

# Original quantitative research

## Sex differences in children's exposure to food and beverage advertisements on broadcast television in four cities in Canada

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### Abstract

**Introduction:** Sex differences exist in children's obesity rates, dietary patterns and television viewing. Television continues to be a source of unhealthy food advertising exposure to children in Canada. Our objective was to examine sex differences in food advertising exposure in children aged 2 to 17 years across four Canadian English-language markets.

**Methods:** We licensed 24-hour television advertising data from the company Numerator for January through December 2019, in four cities (Vancouver, Calgary, Montréal and Toronto) across Canada. Child food advertising exposure overall, by food category, television station, Health Canada's proposed nutrient profiling model, and marketing techniques were examined on the 10 most popular television stations among children and compared by sex. Advertising exposure was estimated using gross rating points, and sex differences were described using relative and absolute differences.

**Results:** Both male and female children were exposed to an elevated level of unhealthy food advertising and a plethora of marketing techniques across all four cities. Differences between sexes were evident between and within cities. Compared to females, males in Vancouver and Montréal viewed respectively 24.7% and 24.0% more unhealthy food ads/person/year and were exposed to 90.2 and 133.4 more calls to action, 93.3 and 97.8 more health appeals, and 88.4 and 81.0 more products that appeal to children.

**Conclusion:** Television is a significant source of children's exposure to food advertising, with clear sex differences. Policy makers need to consider sex when developing food advertising restrictions and monitoring efforts.

**Keywords:** *children, adolescents, sex differences, food advertising, marketing techniques, television exposure*

### Introduction

In the United States, the prevalence of obesity among children aged 6 to 11 years is 20.3% (21.3% of males and 19.2% of females), while rates for children aged 12

to 19 are 21.2% (22.5% of males and 19.9% of females).<sup>1</sup> In Canada, rates of obesity are lower but remain a public health concern;<sup>2</sup> in 2015, 10.4% of children aged 5 to 11 years had obesity (12.3% of males and 8.5% of females), while

### Highlights

- Children continue to be exposed to unhealthy food and beverage advertising on television.
- Targeted advertising based on ethnicity, age and sex is used to influence consumer subpopulations.
- Differences in male and female exposure to food advertising, including unhealthy foods, and marketing techniques were evident between and within cities in Canada.
- Policy makers should consider sex when developing food advertising restrictions and planning monitoring efforts.

rates were higher for those aged 12 to 17 (16.9% of males and 10.6% of females).<sup>3</sup>

A contributing factor to obesity is poor diets. Over time, the diets of Canadian children have shifted; currently 50% of their daily dietary intake is from foods containing added sugar, fat and salt, increasing children's risk of obesity and other chronic illnesses.<sup>4</sup> Compared to females, males consume slightly more ultra-processed foods, that is, foods that go through multiple processes and contain added fats, sugars and sodium.<sup>4</sup>

Unhealthy foods are heavily marketed to children in a variety of media and

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settings.<sup>5</sup> The World Health Organization considers unhealthy food marketing to children a harmful influence on their dietary behaviour as it impacts their food preferences, requests and consumption of energy-dense food.<sup>5-7</sup> Children are vulnerable to marketing due to their limited ability to understand the persuasive purpose of advertising.<sup>8</sup> This is exacerbated when food companies promote products using appealing marketing techniques, like cartoon characters or popular athletes.<sup>9,10</sup> Adolescents are susceptible to food marketing due to their neurocognitive and psychosocial development, which includes their growing independence, susceptibility to peer influence and desire to fit in.<sup>11</sup>

Consumers are influenced by the groups they identify with, and marketers leverage this to appeal to subpopulations. Food companies sometimes use individual characteristics, like ethnicity, to provoke familiarity and a sense of belonging in their advertising.<sup>12,13</sup> Although sex-based targeted marketing has been shown in tobacco and alcohol advertising, we need to investigate if it is used in food advertising given that research has shown that, compared to females, males view more and are more influenced by food marketing.<sup>14,15</sup>

