:

> "Just because they [Wendy's fries] look good, and I think they might agree. For some, I share because I think we should try this sometime." (Girl, 17)

> "If it's like Starbucks and it's like a new drink, then I will, or if it's like somebody making something, and it looks really cool then sometimes. But not very often." (Girl, 13)

> "Because it was stuff like "aww this looks awesome, we must eat this." I just wanted to share it with them." (Boy, 17)

3.6. Marketing technique identification

Several marketing techniques were identified including the use of animations or effects, the use of influencers, humour, colours, the use of prizes and music, and descriptions that speak to the consumer ["it'll just be perfect for you to have this food"]. It was more common for girls to notice aesthetics (e.g., colours) compared to boys. Examples of marketing techniques participants identified include:

> "I've seen songs with like pizza companies on the radio, which helps you memorize the phone number for sure. Putting a little jingle to it so you can memorize it, and then it's stuck in your brain." (Girl, 13)
> "The obvious one is using colors like something simple as colors to attract the eye. Compared to like, if I try to scroll to find an ad here like (reviews post). See that – purple, pink, and blue colors. In your face. It's also a video playing compared to the rest of the whole feed. The ads usually stand out and then usually bigger than the rest of feed so you can tell if their an ad." (Boy, 15)

> "I think it's intriguing because it's giving you, if you buy something of theirs you get a chance to win a big prize, or you win every time. So, people would definitely be intrigued by that yeah, it's definitely a good tactic to get people interested in Tim Hortons for sure." (Girl, 16)

> Some participants identified specific ads. One participant noted:

> **"**Immediately the One Direction ones, the Lindor you know the guy with the whisk, love those. Those are so fun. And then almost any Dorito one, because they always make those fun little skits. And then the very, very, very old one, the Nestle crunch." (Girl, 14)

Social media influencers generated some of the lengthiest discussions. All but one participant followed at least one influencer. Boys favoured male influencers, usually athletes or rappers whereas girls followed both male and female influencers, including actors, musicians, and pop culture influencers. Participants indicated a high level of trust based on influencers' opinions and a strong likelihood of being influenced by their marketing.

> "Yes, like if some random person on Instagram were to show me an ad for a new drink, I probably wouldn't buy it but if Arianna Grande were to tell me that this drink at Starbucks is amazing, I'd probably go try it out right now." (Girl, 15)

> **"**Run. I would run. There's a One Direction ad they're broken up now, unfortunately, but there was an ad they did, for Pepsi. I didn't even know about them when they did it, but I saw that ad I went and got Pepsi. I don't like pop, but I went and got Pepsi." (Girl, 14)

Participants noted how they positively regard the opinions of products promoted by influencers.

> "Somehow, I would feel its important to have it. Drake is a top influencer, so if he's advertising it, then it's a good product. Same thing with Chris Brown. I automatically think it's a good product." (Boy, 15)

> "If it was, say, like an energy drink then I feel like I trust an athlete more just because like usually they need more energy." (Girl, 13)

> "If it's good enough for the celebrity then it's good enough for me." (Girl, 15)

When it came to whether gender can play a role in marketing, there were differences between girls and boys. Boys were less likely to see gender stereotypes or the gender of the individual in the advertisement as having an influence when it comes to marketing, whereas girls noted stereotypes, such as using pink for girls and highlighting sports for boys, in certain marketing instances. For example:

> "Yeah, [boys] get a bit a bit more of sports enhancement like sports and enhancement drinks than I do. I get a bit more like fast food or people try to promote like, I guess, healthier stuff." (Girl, 16)

One participant noted the differences in Starbucks ads from a gender perspective:

> "I mean maybe I don't think my boyfriend would get a lot of Starbucks ads. I feel like they're more targeted towards like girls I get a lot of them. But when I'm using someone else's like my brothers or my boyfriend's phone I don't see a lot of Starbucks ads. I'd see like other type of ads. A lot of like girls are more interested in going to Starbucks and boys think that going to Starbucks is like not cool." (Girl, 15)

Table 2 provides an overview of the gender variations of the main themes.

Discussion

This study explored if gender has an impact on the food marketing experiences of adolescents as they navigated their personal social media accounts. It aimed to answer does gender influence the way adolescents interpret and engage with digital marketing messages for unhealthy foods. Our results provide contextual meaning to how adolescents in this study interacted and are impacted by food marketing on social media, highlighting such themes as predatory actions taken by food companies, protective factors such as family, and the power of social media influencers. During this study, notable gender differences emerged in the participants' responses. Specifically, girls more often described family as a protective factor, described more marketing techniques, and recognized gender as an influential factor. They were also the only ones to report seeing alcohol advertisements. Boys more often followed food companies, shared food posts, and followed primarily male influencers. While other studies have also demonstrated gender differences (Amson et al., 2023; Castronuovo et al., 2021; Elliott et al., 2022), this is the first study to describe how the genders are impacted differently by digital food marketing.

Table 2

Gender differences within themes from go-along interviews conducted with adolescents aged 13–17 from across Canada, from January to June 2022.

Code	Description	Gender Observations
Predatory Marketing Practices		
Alcohol Ads	Adolescents being exposed to an alcohol ad.	Only girls viewed alcohol posts
Data Collection	Participants noted that after searching for or buying a food product they received ads after the purchase.	Girls more often described instances of data collection than boys

Possible Moderating or		
	Participants eating choices based on family values/ eating practices	Girls more often described familial influence having an impact on their dietary habits than boys
Types of Engagement		
Following food companies	Passages referring to why participants follow food and beverage companies.	Boys more often followed a food company than girls
Like or Comment	Reasons for why a participant would like or comment on a food post	Boys more often described liking or commenting on a food post than girls
Influencers	Participants commented on how influencers affect them or why they follow them.	Boys more often followed male influencers (athletes or rappers) whereas girls more often followed a mix (both girls and boys and a variety – actors, musicians, influencers, etc.) All but one individual followed an influencer
Identification of Marketing Techniques	Refers to instances where participants highlight various marketing techniques, they are aware of.	Girls were able to describe slightly more marketing techniques than boys
Gender and Marketing	Participants indicated how gender may affect marketing	Girls more often described food companies using different strategies to market their products based on gender than boys

4.1. Predatory marketing practices

During this study, girls were exposed to alcohol marketing while navigating their personal social media pages, without any prompting or searching. No boys witnessed such marketing. This finding is concerning as a systematic review of 12 long-term, international studies established a positive correlation between exposure to alcohol marketing and drinking behaviour in youth (Jernigan, Noel, Landon, Thornton, & Lobstein, 2017). Results from each study in the review illustrated a clear link between increased exposure to alcohol marketing and early initiation of drinking, in addition to engagement in binge drinking (Jernigan et al., 2017). Recent research has shown that women aged 15–24 years have the highest rates of alcohol-related hospital visits in Ontario and that females under the legal drinking age are more likely than males to visit the emergency room due to alcohol (Myran, Hsu, Smith, & Tanuseputro, 2019).

The Canadian Radio-Television and Telecommunications Commission's *Code for Broadcast Advertising of Alcoholic Beverages* prohibits television and radio advertising targeting minors, but no federal digital media regulations exist (Government of Canada, 1996). Social media platforms, like Instagram, have self-regulatory policies governing alcohol marketing to youth, emphasizing compliance with local laws. Instagram's policy states that branded content must be age-gated and follow country-based drinking age laws (Meta, 2023). Despite voluntary pledges and internal advertising codes, youth-centric digital advertisements persist (Beer Canada, 2020; Potvin Kent & Pauze, 2018′). The alcohol and tobacco industry have historically targeted women to increase consumption of products that were traditionally appealing to boys and men (Anderson, Glantz, & Ling, 2005; Feeny et al., 2021). Given this, companies that manufacture alcohol may be intentionally targeting underage girls to increase drinking habits amongst this demographic.

More girls noted that after purchasing or searching for a product, they were bombarded with advertisements. Our contemporary digital landscape, where 'big data,' cookies, and algorithms wield omnipresent influence, can shape our social media experiences (Bazzaz Abkenar, Haghi Kashani, Mahdipour, & Jameii, 2021). These technologies systematically collect user information, including digital preferences, interests, behaviours, and interactions (Bazzaz Abkenar et al., 2021; Montgomery & Chester, 2009). This wealth of data enables platforms to finely tailor content with precision. The algorithms, analyzing patterns and predicting user preferences, curate personalized feeds that mirror individual tastes and behaviours (Tatlow-Golden & Garde, 2020). This level of personalization raises critical questions about privacy, consent, and the potential reinforcement of existing beliefs (Tatlow-Golden & Garde, 2020).

Food and beverage companies can leverage extensive user data to tailor marketing in a way that reflects individual dietary preferences and habits. For example, a boy who clicks on an energy drink advertisement may amplify the visibility of these beverages in their social media feed. This personalized curation not only mirrors individual preferences but may also entrench dietary patterns. As more data is collected, companies can experiment with marketing techniques and refine their ability to capture youth's attention. The extent of this data collection is unknown. A recent report from Canada highlighted that popular fast-food ordering applications collect data on children, but less than half were willing to disclose what data they collected despite legislation mandating such disclosure (Potvin Kent, Pauz´e, et al., 2023). Understanding the role algorithms play in shaping food-related choices within the digital space requires an exploration of gendered data, as it may reveal nuanced influences on the types of food and beverages presented to users or present gendered patterns that are in need of further research and protection.

4.2. Possible moderating or protective factors

Familial influence surfaced as a potential moderating or protective factor in food choices. Girls more frequently mentioned that their families played a role in shaping their dietary patterns, with parents encouraging mindful food selection and moderation when it came to unhealthy options. Some noted their food choices being modified due to their parent's preferences. Parents can potentially serve as a protective factor by actively promoting and modeling healthy eating patterns, encouraging critical thinking about advertising, and maintaining open and informed discussions about nutrition and food choices (Savage, Fisher, & Birch, 2007). Although some participants in this study reported that their parents were a positive influence on healthy food choices, there is potential for parents with unhealthy eating practices to also negatively influence the food habits of their children (Hoffmann, Marx, Kiefner-Burmeister, & Musher-Eizenman, 2016; Savage et al., 2007).

Family influence on food choice aligns with previous studies noting the influence of parents' food choices, habits, and views on the entire household (Savage et al., 2007). Parental influence on attitudes toward food, healthy eating, perceptions of health, as well as health outcomes, appear to have gender-based differences. Research indicates that parents pay greater attention to the diets and body weight of their daughters compared to their sons (Lipowska, Lipowski, Jurek, Jankowska, & Pawlicka, 2018). For men, healthy eating is not as emphasized (Lipowska et al., 2018). As such, boys may not be attune to dietary patterns and their consequences compared to girls (Wardle et al., 2004). Recognizing gendered differences can shed light on the need for increased parental support for boys in specific areas. By understanding how gender influences adolescents' responses to various factors, including food marketing, we can identify potential disparities in the challenges and vulnerabilities faced by boys. This knowledge can guide parents and caregivers in providing targeted support and resources to address the unique needs and concerns of boys, ultimately fostering healthier choices. *4.3. Types of engagement*

Digital marketing provides an interactive and participatory environment, enticing users to be involved with products by sharing, liking, and commenting on posts (Bragg et al., 2020). Digital environments encourage youth to interact with brands, incorporating them into their personal and social relationships, at times creating emotional attachments to products (Bragg et al., 2020). Girls described sharing food and beverage marketing with their friends more often than boys, whereas boys more often described 'liking', 'commenting' and 'following' food company content on social media. In this respect, gender differences emerged between the types of engagements that participants undertook. Girls in our study engaged with their existing social network of friends, sharing content cooperatively. Some girls specifically noted that they created and shared content to invite their friend(s) to a try a food or beverage product with them.

Boys in our study demonstrated more individualistic engagements, as they were more likely to voice their opinions in comment sections or to follow a food company page; however, they still shared items with their friends. The tendency for boys to participate more in one-way communication is congruent with other research that indicates boys are more likely to be socially isolated (Umberson, Lin, & Cha, 2022) while girls have stronger social ties (Szell & Thurner, 2013). Given there is a potential for gender-based online behavioural differences, it is possible that food companies are leveraging these when creating strategies to engage girls or boys more actively.

4.4. Marketing technique identification

Participants observed and discussed a range of social media marketing techniques. They were aware of the general concept of companies trying to engage consumers using strategies like colour, celebrities, and contests to attract consumer attention. Girls were able to identify more marketing techniques compared to boys including colours, contests, music, and humour. Boys were not as adept at identifying a breadth of techniques. Similar to previous research, the predominant marketing technique that was identified was visual effects, with girls more likely to point this out compared to boys (Elliott et al., 2022). Findings from a scoping review also suggest that male and female youth respond differently to marketing techniques (Castronuovo et al., 2021). Awareness of these preferences is important to monitor as food companies may be utilizing certain techniques over others to target a certain gender.
Indeed, the most frequently mentioned technique was the acknowledgement and trust in social media influencers and celebrities. All but one participant followed an influencer. Overwhelmingly, participants expressed a likelihood to purchase products endorsed by a social media influencer or celebrity because they trusted them and by extension, the product. The trust that participants expressed for social media influencers and celebrities is congruent with other studies that confirm the sway celebrities have with young people's food choices (Alruwaily et al., 2020; Coates, Hardman, Halford, Christiansen, & Boyland, 2019; Murphy, Corcoran, Tatlow-Golden, Boyland, & Rooney, 2020). The degree of trust is problematic as celebrity influence has impacted adolescent food choice, increasing their unhealthy food recall and consumption (Murphy et al., 2020).

In this study, boys predominantly followed male athletes and rappers, while girls reported following a mix of male and female actors, musicians, and lifestyle influencers. The noted gender-based differences are not surprising, given that previous findings have shown that female influencers have a greater influence on females and male influencers with males (Al-Shehri, 2021). This may be explained by social cognitive theory whereby adolescents learn behaviours through those they wish to emulate, in this case, social media influencers (Bussey & Bandura, 1999; Coates, Hardman, Halford, Christiansen, & Boyland, 2020). Girls and boys also find influencers of the same gender more relatable, which positively impacts engagement and attitude towards products endorsed by those influencers (Hudders & De Jans, 2022). Researching the intersection of gender, food marketing, and social media influencers popular among

teens is important as adolescents are highly susceptible to marketing messages (Boyland et al., 2020) and these creators have the power to create social norms and gender stereotypes in their posts. Understanding social media influencer and consumer dynamics can support the creation of government regulations that encourage socially responsible marketing practices.

According to Story, Neumark-Sztainer, and French (2002)'s theoretical framework, adolescent eating behaviour is shaped by a variety of factors including macrosystem influences (e.g., media and social norms) (Story et al., 2002). Social media provides an avenue for influences, encompassing peers (recognized as one of the most influential determinants of adolescent behaviour), influencers (similar in age and perceived as approachable peers), advertisements, media, and norms to affect adolescent behaviour (Qutteina, Hallez, et al., 2019). This social influence can be manifested both positively and negatively, either prompting personal growth, and healthy patterns of behaviour, or conversely, fostering undesirable habits, and elevating risk factors for health problems (Masur, DiFranzo, & Bazarova, 2021). Social norms have a powerful impact on behaviour (Reynolds, 2019) and these norms can be perpetuated by social media and social media influencers.

4.5. Gender and marketing

Boys were more likely to believe that gender did not play a role in marketing. Girls, however, were more likely to think that there would be differences based on stereotypes. For example, they believed marketers targeted boys based on athletic aspects and girls based on soft colours and academic achievement. Despite the difference in opinion, these results may be explained by whether a male or female was used to display a food product in a given advertisement. Previous research indicates that male depictions in advertising tend to highlight power and authority, while female depictions tend to showcase more traditional female roles (Tsichla, 2020). Further, males are used more often in marketing than females (Sadeghirad, Duhaney, Motaghipisheh, Campbell, & Johnston, 2016). The prevailing presence of men and masculine themes in marketing may be attributed to cultural biases. Food advertisements, in this regard, perpetuate and reinforce gender stereotypes that are deeply rooted in society (Castronuovo et al., 2021). There is a recognized necessity for a more comprehensive examination of the socially constructed stereotypes and how these manifest in advertisements, subsequently affecting the food preferences of both girls and boys.

Previous food marketing research indicates that there is gender- based differences in how marketers target audiences (Amson et al., 2023; Castronuovo et al., 2021; Elliott et al., 2022). While food products inherently lack a gender, marketing approaches are structured in a manner that assigns gendered characteristics to products. Consequently, specific promotional techniques can render certain foods more appealing to either girls or boys. It would benefit adolescents to be informed of these gender-specific marketing techniques to empower them with the skills and awareness necessary to critically evaluate and navigate food marketing messages effectively. Governments developing food marketing restrictions to protect adolescents would also benefit as this would permit them to develop more targeted and effective regulations that address the specific vulnerabilities and concerns associated with gender-specific food marketing practices, ultimately promoting the health and well-being of this demographic.

4.6. Strengths and limitations

To our knowledge, this is the first study to use go-along interviews to understand how adolescents interact with the food marketing they view on their social media accounts and whether gender plays a role in this interaction. Despite the novelty of this research, there are limitations. This study had a small sample size,

where roughly 69% of participants were White, and over 40% were from households whose annual income was $150,000 or more, limiting the generalizability to the Canadian population. We were also unable to recruit gender diverse participants. Additionally, this study did not account for other confounding variables, such as age, which may explain differences in opinion. Further, this study did not measure the volume of food posts, or consumption following exposure to marketing instances. Lastly, certain interview questions were asked differently for participants, potentially introducing variations in response patterns that may affect the comparability of data across participants. For example, the first interview introduced the concept of family being a protective factor. This was not an original question in the script but was added based on the first interview. Despite these limitations, our results provide valuable, first-hand accounts of how adolescents perceive digital marketing from a gender perspective. Social norms for adolescents are evolving, with the influence of digital marketing at the forefront. Researching adolescent perspectives of food marketing from a gender perspective not only sheds light on a critical aspect of adolescent health but can also offer insights into marketing practices, can inform public health initiatives and policy, and empower adolescents to be aware of the online influences that may affect their dietary patterns. More research is required to investigate and address gender-based marketing approaches that target adolescents. It is imperative to ensure the inclusion of diverse genders in studies examining the influence of digital food marketing on dietary habits. This approach promotes a more comprehensive understanding of how various gender identities may respond to and be affected by marketing strategies, contributing to the development of interventions and policies that cater to the diverse needs of individuals across the gender spectrum. This inclusive perspective is essential for advancing research in the digital food marketing domain and fostering equitable health outcomes. Future studies would benefit from investigating the exposure of gendered digital food marketing and consumption of unhealthy foods or how various identities such as socioeconomic status or race and ethnicity intersect with gender in influencing adolescent’s response to digital food marketing.

5. Conclusion

Adolescence is a pivotal point in child development. Food companies are targeting adolescents due to their independence and potential for brand loyalty. A prospective avenue for targeting adolescents is from a gender perspective. Our research investigated the intersection of digital food marketing and gender aiming to uncover how gender may influence adolescents’ perceptions, responses, and behaviours in the context of food marketing strategies. By examining the impact of gender on food marketing dynamics, we sought to identify potential disparities, which can support adolescents’ awareness of marketing techniques and inform government policies that seek to protect adolescents. The intersection of adolescence and gender has been overlooked and requires dedicated attention to provide policy makers with evidence to develop and implement policies that limit adolescent exposure to the marketing of unhealthy food.

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Data and code availability

Data used in this study is available upon request. The lead author has full access to the data reported in the manuscript.

Ethical statement

This study was approved by the University of Ottawa's Health Sciences and Science Research Ethics Board H-09-21-6152. This statement is included in the manuscript within the methods section. The participants and their parents/guardians also gave consent and assent prior to participation. This too can be found in the methods section.

CRediT authorship contribution statement

A. Amson: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. **E. Pauze:** Validation, Writing – review & editing. **T. Ramsay:** Writing – review & editing. **V. Welch:** Writing – review & editing. **J.S. Hamid:** Writing – review & editing. **J. Lee:** Writing – review & editing. **D.L. Olstad:** Data curation, Validation, Writing – review & editing. **C. Mah:** Writing – review & editing. **K. Raine:** Writing – review & editing. **M. Potvin Kent:** Conceptualization, Supervision, Writing – review & editing, Funding acquisition.

Declaration of competing interest

None

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi. org/10.1016/j.appet.2023.107153.

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Study 3: Beyond the Screen: Exploring the Dynamics of Social Media Influencers, Food Marketing, and Gendered Influences on Adolescent Diets

Approach

Leveraging insights from the second study, the third and final study, *Beyond the Screen: Exploring the Dynamics of Social Media Influencers, Food Marketing, and Gendered Influences on Adolescent Diets*, delved deeper into the most prevalent digital marketing technique identified — the use of social media influencers. This quantitative study consisted of a content analysis of SMI food posts examining the frequency, types of food products promoted, and marketing techniques used within these posts, based on their popularity with male and female adolescents. This study addresses a gap in the literature by exploring the interplay between digital food marketing of SMIs and gender dynamics in shaping adolescent dietary habits. By exploring these dynamics, the article offers valuable insights into the frequency and methods with which SMIs endorse unhealthy food products/brands, lending understandings into the changing social and cultural environments influenced by digital media. These results are important for developing effective safeguards for adolescents.

Author's Contribution

My contribution to this research included identifying the research question and supporting the design of the study, collecting, and analyzing the data, interpreting the findings, putting together the tables, and writing the manuscript.

Knowledge Translation

This research was submitted to *BMC Public Health* in February 2024. There are intentions to present this research at a future conference.

Beyond the Screen: Exploring the Dynamics of Social Media Influencers, Food Marketing, and Gendered Influences on Adolescent Diets

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Abstract

Background: Adolescent obesity remains a public health concern, exacerbated by the risks posed by unhealthy food marketing, particularly on digital platforms. Social media influencers are increasingly utilized in digital marketing, yet their impact on adolescents remains understudied. This research explores the frequency of posts containing food products/brands, the most promoted food categories, the healthfulness of featured products, and the types of marketing techniques used by social media influencers popular with male and female adolescents.

Methods: A content analysis was conducted on posts between June 1, 2021, and May 31, 2022, posted by the top three social media influencers popular with males and female adolescents (13–17) on Instagram, TikTok, and YouTube (N = 1373). Descriptive statistics were applied to calculate frequencies for posts containing food products/brands, promoted food categories, product healthfulness, and marketing techniques. Health Canada's Nutrient Profile Model classified product healthfulness.

Results: On average, social media influencers popular with males featured 1 food product/brand for every 2.5 posts compared to social media influencers popular with females who featured 1 food product/brand for every 6.1 posts. Water (27%) was the primary food category for social media influencers popular with females, while restaurants (24%) dominated for males. Social media influencers popular with males more commonly posted food products that were less healthy (89% versus 54%). Marketing techniques varied. Social media influencers popular with females used songs or music (53% vs 26%), the use of other influencers (26% vs 11%), appeals to fun or coolness (26% vs 13%), viral marketing (29% vs 19%), and appeals to beauty (11% vs

0%) more commonly. Comparatively, those popular with males more commonly used calls-to-action (27% vs 6%) and price promotions (8% vs 1%).

Conclusion: Social media influencers play a role in shaping adolescents' dietary preferences and behaviors. An often-overlooked aspect is the nuanced interplay of gender dynamics, where influencers contribute to the reinforcement or subversion of gendered expectations. As marketing plays a pivotal role in shaping dietary choices, understanding these gender-specific dynamics is essential for developing targeted interventions, policies, and educational initiatives aimed at promoting healthier food choices directed towards adolescents.

Introduction

Adolescent obesity remains a public health concern in Canada and abroad (1). Findings from the 2017/2018 Health Behaviour in School-aged Children (HBSC) survey in Europe and Canada found that 21% of adolescents aged 11–15 years were classified as overweight or obese based on self-reported height and weight data (2). This proportion was higher for boys than girls (25% vs 16%, respectively) (2). In Canada, available self-reported data from 2017–2018 shows that 24% of adolescents aged 15 years were classified as having overweight or obesity, with the prevalence being higher among boys relative to girls (27% vs 21%, respectively) (2).

Poor dietary patterns are a contributing factor. Current adolescent dietary intakes consist of high levels of ultra processed foods that are elevated in salt, sugar, and saturated and trans fats (3). Sex differences related to dietary intake have also been reported. For instance, data from 2015 shows that Canadian males aged 14–18 years consumed a mean intake of 91.7g of free sugars (e.g., all mono and di saccharides added to foods by the manufacturer, plus sugars naturally present in honey, syrups, and fruits juices/juice concentrates) while their female counterparts consumed 68.3g (4). Further, males aged 14–18 also consumed more daily sodium

than their female counterparts (3320mg vs 2350mg) (5.) Results from systematic reviews repeatedly show that exposure to unhealthy food marketing influences adolescent food preferences, short-term intake, and purchase requests, thereby increasing their risk of obesity and other chronic diseases (6).

Adolescents are susceptible to food marketing due to their stage of neuro-cognitive development and their impressionable nature (7). This makes them an ideal target for food companies looking to foster brand loyalty, which may carry into adulthood and create life-long customers (8). Food companies have been reported to exploit these vulnerabilities over digital marketing platforms including on social media applications, websites, and online game sites (8–11). Unhealthy food and beverage (henceforth known as food) marketing is prevalent on digital platforms, creating a high level of exposure for youth (12).

Nearly half of adolescents aged 14–15 years in Canada use their personal digital devices (e.g., smartphones, tablets, laptops, and desktop computers) for leisure purposes, spending 3 or more hours a day on these devices (13). Online digital media use data from 2019 indicated that 50.2% of girls aged 12–17 years checked social media multiple times daily compared to 41.5% of boys, and 19.7% of girls and 11.8% of boys reported constantly checking their social media apps (14). Recent data from Canada estimated that adolescents aged 12 to 16 years were exposed to an average of 189 food marketing exposures per week on social media, which translates to over 9000 exposures per year (15).

Food is currently the second most marketed commodity on social media and social media influencers are increasingly becoming an avenue for exposing adolescents to instances of food marketing (16). Social media influencers (SMIs) are a type of celebrity who acquire online followers by creating or reposting curated social media content (17). The credibility and trust

gained by SMIs have led many companies to add them to their digital marketing strategies (16, 18). Globally, food marketing promoted on influencer social media pages has been documented. A British study reviewed two YouTube influencer's popular with youth aged 5–15 and found 3,571 branded food and beverage cues in 380 of their YouTube videos. On average, these youth were exposed to 29.9 food cues per hour (19). The same study also conducted nutrient profiling, categorizing food and beverage cues into three groups – healthy, less healthy, and miscellaneous. Less healthy foods had the greatest prevalence at 49.4% of the food cues (20, 21). In the ever-evolving landscape of social media, SMIs play a significant role in shaping trends, opinions, and lifestyles, particularly among adolescent audiences (8, 21).

To date, the frequency of food marketing content posted by SMIs popular with adolescents has not been examined in a Canadian context, nor has it been examined from a gender perspective. Examining this content from a gender lens is important as gender, regarded as both a social construct and a determinant of health, has the capacity to foster beneficial or harmful behaviors (22). Moreover, gender's influence on social and cultural norms has implications on dietary choices (23) and has shown variations in responses, perceptions, exposure, and content to food marketing amongst boys and girls (24– 26).

Given this, the objectives of this study were to determine the frequency of social media posts containing instances of food product/brand content, to identify the most promoted food categories, to examine the healthfulness of the featured products, and to identify the marketing techniques being utilized by SMIs popular with male and female adolescents.

Methods

This descriptive observational study used a content analysis, based on secondary data from survey results, to explore SMI posts containing food products and brands. No human participants were directly involved in this study, so ethical approval was not required.

Identification of influencers

The top three SMIs popular with male adolescents (13–17 years) (n = 1224) and the top three SMIs popular with female adolescents (13–17 years) (n = 1002) were selected based on data from the 2021 International Food Policy Study for Youth (27). Participants (N = 2226) living in Canada were recruited from a commercial panel to complete online surveys in English or French. Participants were asked their sex at birth and responded to an open-text question asking, "Who are your 3 favourite social media stars, TikTokers, or YouTubers?". Overall, 61% (n = 1364; 743 males and 621 females) named at least one SMI and were included in this analysis. SMIs mentioned in the responses were ranked from most mentioned to least. The following SMIs were most popular with females: 1) Charli D'Amelio (mentioned by 2.9% of female participants), 2) Squeezie (mentioned by 2.1% of female participants), and 3) Mr. Beast (mentioned by 1.9% o female participants). The following SMIs were most popular with males: 1) Mr. Beast (mentioned by 4.6% of male participants), 2) PewDiePie (mentioned by 2.8% of male participants), and 3) Markiplier (mentioned by 1.3% of male participants). Due to overlap of one SMI, posts from a total of five SMIs were included in this study.

Social media post collection

Publicly available social media posts including pictures and videos, dated between June 1, 2021, and May 31, 2022, from the Instagram, TikTok, and YouTube accounts of the five identified SMIs were analyzed. These social media platforms were chosen as they are the most used by adolescents (28). Posts were collected by the research team between October 2022 and December 2022. YouTube videos longer than 60 minutes were excluded for feasibility reasons and due to the volume of YouTube videos, only a 50% random sample of YouTube videos were selected using a randomized generator. Instagram "stories" were also excluded from the analysis

as they only appear for 24 hours. Overall, there were 1373 posts (n = 1260 unique, unweighted) included in this study. Content analysis All SMI posts from the selected year were reviewed by one of five research assistants for instances of food products or brands (e.g., a unique name, logo, or symbol that identifies a specific food product or line of products). Both verbal (e.g., no product or brand actually shown, just mentioned verbally) and visual mentions of food products and brands were identified. Posts containing instances of branded food products or brands were reviewed to identify the presence of marketing techniques. Marketing techniques were identified using a coding manual that was adopted from Mulligan et al. and other relevant literature (Supplementary Table 1 – Additional file 1) (29, 30). Before coding commenced, a sample (n = 25) of the total posts was used to determine inter-rater reliability. The coding was compared, and inter-rater reliability was calculated to be 94.5% using Cohen's Kappa, indicating substantial agreement (31).

Food Categories and Nutrient Profiling

Food products were organized into 17 categories, which were adapted based on previous research by Potvin Kent et al. (15). These categories encompassed a range of items, including bread; sweet baked goods or desserts; candy and chocolate; breakfast cereal; dairy; meat and entrees (e.g., fish, poultry, and meat products); fruit and vegetables; energy drinks; regular soft drinks; diet soft drinks; other sweetened beverages (e.g., sweetened coffee or tea, hot chocolate, fruit drinks); water; snacks; restaurants (e.g., fast food and sit-down); food delivery services; condiments, seasonings, oils and dressings; and other (e.g., gum). Food products were categorized using Health Canada's 2018 Nutrient Profile Model (NPM). This model was used as it defines which products would be permitted to be advertised to children in Canada (32). Food products were categorized as healthy (not a concern from an advertising perspective) or less

healthy (of concern from an advertising perspective) based on their content in sugar, sodium, and saturated fats. Nutritional information for each product was collected using the following sources of information in order of priority: the food company's Canadian website, a Canadian grocery store website (e.g., Loblaws or Walmart), or the company's American website. A registered dietitian (EP) revised the collected nutrition data and assisted with the NPM classification.

Data analysis

Descriptive statistics, using excel, were used to calculate the following frequencies for each social media platform, separated by SMI popularity by the survey participant's sex: 1) posts containing food products and brands; 2) promoted food category; 3) product healthfulness; and 4) number and type of marketing techniques. Of note, weighted frequencies were used for YouTube to account for the 50% random sample (i.e. each YouTube post was multiplied by 2). Due to one of the SMIs being popular with both males and females, statistical analyses could not be undertaken, as the samples were not independent. Rates were also calculated by dividing the number of posts by the number of food marketing instances. Often sex and gender can be conflated (33). This paper uses both sex and gender, depending on the content. Participants in the International Food Policy Study for Youth were asked what their sex was at birth, resulting in a male/female comparison. Additionally, statistics at the beginning of this paper relating to obesity and food consumption also use data based on sex. Sex, a biological term, refers to physiological features and is often used when discussing health problems (34). However, the discussion section of this paper will use gender to describe and infer how the content SMIs share on their social media accounts may affect different genders who are exposed to the content. Gender is being used as opposed to sex in this instance as it is a social construct and can affect societal norms and behaviours, such as dietary patterns (22).

Results

Frequency of food brands/products

As shown in Table 1, SMIs popular with females posted a total of 831 times across the three social media apps examined over the year and featured 136 posts (16% of total posts) containing a food product/brand. SMIs popular with males posted a total of 542 times and featured 217 posts (40% of total posts) containing a food product/brand. On average, SMIs popular with males featured 1 food product/brand for every 2.5 posts compared to SMIs popular with females who featured 1 food product/brand for every 6.1 posts. YouTube had the highest rate of featured food products/brands for both males and females (males: 1 food product/brand for every 1.9 posts; females: 1 food product/brand for every 3.4 per posts, respectively), followed by Instagram for males (1 food/product for every 8.8 posts) and TikTok for females (1 food/product for every 6.0 posts). Products were promoted more frequently than brands for both SMI groups (data not shown). SMIs popular with females had 136 posts containing food products/brands with 83% featuring products and 17% featuring exclusively brands, whereas SMIs popular with males had 217 posts containing food products/brands with 97% featuring products and 3% featuring exclusively brands. The top three most common brands featured in posts by SMIs popular with females include Starbucks (n = 11, 14%), McDonald's (n = 5, 7%), and Mr. Beast (n = 3, 4%). The most common products featured in posts include MyMuse Enhanced Water (n = 29, 9%), Dunkin Donuts Iced Coffee (n = 13, 4%), and Coca Cola soft drink original (n = 11, 3%). For SMIs popular with males, the top three most common brands featured in posts included Gfuel (n = 29, 32%), McDonald's (n = 6, 7%), and Mr. Beast (n = 3, 3%). The most common products featured in posts include Coca Cola soft drink original (n = 7, 6%), Feastables chocolate bars (n = 4, 3%), and G Fuel energy drink powder (n = 3, 2%).