Canadians aged 2 to 17 years watch between 13.9 and 17.3 hours of television weekly, with males watching more than females.<sup>16</sup> This high level of viewership exposes children to a myriad of unhealthy food advertisements (ads).<sup>17</sup> One study in Canada showed that there were 13.4 food ads per hour on children's channels during peak viewing times.<sup>17</sup> This is a concern; a meta-analysis also showed that exposure to food advertisements increased short-term food consumption by an average of 60 kcal more than for children who were not exposed.<sup>18</sup>

Quebec is the only Canadian jurisdiction with legislation restricting advertising to children.<sup>19</sup> Quebec's *Consumer Protection Act* protects children less than 13 years old from all commercial advertising directed at children.<sup>20</sup> Although imperfect, research has shown that, compared to children in Ontario, French-speaking children in Quebec are exposed to fewer child-appealing marketing techniques in food advertising on television.<sup>21</sup> In the rest of Canada, 15 food and beverage companies self-regulate their advertising to

children through the *Canadian Children's Food and Beverage Advertising Initiative*. This initiative has been shown to be ineffective.<sup>22,23</sup> Other countries, such as Chile, Ireland, Mexico, Norway and the United Kingdom have statutory television advertising restrictions.<sup>24</sup>

Few studies have examined children's exposure to food advertisements on television in Canada; most have examined ad frequency.<sup>25,26</sup> In addition, most studies investigating television exposure have focussed on one jurisdiction for a period of one month.<sup>27-29</sup> There is also a paucity of research on sex differences in children's exposure to television food advertising that could help inform food advertising regulations.

In this study, we compared children's food advertisement exposures by sex in four cities across Canada over the course of 2019. We hypothesized that, compared to females, males would be exposed to a greater number of unhealthy food ads.

## Methods

### Data collection

Twenty-four-hour television advertising data collected from January 1 to December 31, 2019, for 57 select food and beverage categories and 2475 unique ads, were licensed from Numerator, a company providing audience profiling services in Canada. These data included the broadcast frequency, viewership metrics for audience categories (e.g. general population, children, adolescents and/or adults), the name of the featured company and brand, and the broadcast day, time and station.

Television viewership data were collected from a stratified sampling of households by Numeris, a company that measures media and audiences. Households with a landline are randomly selected from across Canada and asked to complete a telephone survey that collects demographic information. All households that complete this survey are available for recruitment. To ensure that the panel is geographically representative, all phone numbers are assigned a geographical code according to location. Households are then randomly selected from each geographical area. Numeris also uses an iterative marginal weighting technique to maximize the reliability of the sample

data and minimize any statistical bias. The recruitment process is conducted regularly throughout the year to replace households that have been removed from the panel. The number of individuals on a Numeris panel can vary as people join or leave the panel; the average sample of children per month was 77 males and 71 females in Vancouver, 99 males and 85 females in Calgary, 66 males and 72 females in the Montréal English market ("Montréal English") and 138 males and 143 females in Toronto. Participants wore portable recording trackers that monitored their television-viewing habits. Numerator then weighted these data by population characteristics such as age, sex, household size, television reception type, region and telephone to approximate market-level viewership of commercial and non-commercial programming.

Television data were examined for four major English-language media markets across Canada (Toronto, Montréal [the English market only], Calgary and Vancouver). The 10 television stations with the highest viewership during peak viewing times for children aged 2 to 17 years were selected for each market. The 57 food and beverage categories, which have been published elsewhere,<sup>30</sup> were selected out of 112 possible options because they are among the most advertised to children, as determined by previous research,<sup>21</sup> and are of public health concern (e.g. they are high in fat, salt and sugar). The other food categories (e.g. tofu, diet products) were not included in this study because they are not heavily advertised on television or particularly consumed by children.

### Frequencies

Food advertisement frequency was drawn from Numerator's AdQuest platform. Frequencies were weighted by the number of products featured in an advertisement and the number of times the advertisement was broadcast. For example, an advertisement featuring two products and broadcast 500 times would have a weighted frequency of 1000. Any advertisement featuring four or more products was limited to a weighting multiplier of 3, so the weighted frequency of an advertisement with five products airing 500 times was 1500. This formula is how Numerator weights the gross ratings point (GRP) based on products being advertised. To maintain consistency, the research team

did the same with the frequency for all advertisements.