Table 1. Weighted frequencies of collected food product/brand related posts on YouTube, Instagram, and TikTok between June 1, 2021, and May 31, 2022, posted by the top three most popular SMIs with adolescent males and females aged 13-17

	SMI Popular with Females			**SMI Popular with Males**		
Social Media Platform	Posts Collected n(%)	Food Product/ Brand Posts n(%)	Rate of posts per food product	Posts Collected n(%)	Food Product/ Brand Posts n(%)	Rate of posts per food product
YouTube[a]	103(12)	30(22)	3.4	392(72)	202(93)	1.9
Instagram	214(26)	20(15)	10.7	53(10)	6(3)	8.8
TikTok	514(62)	86(63)	6.0	97(18)	9(4)	10.7
Total	**831(100)**	**136(100)**	**6.1**	**542(100)**	**217(100)**	**2.5**

[a]A random sample of 50% of YouTube posts were analyzed. Frequencies displayed are weighted.

Frequency of products by food category

Among SMIs popular with females, the most featured products were water (27%), restaurants (24%), and snacks (18%) (Table 2). For SMIs popular with males, the most featured food categories were restaurants (24%), energy drinks (18%), and snacks (15%). SMIs popular with males were more common to have posts containing breakfast cereals (5% vs 0%); energy drinks (18% vs 1%); regular soft drinks (5% vs 3%); and other sweetened beverages (17% vs 7%). Whereas SMIs popular with females were more likely to have posts containing water (27% vs 0%). No SMI posts included bread, dairy, or fruits and vegetables.

Table 2. Weighted frequencies of posts containing food products, by category, on YouTube, Instagram, and TikTok between June 1, 2021, and May 31, 2022, posted by the top three most popular SMIs with adolescent males and females aged 13-17

	SMI Popular with Females				**SMI Popular with Males**				
Food Category	YouTube[a] n(%)	Instagram n(%)	TikTok n(%)	**Total n(%)**	YouTube[a] n(%)	Instagram n(%)	TikTok n(%)	**Total n(%)**	**Total not stratified by sex n(%)**
Restaurants (e.g., fast food and sit-down)	8(36)	6(40)	15(18)	**29(24)**	44(22)	2(33)	4(44)	**50(24)**	**79(24)**
Snacks	2(9)	1(7)	19(23)	**22(18)**	32(16)	0(0)	0(0)	**32(15)**	**54(16)**
Other sweetened beverages	2(9)	2(13)	4(5)	**8(7)**	34(17)	1(17)	0(0)	**35(17)**	**43(13)**

Energy drinks	0(0)	0(0)	1(1)	**1(1)**	38(19)	0(0)	0(0)	**38(18)**	**39(12)**
Candy and chocolate	8(36)	5(33)	4(5)	**17(14)**	12(6)	2(33)	2(22)	**16(8)**	**33(10)**
Water	2(9)	0(0)	30(36)	**32(27)**	0(0)	0(0)	0(0)	**0(0)**	**32(10)**
Sweet baked goods/ desserts	0(0)	0(0)	3(4)	**3(3)**	10(5)	0(0)	1(11)	**11(5)**	**14(4)**
Regular soft drinks	0(0)	0(0)	3(4)	**3(3)**	10(5)	0(0)	0(0)	**10(5)**	**13(4)**
Breakfast cereal	0(0)	0(0)	0(0)	**0(0)**	10(5)	0(0)	0(0)	**10(5)**	**10(3)**
Condiments, seasonings, oils, and dressings	0(0)	0(0)	3(4)	**3(3)**	2(1)	0(0)	1(11)	**3(1)**	**6(2)**
Diet soft drinks	0(0)	0(0)	1(1)	**1(1)**	2(1)	0(0)	0(0)	**2(1)**	**3(1)**
Meat and entrees (e.g., fish, poultry, and meat products)	0(0)	0(0)	0(0)	**0(0)**	0(0)	1(17)	1(11)	**2(1)**	**2(1)**
Other (e.g., gum)	0(0)	0(0)	0(0)	**0(0)**	2(1)	0(0)	0(0)	**2(1)**	**2(1)**
Food delivery services	0(0)	1(7)	0(0)	**1(1)**	0(0)	0(0)	0(0)	**0(0)**	**1(0.3)**
Total	**22(18)**	**15(13)**	**83(69)**	**120(100)**	**196(93)**	**6(3)**	**9(4)**	**211(100)**	**331(101.3)***

[a]A random sample of 50% of YouTube posts were analyzed. Frequencies displayed are weighted.
*Over 100% due to rounding

Healthfulness

Across all platforms, 54% of food products featured in posts by SMIs popular among females were classified as less healthy compared to 89% for SMIs popular with males (Table 3). For SMIs popular with females, 68% of less healthy food products were posted on TikTok followed by 19% on YouTube, and 12% on Instagram. Conversely, 84% of posts containing healthy food products were posted on TikTok by SMIs popular with females. Of the less healthy food products posted by SMIs popular with males, 84% were posted on YouTube, 10% on TikTok, and 6% on Instagram.

Table 3. Weighted frequency of the healthfulness of posts containing food products on YouTube, Instagram, and TikTok between June 1, 2021, and May 31, 2022, posted by the top three most popular SMIs with adolescent males and females aged 13-17

	SMI Popular with Females			**SMI Popular with Males**		
Social Media Platform	Healthy n(%)	Less Healthy n(%)	**Total n(%)**	Healthy n(%)	Less Healthy n(%)	**Total n(%)**
YouTube[a]	4(8)	11(19)	**15(14)**	4(67)	41(84)	**45(82)**
Instagram	4(8)	7(12)	**11(10)**	1(17)	3(6)	**4(7)**
TikTok	40(84)	39(68)	**79(75)**	1(17)	5(10)	**6(11)**
Total	**48(46)**	**57(54)**	**105**	**6(11)**	**49(89)**	**55**

[a]A random sample of 50% of YouTube posts were analyzed. Frequency of products and brands displayed are weighted.

Marketing techniques

Overall, the most common marketing techniques for both SMI groups were depictions of the product/brand in a positive or neutral context (female: 97%; male: 83%, respectively) and the product being consumed (female: 59%; male: 47%, respectively) (Table 4). SMIs popular with females more commonly used songs or music (53% vs 26%), the use of other influencers (26% vs 11%), appeals to fun or coolness (26% vs 13%), viral marketing (29% vs 19%), appeals to beauty (11% vs 0%), and the presences of teens (10% vs 4%). Comparatively, SMIs popular with males more commonly used calls-to-action (27% vs 6%) and price promotions (8% vs 1%). There were no instances of the following marketing techniques being used: presence of children; adult-teen situations; teen themes, spokes characters; use of athletes; use of musicians; appeals to social enhancement; appeals to sex; cross-promotions; games or activities; corporate social responsibility; and advercation (not presented in the table).

Table 4. Weighted frequency of marketing techniques used in all posts featuring food products/brands on YouTube, Instagram, and TikTok between June 1, 2021, and May 31, 2022, posted by the top three most popular SMIs with adolescent males and females aged 13-17

	SMI Popular with Females	**SMI Popular with Males**
	Total ***N=136** **n(%)**	**Total** ***N=217** **n(%)**

Unusual product appearance	12(9)	13(6)
Unusual product flavour	13(10)	23(11)
Positive or neutral context	132(97)	181(83)
Product consumed	80(59)	103(47)
Sponsorship disclosure	22(16)	32(15)
Presence of teens	14(10)	9(4)
Adult-child situations	1(1)	0(0)
Child or teen language	0(0)	2(1)
Child themes	2(1)	2(1)
Licensed characters	1(1)	1(0.5)
Other cartoon characters	1(1)	0(0)
Use of actors	0(0)	2(1)
Use of other influencers	36(26)	23(11)
Appeals to fun or coolness	35(26)	29(13)
Appeals to healthfulness	5(4)	9(4)
Appeals to athleticism	1(1)	0(0)
Appeals to beauty	15(11)	0(0)
Appeals to energy	1(1)	2(1)
Appeals to achievement	3(2)	0(0)
Songs or music	72(53)	57(26)
Appealing graphic effects	18(13)	31(14)
Animations	1(1)	3(1)
Price promotions	1(1)	18(8)
Calls-to-action	8(6)	59(27)
Incentives/giveaways	5(4)	3(1)
Limited time/seasonal item	0(0)	1(0.5)
Viral marketing	39(29)	42(19)

*% are a proportion of total posts containing food products/brands (N)

Discussion

This study provides preliminary insights into the frequency of posts featuring food products/brands, the most featured food categories, the healthfulness of products, and the marketing techniques most often used by SMIs popular with adolescents, while considering gender. The results highlight differences in posts among SMIs popular with males and females, including the frequency of posts containing food products/brands and the variance of marketing techniques, as well as the proportion of energy drinks and unhealthy food products being shared by SMIs popular with males.

Frequency, food categories, and healthfulness

Adolescents are heavily exposed to food marketing on various mediums (35). SMIs are burgeoning in popularity among adolescents and have an influence on adolescents' dietary patterns (19). In this study, SMIs popular with males posted one food product/brand for every 2.5 posts, whereas those popular with females posted one food product/brand for every 6 posts. Further, most food products promoted by both SMI groups were unhealthy. Differences amongst SMI groups were noted, with SMI popular with females featuring 54% of food products as less healthy or "of concern from an advertising perspective", compared to 89% for SMI popular with males (32). These results hold significance, considering research highlights that boys have an increased susceptibility to the influence of food marketing compared to girls (26). The notable prevalence of unhealthy food content and increased instances of food marketing by social media influencers popular among males may indicate a troubling trend in heightened exposure to unhealthy food products for boys, potentially leading to adverse short- and long-term health consequences (2).

We also observed that SMIs popular with a certain sex posted their content to platforms predominantly used by individuals of the same sex/gender. For instance, SMIs popular with males predominantly created content on YouTube, aligning with trends that a higher proportion of boys use YouTube compared to girls (36). Trends and patterns have been observed for platform preferences between boys and girls (37). Boys are more drawn to YouTube content, particularly gaming videos, sports highlights, or technology related videos. TikTok focuses on visual and short-form content, which appeals to girls, as they tend to enjoy sharing photos, videos, fashion, beauty, and creative content (38). A SMIs choice in platform selection could reflect an awareness of demographic preferences, suggesting they are intentional in reaching

certain audiences. Food companies may also capitalize on this awareness, selecting specific SMIs who are on certain platforms to promote their products. The relationship between the popularity of a SMI, their platform choice, and the demographic composition of platform use emphasizes the importance of considering platform specific dynamics in influencer marketing strategies.

In the contemporary landscape of social media, the promotion of food products by SMIs can shape consumer perceptions, preferences, and behaviors. For both SMI groups, restaurants, including fast food, were among the top three most featured food products. It is not surprising that restaurants, including fast-food, were common among both SMI groups. These findings align with other research that highlights the frequency of fast-food marketing in digital media and traditional media (12, 19, 35).

For SMIs popular with males, the most featured products were energy drinks, restaurants, and snacks. While this study did not investigate exposure, this suggests that boys may be exposed to energy drink marketing more frequently than girls. Other research has noted how male adolescents reported greater exposure to online energy drink marketing compared to their female counterparts (39). There is a widespread prevalence of energy drink marketing, particularly on social media and livestreaming platforms like Twitch, Facebook gaming, and YouTube, platforms that are more favored by boys than girls (37, 39). Energy drink marketing is presently directed primarily towards boys, and this approach appears to be effective, as reflected by higher levels of energy drink consumption among boys compared to girls (39–41).

Marketing Techniques

A variety of marketing techniques were used by each SMI group. The most common across all platforms and amongst both groups were displaying the product using a positive or

neutral context and the product being consumed. These techniques are not surprising, given the nature and intent of marketing. The ubiquity of food products/brands presented in a positive or neutral context found in our results aligns with other literature (19, 42). These results are noteworthy, as positive presentations of unhealthy food by SMI can translate into a positive view of these foods and brands by adolescents, leading to unhealthy dietary patterns (43).

There were differences between the techniques more commonly featured by SMIs popular with males versus females. The use of songs or music, the use of other influencers, appealing to fun or cool, viral marketing, appeals to beauty, and the presence of teens were marketing techniques more commonly used by SMIs popular with females, whereas SMIs popular with males more commonly featured calls-to-action (prompts for additional actions beyond the initial advertisement (44)), and price promotions. Creating techniques that appeal to an intended audience can include the use of gender stereotypes and norms (25). Recent research has found that a small sample (n = 139) of boys and girls aged 12 to 16 were exposed to statistically different marketing techniques based on their gender, suggesting targeted marketing (25). The public health impact of targeted marketing is significant, as it can create health disparities (45).

Traditional gender roles and societal expectations can shape preferences and interests, resulting in SMIs using these as marketing techniques. It is no surprise that appeals to beauty were only present among SMIs popular with females and not males. Influencers will tailor their content to align with the interests of their target audiences and adapt their techniques to the platform preferences of those audiences (46). For example, the use of music and beauty appeals is more commonly found on TikTok, a platform more popular with girls, while calls to action are emphasized more on YouTube, which is favoured by boys (36). Understanding the content and

marketing messages endorsed by SMIs can provide insights into the interplay between influencers and audiences, supporting the discovery of more gendered nuances of social marketing.

Power of SMIs

The influence of SMIs on consumer behavior has become a subject of growing interest. SMIs represent a unique and dynamic marketing technique in themselves, serving as relatable and influential figures who engage with audiences on a personal level (47). SMIs perceived authenticity and direct connection with followers distinguish them from traditional advertising methods. Social media platforms have provided influencers with unprecedented reach and access to diverse audiences, enabling them to impact consumer choices and preferences (20).

A recent qualitative study that explored how adolescents engage with unhealthy food marketing in online settings found the most frequently mentioned marketing technique was the use of a SMI (24). Nearly all participants in the study reported following at least one influencer. Participants also expressed a strong inclination to purchase products endorsed by a SMI due to the trust they placed in them, which by extension, translated to a positive reaction to the promoted products (Amson et al., 2024). This observed trust aligns with several findings underscoring the significant influence SMIs wield over adolescents' food preferences (20, 21, 48). This degree of trust is what links adolescent food choices, increased recall, and consumption of unhealthy foods, to SMI food promotion (21). Adolescents ate more unhealthy snacks and had a higher caloric intake after viewing videos of SMIs endorsing foods like cookies, candy, and chocolate (20). Furthermore, adolescents showed a preference for food posts when they belonged to a celebrity, influencer, or peer, opposed to posts from a food company (21). Given this, the

food industry could be strategically leveraging SMIs as a marketing tool to promote their products, revealing a calculated approach in targeting specific populations, such as adolescents.

Gender roles and societal expectations can influence food choices (49). For instance, if male SMIs popular with males promote indulgence in unhealthy and high-calorie foods, their male followers may be more inclined to adopt these eating habits to conform to that SMI. Similarly, female influencers who endorse specific food choices have the potential to persuade females, potentially shaping the consumption behaviors of their female followers. An interesting observation from a small sample study revealed that female audiences engaged with both female and male influencers, while males predominantly followed only male influencers (24). If this observed trend is generalizable, it suggests that females might be exposed to a more diverse range of marketing techniques and products compared to their male counterparts. This nuanced relationship between gender, SMIs, and food choices is a complex interaction of relatability, targeted marketing, and social norms. Recognizing these factors can help adolescents become more mindful media users, critically evaluating the content they encounter on social media platforms.

Implications

The landscape of food marketing has transformed, with SMIs becoming influential intermediaries between brands and consumers (47, 50). This shift is particularly significant when targeting adolescents, a demographic highly susceptible to marketing influences who are actively engaged in social media (7). In safeguarding adolescents against the multifaceted influences of social media, particularly exposures to SMIs, a three-pronged strategy including parental involvement, media literacy, and policy presents as an approach.

Parental involvement can be a protective factor for obesity prevention whereby they endorse and model healthy eating patterns, foster critical thinking about food marketing, and engage in open and informed discussions about food (51). Research initiatives from the USA and Jamaica emphasize the role of parent–child communication as a catalyst for obesity prevention (52). This is further reinforced by a small qualitative study that revealed the potential protective influence of parents on adolescents' food choices. This notion was mostly cited by girls in the study (24).

Parental influence on attitudes toward food and healthy eating exhibit gender-based differences (51). Parents typically show greater concern for the diets and body weight of their daughters compared to their sons (53). Healthy eating is not as emphasized or discussed by men and consequently, they may be less aware of their dietary patterns and its consequences (53). Understanding how gender shapes adolescents' responses to food marketing, how SMIs may be targeting their child, and recognizing current food norms can guide parents in providing tailored support to their child's unique needs, fostering better evaluative skills in response to food marketing.

The second facet of this strategy involves bolstering media literacy, where the combination of family discussions, critical analysis of media messages, and educational components about media use collectively empower adolescents to assess and discern information (52). Educating adolescents about social media, particularly SMI marketing, is needed to enhance their ability to recognize these persuasive tactics (54). While media literacy programs have demonstrated effectiveness, several challenges exist, such as the absence of a standardized marketing literacy curriculum, difficulties integrating interventions into the school setting due to existing curricular constraints (55), and teachers requiring specific knowledge and skills to

implement such a curriculum, necessitating their own refinement of marketing literacy (56). Nevertheless, more robust media literacy among adolescents can cultivate awareness and critical thinking about their social media exposures, with particular attention to gender nuances and the targeted efforts of food companies and SMIs based on gender stereotypes and norms.

Lastly, policies designed to monitor and restrict unhealthy marketing practices that effect adolescents are needed, as currently children are the focal point (10). Impactful policies need to consider restricting the persuasive power of food marketing, such as influencer and celebrity endorsements. Suggestions have been made to enforce advertising disclosures to support adolescents in recognizing sponsored content as advertising; however, the effectiveness of such disclosures has produced mixed results (57). Further, the absence of a coordinated international approach to influencer marketing regulation poses challenges, with variations in enforcement and guidelines across countries (58, 59). The diversity of disclosures poses challenges, considering the global reach of platforms and the potential for adolescents to follow influencers from different countries.

Moreover, developing comprehensive food marketing policies necessitates an understanding of gender dynamics. Gender analyses of food marketing content is important for evaluating gender-specific messaging and biases, guiding policies that discourage the perpetuation of gender portrayals in marketing, and for uncovering targeting patterns so that policies can be responsive to the emerging marketing trends impacting different gender groups. Recognizing adolescents' heightened susceptibility to marketing, regulations addressing gender dynamics in marketing strategies targeted at this demographic, including content restrictions based on nutrient profiling models, are essential (60). By integrating these policy considerations, an environment can be created that actively addresses the complex intersections between gender,

dietary choices, and marketing influences. This approach reflects a commitment to fostering equity and promoting health-conscious decision-making in the realm of food marketing. Combing parental involvement, media literacy, and policy can contribute to synergistically creating a healthy social media environment for adolescents, mitigating the potential negative impacts of SMI exposures.

Strengths and Limitations

To our knowledge, this is the first study to examine social media posts across three platforms shared by SMIs popular with Canadian adolescents. It is important to highlight that while our study focused on SMIs popular with adolescents in Canada, many of these influencers are popular in other countries. This suggests that the potential impact and reach of marketing by these SMIs extends beyond national borders. Despite this, this study has several limitations. Actual exposure was not captured. Instead, this study captured the frequency or potential exposure to food marketing by examining posts of SMIs popular with males and females. It was also not feasible to code every YouTube video, and as such, a 50% sample was used and weighted frequencies were applied. This in turn only provides an estimate for the total number of posts containing food products and brands on YouTube and may not be reflective of the actual total. Additionally, our study may not be representative of all potential posts as the researchers reviewed posts dated from June 1, 2021, to May 31, 2022, but they were collected from October to December 2022. This allowed the potential for SMIs to delete posts that we cannot account for. Further, due to the popularity of one of the SMIs being prevalent with both males and females, statistical analyses could not be undertaken, as the samples were not independent. The SMIs included in this study are a small sample size with a disproportionate SMI sex representation (4 male SMIs and 1 female SMI), which could impact the generalizability of

findings, as the limited female representation may not fully capture the diversity of influencer content targeted at girls. Additionally, the presence of Mr. Beast in both samples could skew the comparisons. Nevertheless, this study offers insights into what adolescents may be exposed to while viewing posts by their preferred SMI. By understanding how and how often influencers promote unhealthy food products/brands, we can gain a deeper understanding of the evolving social and cultural landscapes shaped by digital media. Future research could investigate how SMI content impacts the eating and purchasing behaviors of adolescent boys and girls.

Conclusion

Our research sheds light on the food marketing content posted by SMIs popular among adolescent boys and girls. The differences in SMI preferred platforms, food categories, and marketing techniques suggest they are tailoring their content to specific demographics. This adaptation implies an awareness of audience preferences based on sex/gender, influencing both content creation and promotional strategies. The disparities in food posts among influencers emphasizes the importance of recognizing gender-specific dynamics in influencer marketing. Understanding how influencers engage with their audiences, considering gender nuances, can guide more effective and responsible marketing practices to protect adolescents. Further studies exploring the implications of these differences on consumer behaviors, health outcomes, and societal perceptions will be instrumental in advancing our understanding of the multifaceted influence of SMIs in shaping food marketing trends.

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Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: DH has provided paid expert testimony on behalf of public health authorities in response to legal challenges from the food and beverage industry. EP received an honorarium from the Stop Marketing to Kids Coalition (2018) and Heart and Stroke (2023) for policy or advocacy work related to food marketing to children. She is currently employed by Heart and Stroke. All other authors declare that they have no competing interests to disclose.

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Supplementary Files This is a list of supplementary files associated with this preprint. Click to download.

Chapter 3: Discussion

This research demonstrated that gender does play a role in the digital marketing of food as viewed by adolescents. The first study highlighted how exposures to marketing techniques and the healthfulness of food products, differed by a participant's gender. Complementing this, the second study unraveled the nuanced ways in which adolescents' interactions with digital food marketing content can be influenced by gender. Finally, considering the overwhelming consensus of the power of SMIs, the last study explored SMI posts containing food, offering insights into the relationship between social media, SMIs, and potential gender norms shaping adolescents' dietary behaviours. Together, these studies provide a foundation for considering gender and digital food marketing.

Summary of Findings by Study

Study 1

This study examined whether adolescents' exposure to digital food marketing differed by gender. Our results were consistent with our hypothesis in that gender differences were observed. In analyzing food marketing exposures on social media, boys and girls encountered a similar number of marketing instances; however, notable gender differences emerged in the types of food products and marketing techniques viewed. A higher percentage of girls (67%) viewed food products high in total fat compared to boys (35%) ($P = 0.02$). Overall, fast foods dominated marketing exposures, confirming a universal trend in online food marketing viewed by youth [32, 33].

The marketing techniques that participants viewed differed by the gender of the participant. Boys were significantly more likely to see instances of food marketing that featured a male as the dominant user (50% vs. 22%, $P = 0.03$); appeals to achievement (42% vs. 17%, P =

0.04); influencers (42% vs. 14%, P = 0.02); and appeals to athleticism (35% vs. 11%, P = 0.03). These findings echo those of a recent scoping review [62] and suggest that strategically featuring marketing techniques such as appeals to achievement and athleticism in food marketing effectively embeds a product within sociocultural ideals that are idolized by, in this instance, boys and men [163]. By aligning with such values, companies convey their products as having greater significance and appeal to a particular gender. This poses a concern considering the potential associations that can be established between gendered stereotypes and unhealthy foods [130].

On the other hand, girls were more likely to encounter instances of food marketing that featured quizzes, surveys, or polls (25% vs. 0%, P = 0.01). This becomes challenging as young women interacting with such content may not fully discern the promotional nature as it is disguised as interactive or advertainment content [94]. These findings highlight gender-specific differences in the exposure and nature of food marketing techniques viewed by adolescents on social media, with implications for targeted marketing and potential impacts on dietary behaviours. Exposing marketing techniques that are entrenched in gender stereotypes is needed to support policymakers, public health practitioners, and educators to craft more precise interventions and policies that mitigate the potential adverse repercussions of gendered food marketing on adolescents' dietary health outcomes.

Study 2

The results of this study highlighted the role gender plays in adolescents' perceptions of digital food marketing. The findings offer contextual meaning to the interactions experienced by adolescents when viewing digital food marketing on social media. Key themes surfaced including the significance of protective elements like familial influence, the recognition of

marketing techniques, and the impact of SMIs on molding the dietary preferences of adolescents. Notably, gender differences emerged among the participants.

Girls perceived family as a protective factor more frequently than boys and identified a wider array of marketing techniques. They were also exposed to instances of alcohol marketing while scrolling through their social media while boys in this study were not. Further, girls were more likely to believe in gender-based differences in marketing strategies than boys as noted by one female participant “I mean maybe I don't think my boyfriend would get a lot of Starbucks ads. I feel like they're more targeted towards like girls I get a lot of them. But when I'm using someone else's like my brothers or my boyfriend's phone I don't see a lot of Starbucks ads. I'd see like other type of ads. A lot of like girls are more interested in going to Starbucks and boys think that going to Starbucks is like not cool” [164].

Additionally, boys and girls exhibited different types of engagement with food marketing content on social media. Girls were more likely to create and share user-generated content while boys engaged in more individualistic interactions (e.g., likes and comments). Trust in SMIs and celebrities was prevalent among both genders, although boys predominantly followed male influencers while girls followed both male and female influencers. Girls' awareness of a broader range of marketing techniques and exposure to alcohol marketing, coupled with their higher likelihood of sharing content, suggests they might be more vulnerable to diverse marketing techniques, while boys' individualistic engagement points to different, yet equally impactful, marketing influences.

The results of this study are concerning because they reveal notable gender differences in how adolescents perceive and engage with digital food marketing, highlighting the ways in which food corporations may exploit these differences. By unraveling the role of gender in

digital food marketing through the lens of adolescent experiences, this research can inform and empower adolescents to recognize gender-specific marketing techniques and develop strategies to resist or mitigate their influence. Indeed, by integrating parental involvement, regulatory policies, and insights from adolescents, stakeholders can collaboratively cultivate a more holistic and health-promoting social media environment for this vulnerable demographic. Such comprehensive efforts are essential in constructing a supportive framework that not only protects adolescents from the deleterious impacts of unhealthy food marketing but also nurtures environments that facilitate their overall development and well-being.

Study 3

SMIs exert an influence on the dietary preferences and behaviours of adolescents [94, 156]. A frequently underestimated aspect is how gender may also contribute to this influence, wherein influencers either bolster or challenge gendered food norms through their social media posts. This study was born out of the findings from the second study and provides information into how the combination of gender and SMIs may be used in digital food marketing. Our results were consistent with our hypothesis demonstrating gender differences. These were observed in the frequency and healthfulness of food posts among SMIs popular with males and females, as well as variations in marketing techniques used.

SMIs popular with males featured food products more frequently than their female counterparts, with a ratio of 1 food product/brand per 2.5 posts compared to 1 food product/brand per 6.1 posts, respectively. Influencers popular with females primarily featured water (27%), while those popular with males predominantly featured restaurant-related content (24%). Notably, SMIs popular with males posted a higher prevalence of less healthy food products (89% versus 54%).

Marketing techniques varied between genders. SMIs popular with females more commonly incorporated songs or music (53% vs. 26%), other influencers (26% vs. 11%), appeals to fun or coolness (26% vs. 13%), viral marketing (29% vs. 19%), and appeals to beauty (11% vs. 0%). In contrast, SMIs popular with males more frequently used calls-to-action (prompts that encourage consumers to take a specific action, such as purchasing a product or engaging with brand content on social media) (27% vs. 6%) and price promotions (8% vs. 1%). Moreover, gender-specific platform preferences were observed, with SMIs aligning their content with platforms predominantly used by individuals of the same gender. For example, SMIs popular with males had a stronger presence on YouTube, while SMIs popular with females were more prominent on TikTok. These platform differences have also been noted elsewhere [155, 156].

These findings illustrate distinct gender-based differences in the food marketing techniques and the social media platforms used by SMIs, potentially reflecting and reinforcing differing consumer behaviours and preferences. The landscape of digital food marketing has undergone a shift, with SMIs emerging as influential intermediaries connecting brands and products to consumers. Using SMIs in digital food marketing could play a role in the normalization of overconsuming unhealthy food products. This holds particular significance for adolescents who are highly susceptible to marketing influences, particularly SMIs, and actively engaged in social media platforms [107]. Adolescents, being molded by social media content, including that posted by SMIs they follow can have their dietary preferences and behaviours shaped by these interactions. Recognizing gender differences in the food content posted by SMIs may contribute to variations in dietary habits and subsequent health outcomes among adolescents.

Gender Differences and Digital Food Marketing

Exposures

Volume

Analyzing gender differences in adolescents' exposure to digital food marketing revealed notable variations that warrant attention. Study 1 measured the volume of digital food marketing posts adolescents were exposed to. Both boys and girls were exposed to comparable volumes of food marketing with a median of 2 instances per 10-minute period for both groups (Mann–Whitney U = 237, P = 0.51). However, a study examining the exposures of social media food promotions by Australian adolescents showed that, in a span of 10 minutes, female adolescents encountered a significantly higher number of food-related promotions than their male counterparts ($p < 0.01$). The median number of exposures for girls was 19.0 (12.3 to 25.8) while for boys it was 7.3 (3.9 to 12) [59]. Further, findings from six studies from a recent scoping review [165-170] examined gender differences in exposure to television marketing content, indicating that boys were exposed to food advertising more frequently than girls. However, boys in these studies reported spending more time watching television, which is likely a contributing factor to higher exposures.

The findings from these studies differed from our first study findings. This may be due to the nature of exposure (e.g., television versus social media), the timing of the research (e.g., data taken from 2019 versus 2022), and the breadth of platforms. For instance, in our study TikTok was not a prominent platform that was used, but in the study by van der Bend et al., TikTok proved to be a popular platform containing food posts [59]. Additional research on digital food marketing exposures by gender is required to achieve more conclusive results.

Healthfulness

Findings stemming from our first study show that girls encountered more marketing content featuring elevated levels of salt, sugar, and fat compared to boys [171]. Particularly

noteworthy was that girls were exposed to significantly more instances of marketing endorsing products rich in total fat (67% versus 35%, P = 0.02) [171]. Further, the majority (64%) of girls were exposed to marketing content showcasing ultra-processed foods [171]. In 2015, ultra-processed foods accounted for nearly 50% of the daily caloric intake for Canadian females aged 13–18 and 53% for males [27]. Despite historically healthier dietary patterns among women and girls attributed to their heightened health consciousness relative to boys [151] the pervasive promotion of ultra-processed foods via social media platforms threatens to disrupt this trend. If left unchecked, this phenomenon could potentially contribute to elevated rates of obesity and chronic diseases among girls and perpetuate rates among boys.

Variances in potential exposures to food products were complemented by findings from our third study, which demonstrated gender disparities in the promotion of food categories by SMIs [172]. Water emerged as the primary food category endorsed by SMIs popular with females, constituting 27% of promotions, whereas restaurant foods took precedence among SMIs popular with males, representing 24% of endorsements [172]. Other research has documented the higher percentage of females following brands such as Smart Water on Instagram [173]. Social media influencers and food companies may be attuned to certain food preferences, thus explaining their promotion of water products to capture female audiences' attention.

Notably, SMIs popular with males more frequently promoted less healthy food items compared to SMIs popular with females (89% vs 54%) [172]. The higher prevalence of unhealthy food endorsements by SMIs popular among males compared to females raises concerns regarding dietary influences and may be a contributing factor to higher obesity rates and sugar, salt, and fat intakes found in males [15]. This presents an issue not only pertinent to boys but also potentially affecting girls. Findings stemming from our second study revealed that

girls exhibited a propensity to engage with a multitude of SMIs, whereas boys predominantly interacted with influencers of their own gender [164]. The inclination of girls to follow a diverse array of SMIs may consequently expose them to a wider spectrum of marketed products that are unhealthy.

Marketing exerts a pivotal influence by not only reflecting but also shaping prevailing social norms and gender perceptions [174]. Social and cultural norms wield significant sway over individuals' food preferences [152]. Adolescents in their quest for autonomy and conformity within their social circles, including on social media, can adopt unhealthy behaviours such as excessive consumption of ultra-processed foods. The ubiquity of food marketing, particularly by SMIs, poses a risk of normalizing unhealthy dietary practices [156].

Social Media Platforms

Findings from our first study found platform-based gender differences, echoing other research findings. Our results found that boys gravitated towards Facebook and YouTube, while girls preferred Instagram and Snapchat [171]. Available literature corroborates our findings, showing patterns in social media usage revealing that girls favour Instagram, TikTok, and Snapchat, while boys prefer YouTube and Facebook [155, 156]. Other research found Pinterest stood out as a platform where instances of food marketing were exclusively documented by girls [155]. Such disparities may lead to differences in exposure to certain types of content, including food advertising. If platforms like Pinterest, which is primarily used by girls promote unhealthy foods it may result in disproportionate exposures.

Moreover, observations from our third study further corroborate the choice of social media platform and the gender composition of a SMIs audience. For instance, SMIs popular among males tend to focus their content on YouTube, catering to boys' preferences for gaming, sports, and technology-related videos [175]. In contrast, TikTok known for its short and

informative content regarding trendy items, is favored by girls [176]. This seemingly intentional selection of platforms by SMIs and their sponsors suggests an awareness of demographic preferences, which food companies may exploit by aligning with specific audience demographics. Therefore, understanding the interplay between SMI popularity, platform selection, and audience demographics is essential for anticipating and mitigating potential negative impacts on adolescents.