### Exposures

Numerator expresses exposure to advertisements as ratings, which reflect the estimated viewing audience for an individual advertisement. This is calculated by dividing the estimated audience for an advertisement by the total population for their media market and then multiplying by 100. Ratings are then summed into a GRP across a specific time frame. Average exposure for a given time frame is calculated by multiplying GRPs for a specific audience segment (in this case those aged 2–17) by 100%. GRP values in this study include 24-hour broadcasting for all of 2019.

### Marketing techniques

We conducted a content analysis for all unique food and beverage advertisements across all markets in 2019. We downloaded all advertisements from the Numerator database as videos and then determined the number of unique advertisements, that is, ones that differed creatively by language or duration from other advertisements. Two trained research assistants (DW and MB) coded all the unique advertisements to identify the presence of each marketing technique; a list of the examined marketing techniques has been published elsewhere.<sup>30</sup> The types of marketing techniques identified were based on previous research,<sup>31</sup> and were coded once for each advertisement, regardless of the number of featured products in the advertisement. Inter-rater reliability of 0.93 was obtained during training when coding practice advertisements. The sample of unique advertisements was divided equally between the two research assistants, and any differences were concluded by consensus.

### Classification

Advertisements were classified as “healthy” or “unhealthy” according to a proposed Health Canada model defining which products can be advertised to children based on nutrient content.<sup>32</sup> Packaged products were considered unhealthy when they contained added fat, sugar or sodium that exceeded one or more established thresholds for saturated fat (2 g), total sugars (5 g) and/or sodium (140 mg) per serving size or reference amount; restaurant

items were based on 100 g servings. Multi-product advertisements with at least one unhealthy product were designated “unhealthy.” Advertisements that exclusively featured products with no added fat, sugar or sodium or that did not exceed any of Health Canada’s nutrient threshold levels were designated “healthy.”

To conduct this classification, the nutrition information for advertised products was first collected from the University of Toronto’s 2017 Food Label Information Program (FLIP)<sup>33</sup> and the 2016 Menu-FLIP,<sup>34</sup> which contain food label information for about 17 000 products from Canadian retailers and over 12 000 restaurant and fast-food items. Nutritional data unavailable from FLIP or Menu-FLIP were collected from companies’ Canadian websites, product nutrition facts tables from food retailer websites or the companies’ American websites. Nutritional data were also estimated based on similar products from the Canadian Nutrient File. Nutritional information was only collected for identifiable products, that is, where the video quality was clear enough to identify the item, and was not collected for advertisements containing only company branding (e.g. logos, characters and/or no food product).

### Data analysis

We performed descriptive analyses for all media markets. Frequency of advertisements were calculated by market, station, food category and healthfulness. Average exposure to advertisements were calculated by multiplying GRPs for children aged 2 to 17 years by 100%. Average exposure to food advertisements per person per year was tabulated for each sex by market, television station, food category and healthfulness. To characterize differences between sexes, we calculated relative and absolute differences in advertisement exposure between females and males, with females used as the comparator group.

## Results

### Overall exposure to advertisements

Exposure to advertisements differed by sex in all examined markets (see Table 1). Females in Vancouver viewed the lowest number of advertisements (1016 ads/person/year), while those in Calgary viewed the highest number (1353.6 ads/person/

year). In contrast, males in Calgary viewed the lowest number of advertisements (858.5 ads/person/year), while those in the Montréal English market viewed the highest number (1493.7 ads/person/year). Difference in exposure was highest among males compared to females in the Montréal English market and Vancouver, in relative (27.3% and 24.5%) and absolute (320 and 249.2 ads/person/year) terms. Conversely, exposure among males in Calgary was less compared to females (–36.6%; –495.1 ads/person/year).

### Exposure by food category

Restaurants were the most frequently viewed food category across all markets and by sex (see Table 2). In ads/person/year, females’ second and third highest exposures in Calgary, the Montréal English market and Toronto were snacks (Calgary: 102.5; Montréal English: 112.9; Toronto: 108.0) and breakfast food (Calgary: 100.2; Montréal English: 102.9; Toronto: 87.5). Dairy and candy ranked second and third in Vancouver (82.9 and 72.4 ads/person/year). For males, the highest exposures included snacks (Vancouver: 100.1; Calgary: 61.3; Montréal English: 141.7; Toronto: 110.9), breakfast food in Calgary and Toronto (57.6 and 101.1), dairy in Vancouver (109.5) and candy/chocolate in the Montréal English market (117.5).