These findings emphasize the importance of understanding platform-based gender dynamics in social media usage and their implications for adolescents' exposure to digital food marketing. By identifying how different demographics interact with SMIs and the types of content they consume, policymakers and public health advocates can design better regulatory frameworks and educational programs aimed at reducing adolescents' exposure to digital food marketing. By recognizing that boys lean towards Facebook and YouTube while girls prefer Instagram and Snapchat, health educators and policymakers can design more effective, targeted campaigns and be more mindful of marketing techniques that are dominant on those platforms (i.e., Snapchat and quizzes).

Marketing Techniques

Overall

Findings from our research found gendered differences in marketing technique exposures and identification. In our first study, boys exhibited a significantly higher likelihood of encountering instances of food marketing depicting a male as the predominant user (50% vs. 22%, P = 0.03), appeals to achievement (42% vs. 17%, P = 0.04), influencer endorsements (42% vs. 14%, P = 0.02), and appeals to athleticism (35% vs. 11%, P = 0.03). Conversely, girls were significantly more likely to encounter instances of food marketing incorporating quizzes, surveys, or polls (25% vs. 0%, P = 0.01) [171]. The types of digital marketing techniques that

boys were exposed to suggests that marketers are leveraging themes of masculinity, success, and physical prowess to appeal to boys. In contrast, girls are more frequently exposed to digital food marketing that incorporates interactive elements such as quizzes, surveys, or polls. This indicates that marketers are using engagement-driven and potentially more socially interactive content to attract the attention of girls. These findings suggest that food marketing techniques are distinctly gendered, with boys and girls being targeted differently.

In our qualitative study, girls were able to identify a greater variety of marketing techniques compared to boys, including elements such as colors, contests, music, and humor [164]. Consistent with previous research, visual effects emerged as the predominant marketing technique identified by girls [76]. In contrast, boys showed a limited capacity to recognize a diverse array of techniques [164]. The difference in marketing technique recognition is worrisome as it highlights a potential disparity in the susceptibility of boys and girls to marketing influences.

Boys showing a limited capacity to recognize a diverse array of marketing techniques could suggest that they are less equipped to critically evaluate and resist advertising messages they encounter. While girls in our study may be more adept at identifying various marketing techniques, this does not imply immunity to their influence. For instance, an Irish study involving focus group discussions, participant observations, and in-depth interviews with adolescent girls aged 12-14 revealed that despite the girls claiming awareness of hidden advertisements, they struggled to recognize the hidden commercial messages and were unaware of their persuasive intent [177]. This suggests that a superficial understanding of marketing techniques does not necessarily protect adolescents from being influenced by them. Understanding gendered differences when it comes to digital food marketing is essential for

monitoring trends and reviewing a full array of marketing techniques as food companies may strategically exploit certain techniques to target specific genders.

Results from our third study imply that food companies, and by virtue SMIs, may strategically target girls and boys differently using enticing marketing techniques. For example, companies may be using targeted marketing to bolster the consumption of ultra-processed foods among girls and women, a traditionally health-conscious demographic [178]. This tactic may serve to recalibrate social norms, potentially steering girls towards increased consumption of unhealthy foods. It is imperative to examine gendered targeting methods (e.g., featuring males and athletics or women and beauty) used by companies and SMIs.

Recognizing and countering the influence of digital food marketing techniques are needed for developing media literacy programs that would support adolescents. Indeed, the persuasion knowledge theory suggests that enhancing adolescents' persuasion knowledge is important as it equips them to recognize or comprehend the persuasive intent of advertising (conceptual dimension) and fosters more critical or adverse attitudes towards advertising (evaluative dimension) [179]. Theoretical and review articles argue that both dimensions of persuasion knowledge play a pivotal role in an individual's capacity to navigate persuasion attempts within advertising contexts, consequently affecting their behavior [180-182].

The persuasion knowledge theory can be effectively applied to support adolescents in combating digital food marketing by enhancing their ability to critically evaluate and resist persuasive advertising techniques [179]. It is crucial to consider gender when addressing digital food marketing targeting adolescents as marketing techniques exploit gender norms and stereotypes, which can differentially impact boys and girls [171]. By incorporating or enhancing media literacy education into school curricula with a gender-sensitive approach, adolescents can

learn to recognize various marketing strategies, such as product placements, influencer endorsements, and emotional appeals, and those tailored to their gender.

Awareness campaigns and interactive learning tools can also enhance adolescents' conceptual understanding of advertising's intent [183]. Additionally, critical thinking exercises and peer discussions can strengthen their evaluative skills, making them more critical of and disinclined towards advertising including the potential influence of gender-targeted advertising on their perceptions and behaviors [183]. Given the gender disparities in exposure to and recognition of various marketing techniques, media literacy programs could equip both boys and girls with the skills to critically analyze and interpret advertisements. Special attention should be paid to empowering boys to recognize and analyze a diverse array of marketing techniques, as our findings suggest they may have a limited capacity compared to girls [164]. Providing boys with the tools to identify and resist persuasive tactics employed by marketers can help mitigate their vulnerability to advertising influences and subsequently have an impact on male obesity rates.

Additionally, media literacy programs should encourage critical thinking skills and promote discussions around gender stereotypes and representations in advertising [184]. By fostering an understanding of how gender norms are perpetuated and reinforced through marketing messages, adolescents can develop a more discerning approach to media consumption and make informed choices about their food behaviors. This heightened awareness can empower them to recognize and resist marketing techniques that exploit gender stereotypes, ultimately contributing to healthier and more equitable consumption patterns. Furthermore, integrating these discussions into media literacy education can help adolescents become more conscious of

the broader societal impacts of advertising, promoting a culture of critical media engagement and informed decision-making.

Overall, by addressing the gender disparities in exposure to and recognition of marketing techniques, media literacy programs have the potential to empower adolescents to navigate digital marketing and make healthier choices in their consumption behaviors. However, media literacy, a downstream strategy, needs to be layered with upstream policies, such as the regulation of food marketing to provide a comprehensive approach to protecting adolescent health and well-being. This dual approach ensures that while adolescents are educated to critically evaluate marketing messages there are also systemic measures in place to reduce their exposure to harmful advertising practices.

Boys

In our first study, it was observed that boys encountered a higher number of food marketing instances featuring product users that were male. This pattern was also identified in a scoping review where male characters were more prominently featured in television advertisements, either through imagery or voice-overs, compared to females [62]. The prevalence of male-dominated marketing is concerning. Findings from Ogle et al.'s experimental study revealed that children tend to prefer food products adorned with licensed cartoon characters of their own gender [185]. Results from Higgins et al. further demonstrate the effectiveness of advertising campaigns tailored to gender (and age), resulting in notable increases in engagement through gender-specific marketing strategies [186]. Moreover, findings from studies on alcohol and tobacco have noted that marketing has the capacity to sway individuals by representing relatable traits like gender [49, 145]. These results highlight the potential motivations behind marketers' use of gendered marketing techniques to capture the attention of a specific demographic.

When adolescents relate to a person or character promoting a food item, especially if they share the same gender, they tend to prefer that product regardless of its nutritional value [130]. This concept could explain the deliberate use of gender in marketing to appeal to viewers, illustrating a trend toward individualized, gender-specific marketing strategies. Drawing parallels from the strategies used in tobacco, alcohol, and targeted racialized marketing, it can be inferred that food marketers may be capitalizing on existing sex and/or gender differences to influence consumer behaviour, thereby reinforcing and deepening sex-/gender-based preferences for specific foods [151].

Additionally, our results revealed that boys were significantly more likely to view food marketing instances featuring appeals to achievement, athleticism, and the presence of influencers [171]. Interestingly, athleticism and sports were a noted marketing technique by a female participant in our second study - “Yeah, [boys] get a bit a bit more of sports enhancement like sports and enhancement drinks than I do. I get a bit more like fast food or people try to promote like, I guess, healthier stuff” [164]. Achievement, athleticism, and masculinity in food marketing have also been noted in other findings [163]. For example, a study investigating how pre-adolescent children respond to food packaging found that boys favoured those that emphasized athleticism. This was due to the relatability of stereotypical masculine traits [187].

Leveraging influencers like athletes to endorse food products introduces a sense of accomplishment, prompting viewers to link product consumption with achievement. This was reinforced from participants in our second study whereby boys primarily followed male influencers including athletes [164]. One male participant highlighted his positive perception of products endorsed by an athlete noting, [Based on Ronaldo (athlete)] “I would see it as a source of energy for performing because he’s an athlete” [164]. Using influencers, particularly sports

personalities to advertise unhealthy food can create a health halo, deceiving adolescents into believing these items possess health benefits [188]. These results are alarming, particularly because celebrities and influencers promote unhealthy foods notably more than healthier alternatives [130].

Girls

A higher percentage of girls were exposed to food marketing instances of polls, surveys, or questionnaires [171]. Girls exhibit an inclination towards activities centered on communication and information exchange, such as surveys, whereas boys typically gravitate towards seeking information [189]. However, the variety in polls, surveys, and questionnaire exposure could originate from the social media platform itself, particularly Snapchat, which is more commonly used by girls and integrates interactive functionalities like polls [76, 171].

Corporations might use surveys, polls, and questionnaires as tactics to attract women to engage with their products. The risk associated with engaging in surveys, polls, and questionnaires from food companies is that girls may be less aware of the underlying marketing intent, as it is disguised within interactive content [124]. Moreover, adolescents who actively participate in online content are more likely to share and create similar content, thereby perpetuating or establishing social norms surrounding food and dietary behaviours [94].

Gender-based differences were also evident in the marketing techniques utilized by SMIs catering to male versus female audiences. Techniques such as incorporating songs or music, collaborating with other influencers, evoking notions of fun or coolness, employing viral marketing strategies, appealing to conventional beauty standards, and featuring teenagers were more frequently used by SMIs popular with female audiences [164]. These observations highlight the power of traditional gender roles and societal norms on marketing techniques,

particularly evident in the exclusive presence of beauty appeals among SMIs popular with females.

SMIs

Unsurprisingly, the most cited marketing technique by both genders was SMIs [164]. The pervasive influence of SMIs and celebrities on adolescents' purchasing decisions is striking, with participants expressing a strong inclination to buy products endorsed by these figures due to the trust they place in them [164]. For example, one female participant stated, “Yes, like if some random person on Instagram were to show me an ad for a new drink, I probably wouldn't buy it but if Arianna Grande were to tell me that this drink at Starbucks is amazing, I'd probably go try it out right now” [164]. Similar sentiments were expressed by male participants, with one saying “Somehow, I would feel its important to have it. Drake is a top influencer, so if he’s advertising it, then it’s a good product. Same thing with Chris Brown. I automatically think it’s a good product” [164]. This expressed trust echoes similar findings from prior research emphasizing the influence that SMIs have on adolescents' dietary decisions [94, 128, 129]. This is concerning, as SMI endorsements predominantly feature unhealthy food products and exposure to these promotions has been linked to increased recollection and consumption of unhealthy foods among adolescents [94].

Gender-based disparities in the types of influencers adolescents follow were also present, with boys following male SMIs including athletes and rappers, while girls reported following a mix of male and female actors, musicians, and lifestyle influencers [164]. The observed gender preferences are unsurprising, as prior research has indicated that female influencers exert a stronger influence on females, while male influencers hold more sway over males [190]. These gender differences can be explained by Social Cognitive Theory, suggesting that adolescents model behaviours observed in influencers they admire [131].

SMIs will also modify their content to resonate with the interests of their target demographics and adjust their strategies to align with the platform preferences of their audience [126]. For instance, our third study found that SMIs most popular with females posted more food related content on TikTok, and incorporated beauty appeals in their posts. TikTok, a platform predominantly favored by girls, displays posts with a higher prevalence of music and beauty appeals suggesting a deliberate effort by SMIs to engage with their audience effectively. Such findings emphasize the importance of considering platform dynamics and audience preferences in content creation.

An analysis of the content and marketing messages endorsed by SMIs offers valuable insights into the dynamics between influencers and their audiences, facilitating a deeper understanding of the gendered nuances in digital food marketing. When SMIs align their marketing techniques with traditional gender norms, they not only reinforce existing societal expectations but can also perpetuate gender-specific consumption patterns. Understanding these distinctions is needed for addressing the broader implications of gendered marketing on adolescent dietary habits.

Gendered Food Marketing and Adolescent Health

Nationally and internationally, adolescent boys often exhibit elevated rates of obesity and consume higher quantities of salt, sugar, and fat compared to girls [14, 24]. Comparatively, Canadian boys aged 14 to 18 consumed more daily sugar (170g vs 130g), sodium (3320mg vs 2350mg), and total fat intake (13.4% vs. 12.9%) than their female counterparts [15, 20]. This heightened consumption may stem from greater energy demands but is likely influenced by food marketing tailored to this demographic. These concerning patterns emphasize the need for

targeted public health interventions tailored to tackle the distinct health challenges faced by adolescent boys.

Similar to tobacco, food companies may strategically use marketing techniques tailored to appeal to girls and women, a demographic traditionally characterized by health consciousness [151]. This targeted approach would aim to increase the consumption of ultra-processed foods among individuals who are typically more health conscious, potentially reshaping existing social norms around dieting and weight loss while simultaneously normalizing the consumption of unhealthy foods. Marketing plays a significant role in mirroring societal norms and gender expectations while also actively molding them [152]. Social and cultural norms can shape food preferences, including those perpetuated through social media [94]. The pervasive presence of digital food marketing, especially that featuring ultra-processed products, can contribute to the formation of normative views regarding diet and eating behaviours [156].

The evolving landscape of digital food marketing depicts an environment where the overconsumption of ultra-processed foods is heavily promoted and normalized [156]. Given this scenario, it becomes imperative for researchers to delve into the techniques used by companies to target consumers based on gender, with a view to developing targeted digital food marketing regulations. While women and girls have historically exhibited healthier dietary patterns due to their heightened health consciousness compared to boys, the proliferation of ultra-processed food products through social media platforms could be ushering in a new reality [151].

Policy and Regulation

Globally, most government regulations aimed at reducing children's exposure to unhealthy food advertising are voluntary, primarily focus on broadcast media (e.g., television), and protect children under 12 or 13 years [191]. Some jurisdictions such as Chile and Portugal

have implemented mandatory regulations extending to non-broadcast media, including social media. These efforts highlight the growing recognition of the need to adapt regulatory frameworks to the evolving digital landscape to better safeguard the health of young audiences.

Chile has enacted regulations on food marketing to children in both broadcast and non-broadcast media under the *Law of Nutritional Composition of Food and Advertising* [192]. Some regulations include the prohibition of advertising unhealthy foods high in calories, sugar, sodium, and saturated fats that target children and the use of promotional techniques appealing to children, like cartoons and toys [192]. These regulations form part of a comprehensive public health strategy that also includes food labelling and retail setting restrictions, all to combat rising childhood obesity rates and promote healthier dietary habits among Chilean children [192]. However, Chile's regulations only protect children under 14, with unclear provisions for social media [192].

In the UK, regulations for non-broadcast media regarding food advertising to children are primarily governed by the *UK Code of Non-broadcast Advertising, Sales Promotion, and Direct Marketing* [193]. These regulations are designed to safeguard children from potentially harmful advertising practices and ensure responsible marketing communications [193]. Examples include prohibiting the advertising of foods high in fat, salt, and sugar in children's media or other media where children comprise a significant proportion of the audience, prohibition of advertising that condones or encourages poor nutritional habits or unhealthy eating behaviours among children, requirement for marketing communications to be socially responsible and not exploit children's credulity, and for marketing communications to be clearly distinguishable and not disguised as editorial content [193]. Similarly, the UK's regulations apply only to children under 12, with less stringent restrictions on non-broadcast media compared to television [193]. Nevertheless, the UK

plans to enforce comprehensive restrictions on all forms of online unhealthy food marketing by 2025, including not permitting less healthy food products in paid-for space on online media at any time [193].

As of 2019, Portugal restricts advertising to children under 16 years of age for foods high in concerning nutrients, using the Portuguese Nutrient Profile Model [194]. This model aligns with the WHO Regional Office for Europe Nutrient Profile Model and restricts the advertisement of foods that meet the following criteria: energy (more than 200 kilocalories (kcal) per 100 grams (g) of product), sugars (more than 5g of sugars per 100g of product), saturated fat (more than 1.5g of saturated fat per 100g of product), trans fat (more than 0.5g of trans fat per 100g of product), and salt (more than 1.2g of salt per 100g of product) as unhealthy products [194]. The law applies to schools, public playgrounds, and a 100-meter radius surrounding these areas [195]. It also encompasses television, on-demand media services, and radio, specifically targeting the 30 minutes before and after children's programs, as well as programs with an audience comprising at least 25% of individuals below 16 years old [195]. Cinemas are also included, particularly during films rated for children under 16 [195]. Further, the law extends to websites, social networks, and mobile applications intended for children under 16 years old [195]. This multipronged approach mitigates the potential for marketing “creep” (the gradual expansion of marketing practices into new areas, increasing exposure to targeted advertising). The policy is scheduled to be evaluated every five years, with the next evaluation set for 2024. This assessment is anticipated to yield valuable insights into its effectiveness and impact.

Before these regulations, Portugal relied on industry self-regulation which proved ineffective [196]. Despite some food industry initiatives to limit marketing to children, voluntary self-regulation in Portugal has been insufficient with government-led regulations being more

effective [197]. Of note, most regulations often overlook adolescents aged 13-18, despite their significant presence on social media platforms. This could be due to the perception that adolescents are more capable of critically evaluating marketing messages compared to children [12, 34]. As adolescents are seen as having more autonomy and independence in their decision-making processes, regulators may prioritize protecting children who are perceived to be more vulnerable to the influence of marketing [12, 34].

Although this research did not directly address regulations, its findings can inform Canadian and international policy discussions. Comprehensive digital marketing policies must encompass all facets of the digital food environment and various marketing techniques across platforms. This includes social media, mobile apps, websites, and online games, requiring regulations to address content and strategies like SMI marketing, interactive promotions, and personalized advertising algorithms.

The recent WHO report emphasizes the urgency of evidence-based policies to safeguard youth from digital food marketing's adverse effects, urging the development of clear guidelines for advertisement design, placement, and targeting [198]. This entails monitoring and enforcing compliance with advertising standards, implementing age-appropriate marketing practices, and ensuring transparency regarding the commercial nature of promotional content [198]. Proactive measures are also necessary to tackle evolving trends and technologies, requiring collaboration between government agencies, public health organizations, industry stakeholders, and digital platforms to ensure effective regulation and promotion of healthier food environments for adolescents [198].

Current self-regulatory Canadian food marketing regulations exclusively safeguard children under the age of 13, leaving adolescents unprotected [86]. Given the results of this

research and systematic reviews demonstrating the susceptibility of adolescents to marketing appeals and their exposure to advertising messages, there is a pressing need for Canadian and international regulatory measures to extend protection to adolescents [32, 107, 130]. Expanding current regulations to include adolescents up to 18 years old would align with international standards like the United Nations Convention on the Rights of the Child, providing a stronger framework to mitigate the impact of food marketing [104].

Food marketing regulations should also consider gender by implementing specific marketing restrictions and guidelines that address the unique differences of boys and girls. For instance, gender-specific advertising restrictions can prohibit or restrict the use of gender-stereotypical imagery, language, and themes in food advertising, such as banning advertisements that depict boys as sporty and girls as nurturing. This prevents the reinforcement of harmful gender norms and promotes more inclusive advertising practices, contributing to fostering a more equitable and inclusive digital food marketing landscape that prioritizes the well-being of adolescents of all genders.

Given studies revealing differential exposure patterns and marketing strategies between boys and girls, gender considerations are pivotal [62, 164]. The UK has indicated that it will explore online advertising restrictions to mitigate health outcome disparities among different socioeconomic groups, creating an opportunity to include gender within those considerations [199]. Additionally, efforts have been made in Canada to develop a food marketing monitoring framework that incorporates considerations of gender [200]. By addressing gender considerations in digital food marketing research, we can better identify and address the unique challenges and opportunities for promoting adolescent health in an increasingly digitalized world.

Regulating digital data collection of adolescents, an upstream intervention, is also essential to curbing targeted digital food marketing practices that exploit their vulnerabilities [201]. Adolescents are increasingly exposed to sophisticated digital marketing tactics that leverage their online behaviors and preferences through data collection to promote unhealthy food products [104]. By enforcing rigorous regulations on data collection, policymakers can restrict marketers' ability to target adolescents based not only on their age but also on other factors such as gender, among others. Such regulations should prioritize the protection of adolescents' personal information thus limiting the use of data-driven marketing techniques. This not only protects adolescents' privacy but also their health [201].

To further improve Canadian food marketing regulations, much like the UK, it is necessary to establish an independent body responsible for regularly monitoring the marketing practices of the food industry [199]. This body should use clear benchmarks to evaluate compliance with marketing standards, focusing on digital platforms and SMIs where current oversight is lacking. Moreover, this independent entity should have the authority to enforce penalties for non-compliance and mandate corrective actions [44]. Establishing this regulatory body is necessary to address any deficiencies in Canada's current self-regulatory policy. Although its effectiveness remains unassessed, Canada’s current self-regulatory policy may not adequately influence digital food environments as needed. By integrating comprehensive monitoring and enforcement mechanisms, Canada can better protect young people from the harmful effects of aggressive marketing tactics and promote healthier dietary choices among its adolescent population.

Social Media Policies

Social media platforms derive substantial revenue from advertising [191]. Advertising on these platforms is mainly self-regulated, with businesses responsible for ensuring content

accuracy and adherence to local laws and regulations [191]. While social media platforms have policies in place to restrict harmful products like tobacco and alcohol, policies regarding unhealthy food advertising are lacking [191]. Moreover, despite existing social media policies on alcohol advertising adolescents continue to be exposed to such advertisements on social media platforms [164].

A study examining 12 major social media platforms found minimal restrictions on food advertising, with only two platforms (Snapchat and YouTube Kids) having limited policies [191]. YouTube Kids, designed for children under 13, enforces a policy prohibiting the advertisement of consumable food and beverage products, irrespective of their nutritional composition [191]. A 2019 study found that a substantial proportion of videos on YouTube Kids included advertisements for foods and beverages, many of which were unhealthy options high in sugar, fat, and salt [202]. Two-thirds of the videos (n = 260) featured food-related content, including branded products (n = 153), other brand appearances (n = 60), and non-branded food items (n = 203) [202]. Branded products appeared 592 times (3.9 per video), with candy brands making up 42% and sweet/salty snacks, sugary drinks, and ice cream accounting for 32% [202]. These findings raise concerns about the lack of enforcement for food marketing platform policy, highlighting the need for stricter government-mandated regulations.

Snapchat implements industry-specific requirements for certain sectors such as pharmaceuticals, healthcare, diet, and fitness [191]. Within these guidelines, advertisements for food products must provide accurate descriptions of the food's qualities, including any health or nutritional claims associated with them [191]. These guidelines do not seem to be heavily enforced [191]. The fact that most platforms have policies restricting alcohol, tobacco, gambling, and weight loss advertising [191] underscores that these companies can restrict category-based

advertising, including unhealthy food. Here lies an opportunity for social media platforms to voluntarily restrict unhealthy food marketing, contributing to improved dietary habits. Notably, multinational children's entertainment networks like The Walt Disney Company have implemented guidelines prohibiting ads promoting unhealthy lifestyles or excessive consumption of unhealthy foods, showcasing the feasibility and importance of platform-led action in protecting children and adolescents from unhealthy food marketing [203].

Other Interventions

In a recent study, adolescents commonly subjected to extensive food marketing participated in an intervention that reframed manipulative food marketing as incongruent with fundamental adolescent values, such as social justice and autonomy [115]. Through a preregistered, longitudinal, randomized, controlled field experiment, the researchers demonstrated the efficacy of this framing intervention in reducing both boys' and girls' implicit positive associations with food marketing [115]. The intervention substantially improved boys' daily dietary choices in the school cafeteria, leading to significantly healthier snack and drink purchases in the subsequent three months of the school year [115]. The findings indicated a noteworthy gender moderation effect, with the intervention showing a greater impact on boys' cafeteria purchases compared to girls [115]. Specifically, boys exhibited a 31% reduction in daily purchases of unhealthy snacks and drinks post-intervention, along with a 35% overall enhancement in the health profile of their snack and drink purchases [115].

These results can suggest the implementation of similar public health interventions, particularly those designed for adolescent boys. The study highlights the potential of values-alignment approaches in behaviour change interventions, offering scalable solutions to address a persistent public health problem. However, the researchers advocate for further large-scale trials

to explore the efficacy of such interventions in diverse contexts and populations, emphasizing the need for tailored approaches to maximize effectiveness [115]. While this approach represents a valuable downstream strategy, it likely would not have the same reach or impact as upstream policies, such as government regulations on food marketing. This is why a holistic approach is needed to tackle food marketing targeting adolescents, combining both downstream strategies and upstream policies to address the issue comprehensively and effectively.

Potential Contributions

Exploring digital food marketing through a gender lens has practical implications for policy, societal well-being, and advancing scientific knowledge. Results from this research can lend support in mitigating health inequalities and fostering evidence-driven approaches to enhance adolescent health and welfare. By discerning the nature of adolescents' exposures by gender, this research offers insights that will support the social media use among adolescents.

Policy

Understanding the role and impact gender has in digital food marketing can inform evidence-based policy interventions aimed at regulating or mitigating the impact of food marketing practices. By identifying gender tactics in marketing messages, policymakers can develop targeted and equitable regulations that equally protect boys, girls, and gender-diverse adolescents. For instance, these regulations could prohibit gender-stereotypical imagery and language that reinforce harmful norms, such as portraying boys as inherently sporty and girls as nurturing. Such tailored approaches ensure that all adolescents, regardless of gender, are safeguarded against manipulative marketing practices, fostering a more inclusive and supportive environment for their healthy development.

Furthermore, such research can highlight the need for stricter regulations on social media influencers who promote unhealthy foods, ensuring that these endorsements are scrutinized for

gender-targeted content. By incorporating these insights, policies can be crafted to foster a more equitable marketing environment that protects all adolescents from the negative health impacts of unhealthy food advertising, ultimately contributing to reduced rates of diet-related diseases and promoting healthier lifestyles across diverse populations.

Society

Insights from gender-focused research can contribute to the broader societal discourse on gender norms and stereotypes perpetuated through marketing, fostering greater awareness and dialogue around the ethical implications of gender-targeted marketing strategies. Research on tobacco and alcohol has already revealed how marketing reinforces traditional gender roles and finding from this research reinforced male stereotypes of athleticism and achievement [164, 171]. Recognizing these patterns allows for critical discussions and can bring greater awareness to adolescents.

Understanding how marketing utilizes gender can aid adolescents in critically assessing advertising content. If youth recognize how they are being targeted and manipulated based on their gender, they can make more informed choices [115]. These insights can also empower adolescents to connect with policymakers and guide them in developing and implementing regulations aimed at protecting adolescents based on their personal experiences.

Research

Conclusions drawn from this research can pave the way for new and innovative research and interdisciplinary collaborations, advancing knowledge in fields such as marketing, public health, psychology, and gender studies. It can also contribute to the refinement and development of theoretical frameworks in these fields. By exploring the interplay between gender, digital marketing, and adolescent behaviour, findings may shed light on new theoretical constructs and pathways that explain consumer decision-making in the digital age.

These findings can also prompt additional research. For example, considering gender alongside other factors such as socioeconomic status, race, and ethnicity. It can also prompt questions like do boys and girls respond differently to a specific food advertisement? If so, why? Further inquiry and exploration can enhance our understanding of the interaction between marketing, gender, and health. Ultimately, a gender-informed approach to studying digital food marketing to adolescents holds promise for promoting more equitable and healthier food environments for youth, with far-reaching implications for public health and social well-being.

Strengths and Limitations

This research used a novel approach to investigate the digital food marketing adolescents encounter, focusing on gender differences. It sheds light on how gender is leveraged within digital food marketing and examines adolescents' exposure to and engagement with gender-specific food marketing. This research provides new data, primarily from adolescent and SMI accounts, and how digital food marketing to adolescents differs by gender. Using a multi-method approach allowed for a more comprehensive understanding of the research problems by integrating diverse perspectives and methodologies, thereby enhancing the validity and reliability of the findings.

However, several limitations accompany these insights. First, the exploratory nature of these studies warrants caution in drawing definitive conclusions, particularly given the small sample sizes and the overrepresentation of certain demographic groups, such as White participants and those from higher-income households. Additionally, the reliance on self-reported data and the exclusion of direct exposures for newer social media platforms like TikTok and Twitch may limit the generalizability of the findings to the broader adolescent population. Moreover, the absence of consideration for confounding variables, such as age, and the inability

to capture the full scope of marketing exposures, including non-food instances, further complicates the interpretation of results. Lastly and most importantly, it would have been beneficial to have the inclusion of more gender diverse participants. Efforts to recruit participants across the gender spectrum (e.g., non-binary, transgender, etc.) were unsuccessful due to a lack of participant interest. These efforts included asking the Canadian Center for Gender and Sexual Diversity and the Pride Center of Edmonton to feature this research study in their newsletters and to display research posters in their centers. The absence of insights from gender diverse individuals limits the comprehensive understanding of digital food marketing and gender, potentially overlooking important perspectives and experiences relevant to diverse audiences.

Despite these constraints, the findings offer preliminary insights into the gendered nature of digital food marketing and its potential implications for adolescent health outcomes. By highlighting the disproportionate exposure to certain marketing techniques among different genders and the potential perpetuation of unhealthy eating behaviours, these studies emphasize the importance of continued research in this domain. The recognition of platform-specific gender dynamics and the reach of digital marketing beyond national borders highlight the need for comprehensive and inclusive approaches in future research. By addressing these limitations and expanding the scope of inquiry to include diverse gender identities and global perspectives, researchers can contribute to a more nuanced understanding of the complex interplay between digital food marketing, gender, and adolescent health.

Future Research

Adolescent obesity continues to pose a public health challenge, in part, due to the ubiquitous digital marketing of food [32]. Future research would gain from examining the portrayal and evolution of gender stereotypes in food marketing and how these impact

adolescents. Researchers could investigate the intersectionality of gender with other factors such as race, ethnicity, and socioeconomic status to uncover potential disparities in marketing exposures and their implications for health outcomes among diverse populations. Understanding these intersections would shed light on the compounded effects of multiple social identities on susceptibility to marketing influences and health risks.

As marketing regulations evolve, exploring the effectiveness of these regulations, especially those that impose stricter controls on online media is crucial for identifying best practices to mitigate predatory marketing to adolescents. This analysis can reveal which regulatory approaches most effectively limit adolescents' boys and girls' exposure to harmful food advertising. By examining successful case studies and evidence-based strategies, policymakers can implement more robust frameworks that safeguard adolescents from aggressive, gender-targeted marketing tactics, ultimately fostering a healthier and more equitable digital environment.

Further, more qualitative research is needed that engages adolescents in discussions about digital food marketing and its gendered impacts as it directly influences their dietary choices, health behaviors, and overall well-being. By initiating dialogues on this topic, educators, parents, and policymakers can equip adolescents with the tools to resist unhealthy marketing pressures, cultivate healthier eating habits, and advocate for a more equitable and inclusive media landscape. Research in this area would also benefit from more rigorous research design, such as randomized controlled trials. This experimental design could allow for a direct comparison of how gender influences responses to marketing stimuli and immediate food intake.

Additionally, longitudinal studies could be designed to monitor adolescents' exposure to digital food marketing over time, enabling the evaluation of its influence on their dietary habits

and subsequent health outcomes. Such a design would provide insights into the long-term effects of gendered food marketing and how it contributes to the development of obesity and other health issues in adolescence. Overall, such research designs would contribute to a more rigorous understanding of the role of gender in digital food marketing and inform the development of targeted strategies to combat adolescent obesity.

Chapter 4: Conclusion

Overall, the findings of this research demonstrate that gender plays a role in the digital marketing of food. The first study uncovered variations in exposure to marketing techniques and the healthfulness of food products based on a participant's gender. The second study highlighted distinct differences in how adolescent boys and girls engage with digital food marketing. Finally, the third study explored social media influencer posts featuring food, offering insights into how influencers, social media platforms, and gender norms may influence adolescents' dietary behaviors. Given that unhealthy food marketing is targeting youth, it is crucial to continue researching digital food marketing from a gender perspective. Adolescents are highly impressionable, and understanding how gender shapes their interactions with marketing is vital for identifying how unhealthy food products are promoted differently to boys and girls.

Understanding the intersection of digital food marketing, adolescents, and gender is essential for comprehensively addressing the complexities of contemporary health challenges. Adolescence marks a critical developmental period characterized by heightened susceptibility to external influences, including digital marketing messages. Moreover, gender norms and expectations shape adolescents' experiences and behaviours, including their responses to marketing stimuli. By recognizing the differential impact of digital food marketing on boys and girls, we can tailor interventions that account for these nuanced gender dynamics, thereby fostering more effective and equitable strategies for promoting health and well-being.

Ignoring the role of gender in food marketing risks overlooking critical factors that contribute to disparities in health outcomes and perpetuate inequities. The exploration of gender in digital food marketing to adolescents is not merely an academic exercise but a necessary endeavor for promoting public health and well-being. This research lays the groundwork for

future studies and policy interventions aimed at creating a healthier, more equitable digital marketing landscape. By addressing the nuanced ways in which gender influences marketing and subsequently health and behaviour's, we can better protect adolescents from the detrimental effects of unhealthy food advertising and support their development into healthy adults.

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Appendices

Appendix A: Interview Guide

Interview Guide

Introduction

Today we're going to be talking about the kinds of things you experience on social media when it comes to food and drinks. Now, the focus isn't so much what you do – we're not trying to creep your phone to see how often you play video games or watch TikToks – our focus is on what you experience and are exposed to regarding food and drinks while you are on social media. No judgement here.