The largest positive relative differences in exposure among males compared to females were for miscellaneous food (Vancouver: 38.9%) and water (Montréal English: 59.4%), while the largest positive absolute differences, in ads/person/year, were noted for restaurants (Vancouver: 126.5; Montréal English: 187.5), snacks (Montréal English: 28.8) and dairy (Vancouver: 26.6). Conversely, exposures in Calgary were lower among males than among females across all food categories, and most notably for desserts (–44.5%, –15 ads/person/year), breakfast food (–42.5%, –42.6 ads/person/year) and dairy (–42.6%; –39 ads/person/year).

In Toronto, compared to females, males viewed 15.6% or 1.9 fewer advertisements for bread per person/year and 15.5% or 13.6 more advertisements for breakfast foods per person/year.

**TABLE 1**  
Child exposure to food<sup>a</sup> advertisements on the 10 most popular television stations for children 2–17 years, in Vancouver, Calgary, Montréal (English market) and Toronto, by sex, 2019

Market	Frequency of ads, n	Exposure, ads/person/year <sup>b</sup>		Relative difference <sup>c</sup> , %	Absolute difference <sup>c</sup>
		Females	Males		
Vancouver	536 542	1016.0	1265.2	24.5	249.2
Calgary	538 094	1353.6	858.5	–36.6	–495.1
Montréal English	514 696	1173.7	1493.7	27.3	320.0
Toronto	527 265	1279.3	1264.3	–1.2	–15.0

Source: Numerator, 2019.

Abbreviations: ads, advertisements; GRP, gross ratings point.

<sup>a</sup> Analysis based on the 57 selected food classes.

<sup>b</sup> Calculations based on GRPs for children aged 2–17 years.

<sup>c</sup> Males compared to females.

### Exposure to “unhealthy” advertisements

Among females, those in Toronto viewed the highest number of unhealthy advertisements (593.7 ads/person/year), whereas those in Vancouver viewed the least (449.0 ads/person/year) (see Table 3). Among males, those in the Montréal English market viewed the highest number of unhealthy advertisements (693.4 ads/person/year), while those in Calgary viewed the least (350.6 ads/person/year). Male exposure to unhealthy food advertisements

was higher than that of females’ in Vancouver (24.7%, 111 ads/person/year) and Montréal English (24.0%, 134.2 ads/person/year); the opposite was found in Calgary where females’ exposure to unhealthy food advertisements was higher than that of males (–38.3%, –217.9 ads/person/year).

### Exposure by marketing technique

In Vancouver, more males than females were exposed to all marketing techniques

(see Table 4). The most notable relative difference between sexes in Vancouver was to advertisements with licensed characters, where males viewed 32.6% more advertisements compared to females. In absolute terms, the biggest difference was for health appeals (93.3 ads/person/year).

Exposure to marketing techniques was higher for females than for males in Calgary, especially for child language (i.e. language commonly used by children or directed at children, e.g. “hey kids”), with

**TABLE 2**  
Child exposure to food advertisements on the 10 most popular television stations for children 2–17 years, in Vancouver, Calgary, Montréal (English market) and Toronto, by food category and sex, 2019