There are no right or wrong answers to any of these questions, I am interested in your own experiences with food and drinks on social media. Participation in this study is voluntary, meaning you can leave at any time with nothing bad happening. The interview should take a little more than half an hour depending on how much information you would like to share. With your permission, I would like to cast your phone and share your screen based on the instructions I gave you. When you share your phone screen on the computer, it will only be able to project the sites you visit during the interview and will not have access to any of your personal items like text messages or photos, unless you choose to look at them during the interview, which I do not encourage. I also suggest you put on "do not disturb" during the interview so that no text messages come in. I would also like to record the interview because I do not want to miss any of your comments. Your responses will only be shared with my research team and will be kept confidential. This means your interview responses will not have your name on them when they are shared. I would also like to ask your permission to use images from this interview for academic conferences, presentations, or journals. The images will only include posts that you show me and will not contain your personal information (name/username), your face, and will not include any information of those who liked or commented on the post. In order for the research team to use the photo, you will need to get your parent's permission, meaning the photo will need to be shared with your parents. If you do not provide permission, which is fine, your images will not be used in any of the presentations, conferences, or journals we produce. You may also choose not to answer any question or stop the interview at any time, for any reason. Are there any questions (or concerns) about what I have just explained? May I start recording?

My first question is, do I have your (say participant's name) permission to use any images from this recording, which will not include any personal information, for academic presentations, conferences, or journal articles. The shared image will only include a screen shot of what you viewed and will blur out your name/username and the names of those who liked or commented on the photo. Please note, if we are to use an image, it must also be shared with your parent and get their approval. You can say no to this request and still participant in this study. If you say no, the recording will still happen, we will just not share your images beyond the research team. Please let me know by saying "yes, I (your name) agree to having my images shared for academic presentation, conference, or journal purposes" or "no, I do not wish to have my images shared for academic purposes".

Consent.

To start, please feel free to login to your favourite social media app and show me what you see daily. Feel free to talk about pages, photos, and any material related to unhealthy foods.

Non-leading and general prompt examples include
"Can you please tell me a little bit more about that?", "What does that look like for you", "What do you mean by that", "Can you give me an example of", and "Why do you think/feel that way"

1. Can you describe the pages you viewed? How do they make you feel?

2. Do you see anything food or drink related while you're on your social media?

    a. What kind of food and drink items/products do you see most while on social media?
    b. Do you ever see food or drinks items that show up on your social media all the time?

3. I know I asked this question in the survey, but do you like or comment on food and beverage ads? If so, how often would you say?

4. Do you have a favourite fast food or drink that you like? For example, a Big Mac from McDonalds?

5. Do you ever share or tag your friends in social media posts that contain food and drinks?

    a. Do you ever take pictures of yourself with food or drinks in the post?

6. Do you follow any food or beverage companies like Coca-cola or Wendy's?

7. Why do you think food and drink companies post things online?

8. After seeing a food or drink item while scrolling through your social media, have you ever gone out and bought it or asked your parents to buy it?

9. Have you ever ordered food and suddenly that same restaurant starts appearing on your Facebook, in your Instagram, or on the sides of websites your browsing? For example, you go to Starbucks and now all you see are offers from Starbucks all the time.

10. Are you familiar with any strategies or techniques that food and drink companies use to get your attention? (If participant doesn't list, then provide examples and ask, "have you come across any"?)

11. Do you have a favourite ad that's for a food or drink product? For example, Coke's Christmas time bear commercials? There's M&M ones.

    a. What makes the ad your favourite?

12. Do you think food and drink companies advertise their products differently to boys and girls? For example, do you think McDonald's does certain things to promote their products to boys? Why or why not?

13. Do you follow any popular celebrities, influencers, or athletes on social media? If so, who are they?

14. Do you find you are more interested in a food or drink item based on the person advertising it – like if you see your favourite athlete drinking a coke, would you want to try it more than if it was someone you didn't know?

15. Do you think you're more interested in a food or drink item if a man or woman is in the ad?

16. Do you learn anything in school about marketing?

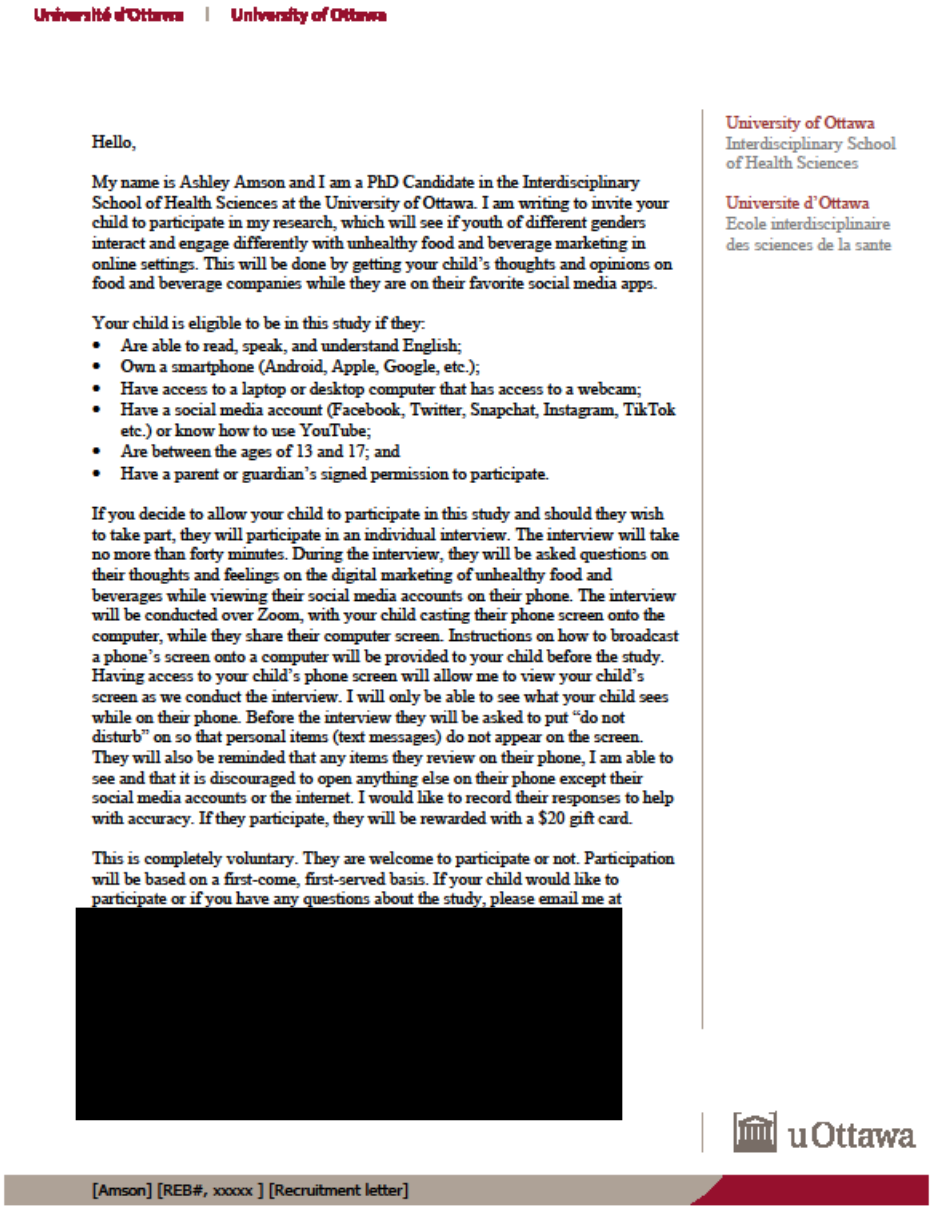
17. Does your family influence what you eat?

Is there anything else that you would like to comment on about digital marketing of unhealthy food that we haven't discussed today?

Thank you for your time today. We greatly appreciate what you've shared with us today. If you know of friends that would be interested in this study, please don't be shy to let them know. I'm going to end the recording.

End recording

Appendix B: Recruitment Letter



Université d'Ottawa | University of Ottawa

University of Ottawa
Interdisciplinary School of Health Sciences

Universite d'Ottawa
Ecole interdisciplinaire des sciences de la sante

Hello,

My name is Ashley Amson and I am a PhD Candidate in the Interdisciplinary School of Health Sciences at the University of Ottawa. I am writing to invite your child to participate in my research, which will see if youth of different genders interact and engage differently with unhealthy food and beverage marketing in online settings. This will be done by getting your child's thoughts and opinions on food and beverage companies while they are on their favorite social media apps.

Your child is eligible to be in this study if they:

- Are able to read, speak, and understand English;
- Own a smartphone (Android, Apple, Google, etc.);
- Have access to a laptop or desktop computer that has access to a webcam;
- Have a social media account (Facebook, Twitter, Snapchat, Instagram, TikTok etc.) or know how to use YouTube;
- Are between the ages of 13 and 17; and
- Have a parent or guardian's signed permission to participate.

If you decide to allow your child to participate in this study and should they wish to take part, they will participate in an individual interview. The interview will take no more than forty minutes. During the interview, they will be asked questions on their thoughts and feelings on the digital marketing of unhealthy food and beverages while viewing their social media accounts on their phone. The interview will be conducted over Zoom, with your child casting their phone screen onto the computer, while they share their computer screen. Instructions on how to broadcast a phone's screen onto a computer will be provided to your child before the study. Having access to your child's phone screen will allow me to view your child's screen as we conduct the interview. I will only be able to see what your child sees while on their phone. Before the interview they will be asked to put "do not disturb" on so that personal items (text messages) do not appear on the screen. They will also be reminded that any items they review on their phone, I am able to see and that it is discouraged to open anything else on their phone except their social media accounts or the internet. I would like to record their responses to help with accuracy. If they participate, they will be rewarded with a $20 gift card.

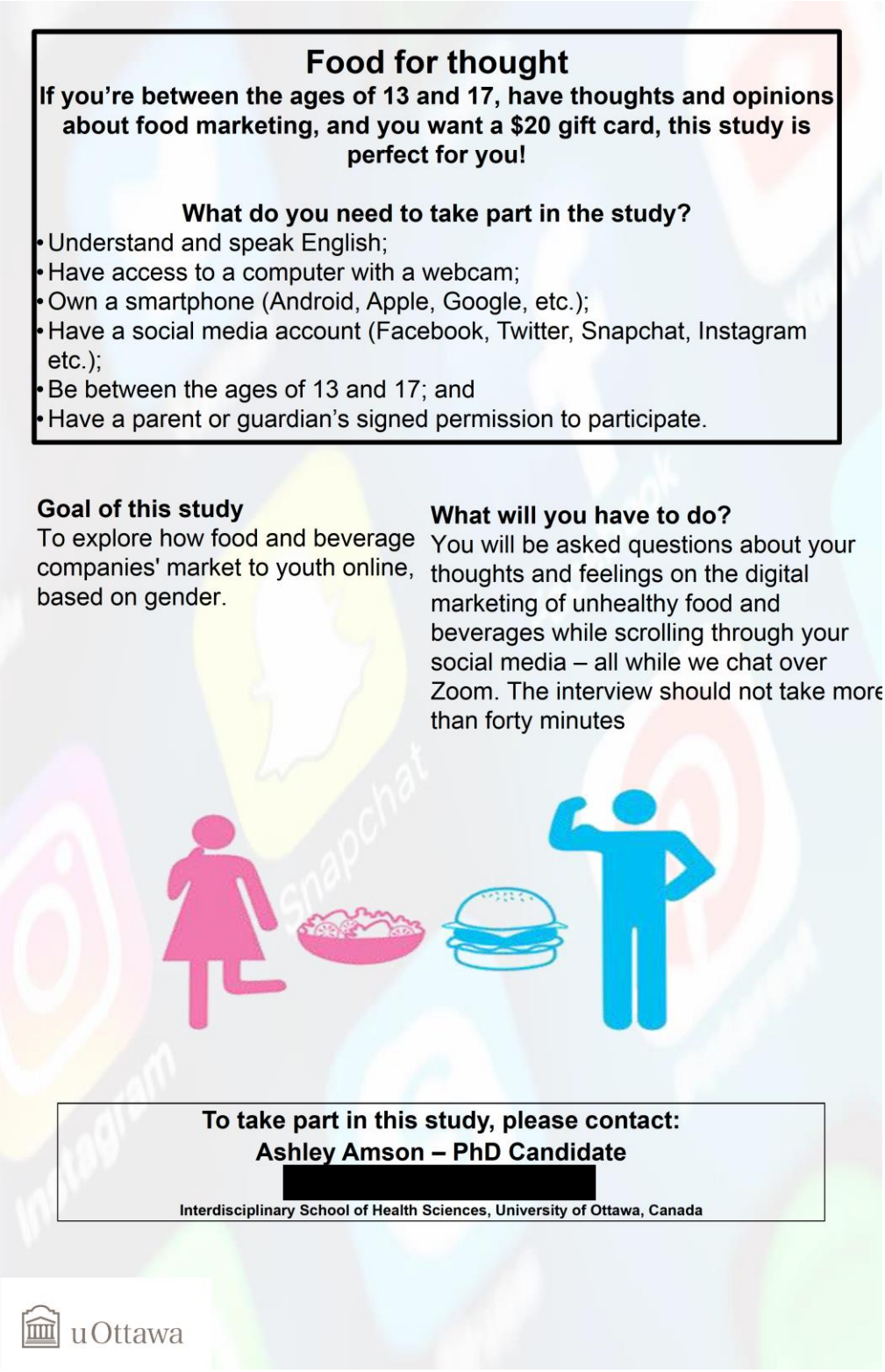
This is completely voluntary. They are welcome to participate or not. Participation will be based on a first-come, first-served basis. If your child would like to participate or if you have any questions about the study, please email me at

[redacted]

uOttawa

[Amson] [REB#, xxxxx] [Recruitment letter]

Appendix C: Social Media Recruitment



Appendix D: Phone Casting Instructions

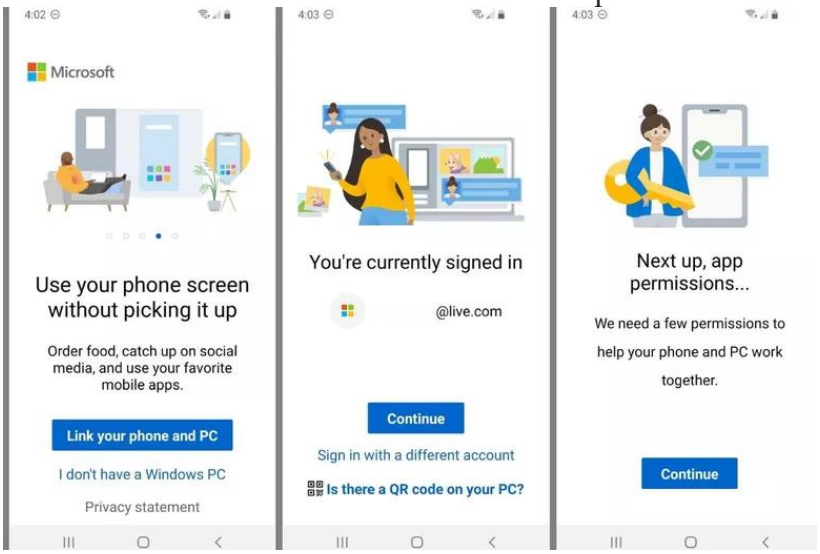
Phone Casting Instructions

Thank you for being interested in participating in this study. Below you will find instructions on how to cast your phone screen onto your computer. Please make sure you try this out at least once before the interview. If you have any questions, please don't hesitate to contact the lead of this research, Ashley Amson, at

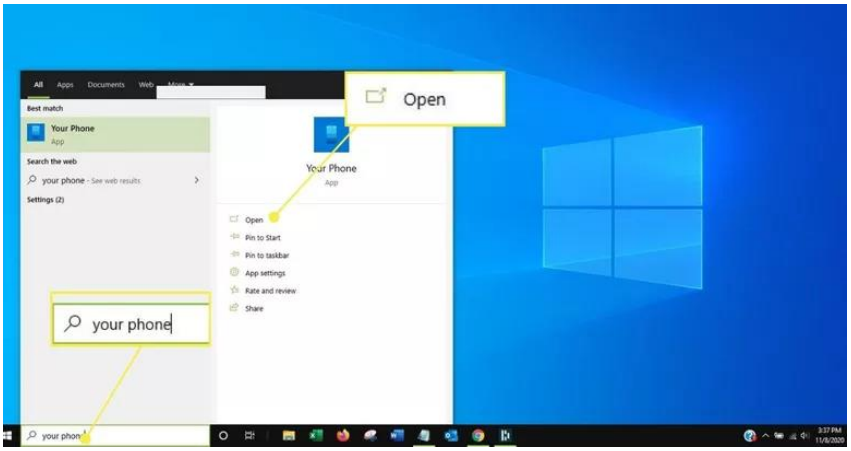
Android - https://www.lifewire.com/show-phone-screen-on-windows-4164406
These instructions apply to Windows 10 PCs and Android devices with Android 7.0 (Nougat) or above.

Get the Your Phone Companion app

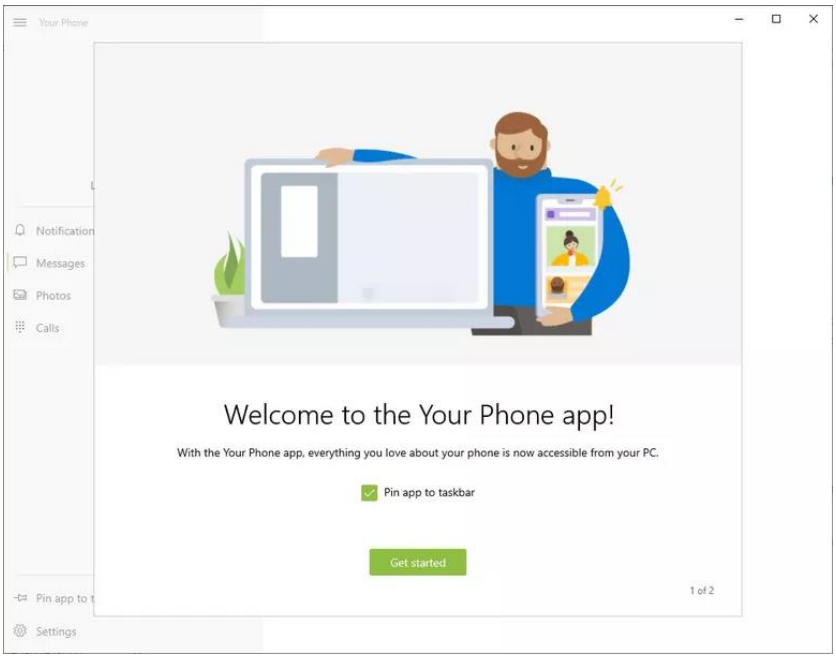
After installing the Your Phone app (found in google play/store), make sure your PC and Android device are nearby, turned on, and connected to Wi-Fi.
Open the Your Phone app on your phone.
Select Link your phone and PC.
Sign in to the Your Phone Companion app using the same Microsoft account you're using on your PC if prompted. Select Continue.
Select Continue and choose Allow to enable permissions.



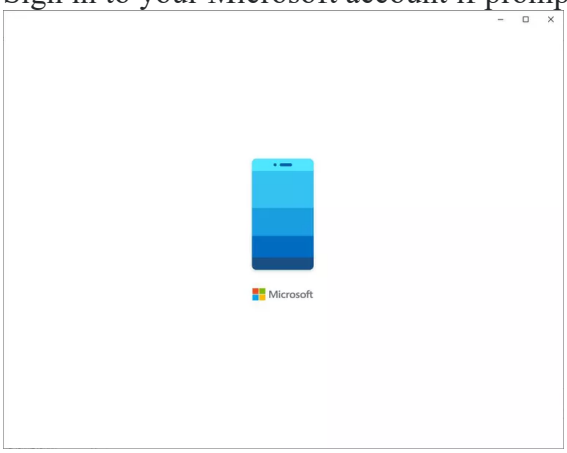
Return to your PC to finish linking your phone with the Windows 10 app.
In the Windows search box, type "your phone" and select the Your Phone app from the results.



Select Get Started.

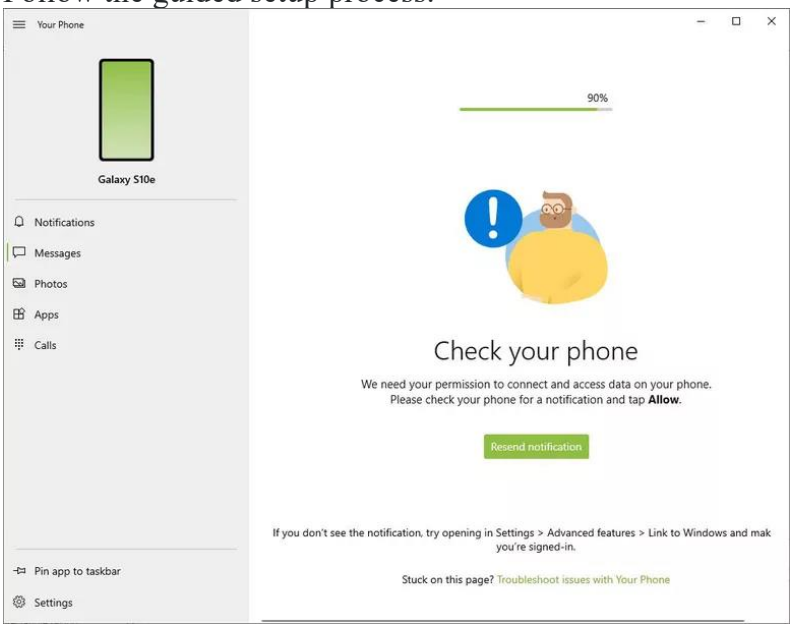


Sign in to your Microsoft account if prompted.

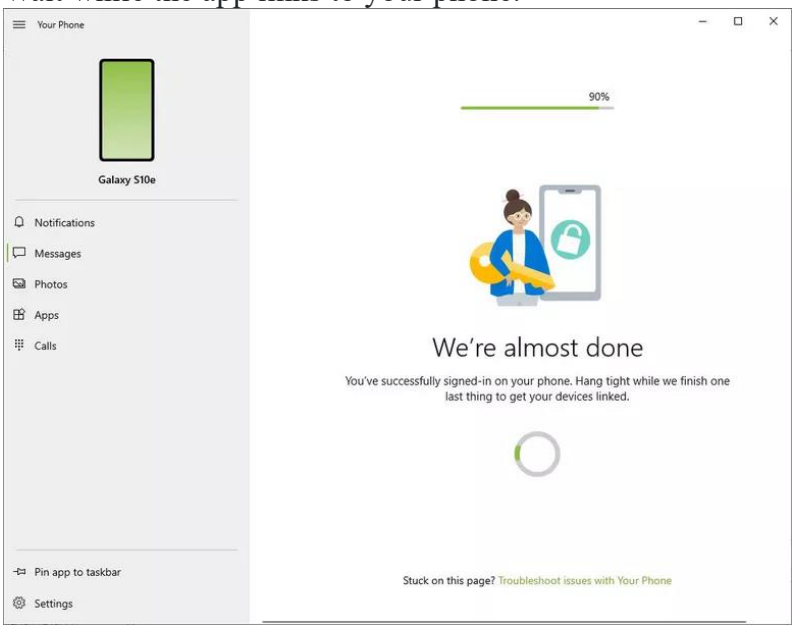


Note: You'll need to sign into the same Microsoft account on your phone and your PC to link the devices successfully.

Follow the guided setup process.



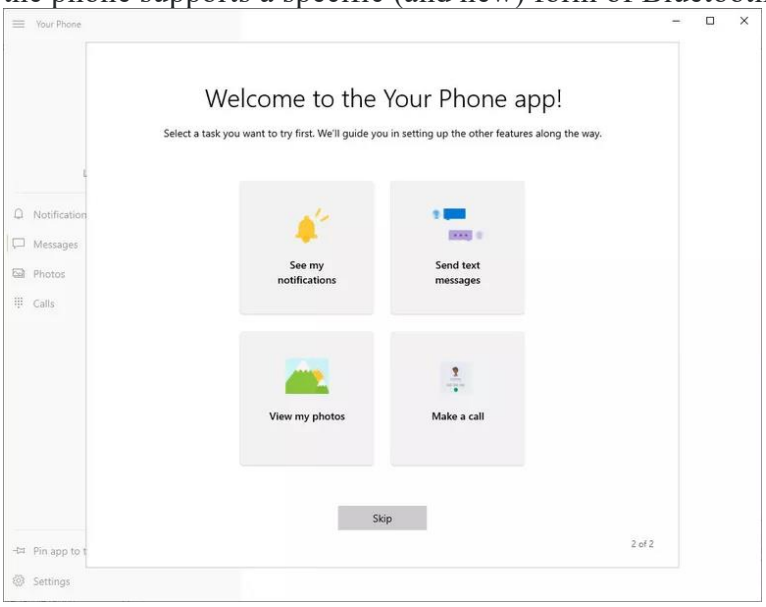
Wait while the app links to your phone.



Select the items from your phone that you want to see on your computer.
The Your Phone app can:
Display Android notifications to the Windows Notification List.
Send and receive text messages through the phone using the Windows app.
Display device photos and manage drag-and-drop file access between the phone and Windows.

**Mirror the Android screen in real-time and support remote control of the phone through the app (this is what will be used primarily for this research).

Send and receive calls through Windows, using the phone as a pass-through device, provided the phone supports a specific (and new) form of Bluetooth connectivity.



Note: For select Samsung devices, the Link to Windows companion app is already installed. Access it by going to Settings > Advanced features > Link to Windows.

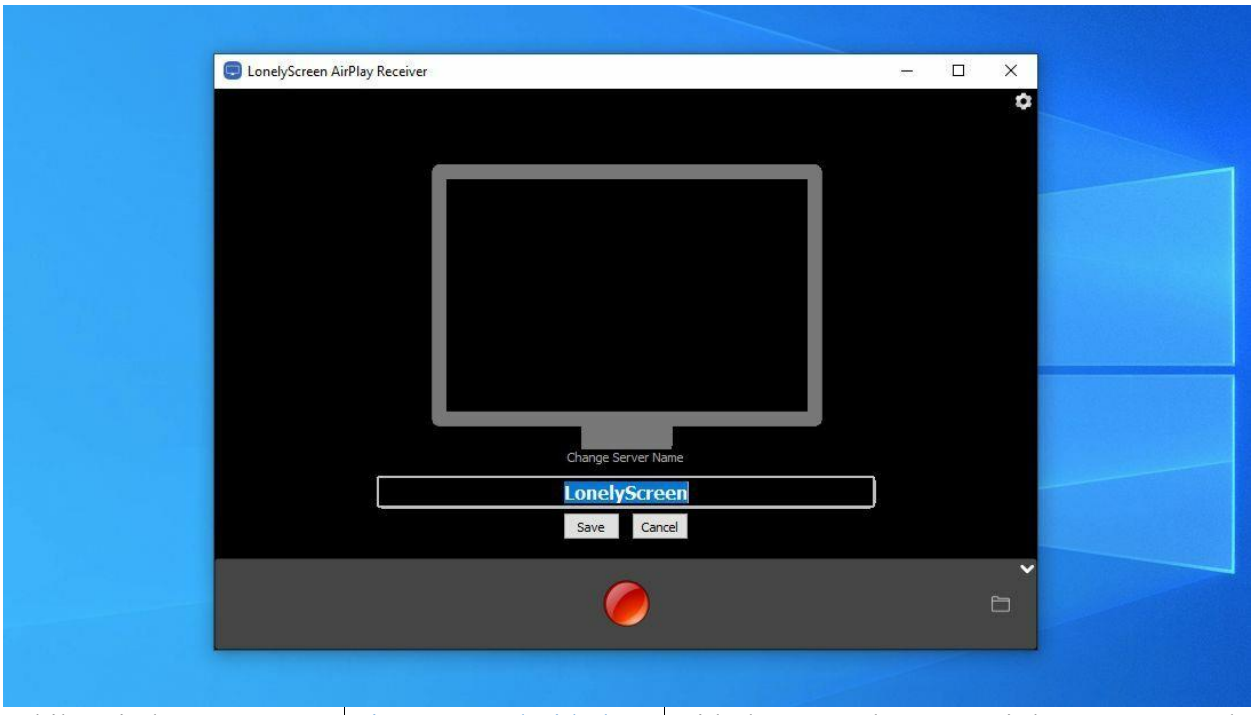
Screen Casting

Apple does not prioritize interoperability between iOS with Windows 10. To cast an iPhone screen to a Windows display, you'll need special software that translates the AirPlay standard. Please see the *Apple* section below for more details.

Apple - https://www.pcmag.com/how-to/mirror-your-iphone-screen-on-a-computer

Airplay
Both need to be fully updated
On macbook go to sharing = airplay receiver (turned on with screen sharing)
Control center – screen mirroring
Phone screen mirroring

How to Mirror Your iPhone Screen to a Windows PC



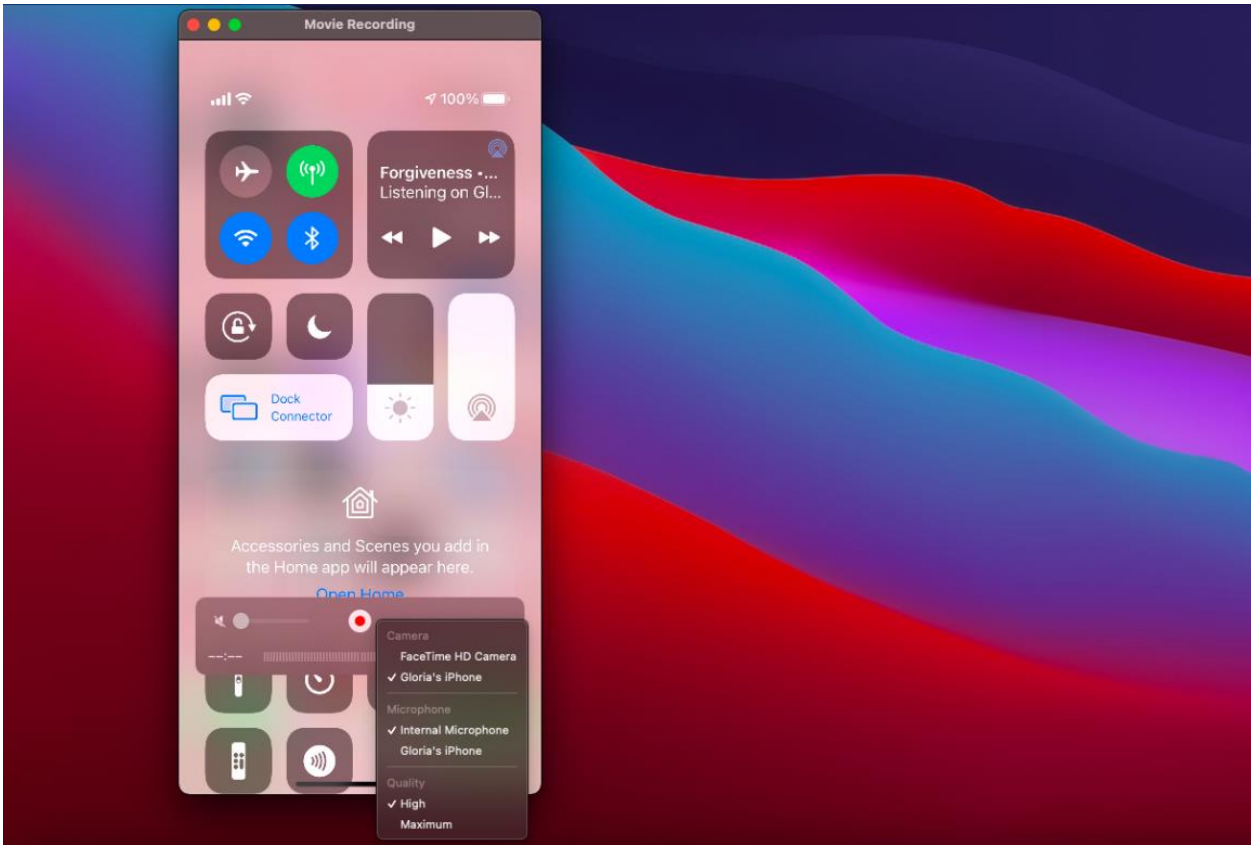
While Windows users can mirror an Android phone with the Your Phone app, iPhone users need to download a third-party tool to cast their phone. There are plenty of tools that offer this functionality, but for simple free casting, check out LonelyScreen. It's a barebones app that does one thing: tricks your iPhone into thinking your PC is an Apple TV.

Install and launch LonelyScreen, then click the "LonelyScreen" title along the bottom to change the name of your AirPlay server (I used "Whitson's Laptop"). From your iPhone, open the Control Center and tap the Screen Mirroring button. If you don’t see such a button, you may need to add it from the iPhone's Settings.

Once you tap the Screen Mirroring button, select your LonelyScreen laptop from the list, and your iPhone screen will appear on your PC right away. If you don't see it, check out LonelyScreen's troubleshooting page—it can occasionally be a bit finicky. From there, you can maximize the window for a closer look, and click the arrow in the bottom-right to bring up a Record button that lets you capture video clips.

Note that LonelyScreen says it's a free trial, but you can click the nag screen away at any time—it doesn't seem to be a limited trial in our testing (though the nag screen may re-appear occasionally as you use it).

How to Mirror Your iPhone Screen to a MacBook



Mac users have it easy because this functionality is built right into your MacBook in the form of the QuickTime video player. There's only one catch: you have to plug your iPhone in over USB. Grab your Lightning cable and plug your iPhone into your Mac. If you haven't done this in a while, you may need to tap the "Trust" prompt that appears on your iPhone before continuing. Once connected, open Launchpad and select QuickTime Player. Once the app is launched, head to **File > New Movie Recording**. You should see a new window appear.