Food category <sup>a</sup>	Vancouver				Calgary				Montréal English				Toronto			
	Ads/person/year <sup>b</sup>		Rel diff, %	Abs diff	Ads/person/year <sup>b</sup>		Rel diff, %	Abs diff	Ads/person/year <sup>b</sup>		Rel diff, %	Abs diff	Ads/person/year <sup>b</sup>		Rel diff, %	Abs diff
	Female	Male			Female	Male			Female	Male			Female	Male		
Bread	5.3	5.9	11.3	0.6	6.3	3.7	–41.3	–2.6	6.1	7.4	21.3	1.3	12.2	10.3	–15.6	–1.9
Desserts	29.6	38.7	30.7	9.1	33.7	18.7	–44.5	–15	29.4	35.5	20.7	6.1	26.4	26.1	–1.1	–0.3
Candy/chocolate	72.4	87.6	21.0	15.2	78.2	46.6	–40.4	–31.6	90.0	117.5	30.6	27.5	80.5	77.8	–3.4	–2.7
Breakfast food	65.4	79.7	21.9	14.3	100.2	57.6	–42.5	–42.6	102.9	103.4	0.5	0.5	87.5	101.1	15.5	13.6
Dairy	82.9	109.5	32.1	26.6	92.5	53.1	–42.6	–39.4	90.8	109.2	20.3	18.4	84.4	82.8	–1.9	–1.6
Condiments	20.8	26.4	26.9	5.6	23.4	17.0	–27.4	–6.4	13.1	16.2	23.7	3.1	25.7	26.1	1.6	0.4
Entrees	26.1	30.9	18.4	4.8	32.2	21.1	–34.5	–11.1	35.4	45.8	29.4	10.4	34.5	31.4	–9.0	–3.1
Fruit/vegetables	10.9	12.5	14.7	1.6	16.2	11.0	–32.1	–5.2	16.5	22.6	37.0	6.1	23.6	21.3	–9.7	–2.3
Beverages	63.5	84.6	33.2	21.1	68.1	46.7	–31.4	–21.4	84.3	109.5	29.9	25.2	74.9	70.5	–5.9	–4.4
Miscellaneous	29.3	40.7	38.9	11.4	37.8	22.5	–40.5	–15.3	41.0	52.0	26.8	11.0	40.8	38.0	–6.9	–2.8
Snacks	78.7	100.1	27.2	21.4	102.5	61.3	–40.2	–41.2	112.9	141.7	25.5	28.8	108.0	110.9	2.7	2.9
Water	3.6	3.6	0	0	3.5	2.5	–28.6	–1.0	6.4	10.2	59.4	3.8	4.9	4.7	–4.1	–0.2
Restaurants	553.0	679.5	22.9	126.5	792.3	517.1	–41.3	–2.6	581.8	769.3	32.2	187.5	710.0	699.6	–1.5	–10.4
Total	1041.5	1299.7	24.8	258.2	1386.9	878.8	–36.6	–508.1	1210.7	1540.5	27.2	329.8	1313.3	1300.7	–1.0	–12.6

Source: Numerator, 2019.

Abbreviations: abs diff, absolute difference (males compared to females); ads, advertisements; GRP, gross ratings point; rel diff, relative difference (males compared to females).

<sup>a</sup> Analysis based on the 57 selected food classes.

<sup>b</sup> Calculations based on GRPs for children aged 2–17 years.



**TABLE 3**  
**Child exposure to food advertisements on the 10 most popular television stations for children 2–17 years, in Vancouver, Calgary, Montréal (English market) and Toronto, by Health Canada Nutrient Profile Model classification and sex, 2019**

Markets	Ads/person/year <sup>a</sup>		Relative difference <sup>b</sup> , %	Absolute difference <sup>b</sup>
	Females	Males		
Vancouver				
Healthy	50.1	57.5	14.8	7.4
Unhealthy	449.0	560.0	24.7	111.0
Calgary				
Healthy	54.9	36.5	–33.5	–18.4
Unhealthy	568.5	350.6	–38.3	–217.9
Montréal English				
Healthy	53.8	68.7	27.7	14.9
Unhealthy	559.2	693.4	24.0	134.2
Toronto				
Healthy	49.6	44.6	–10.1	–5.0
Unhealthy	593.7	601.9	1.4	8.2

**Abbreviations:** ads, advertisements; GRP, gross ratings point.

<sup>a</sup> Calculations based on GRPs for children aged 2–17 years.

<sup>b</sup> Males compared to females.

males viewing 42.8% or 38.5 fewer ads/person/year relative to females. At –190.9 ads/person/year, calls to action, a technique designed to motivate the audience to take a desired action, had the largest negative difference in absolute terms for males compared to females.

The greatest relative difference between males and females in the Montréal English market was for teen incentives, where male exposure was 37.1% higher than females' exposure, while the greatest absolute difference was for calls to action (133.4 ads/person/year). In Toronto, male exposure to advertisements using licensed characters was 44.7% or 2.1 ads/person/year higher than females' exposure. Compared to females, males were less exposed to advertisements for parent-child situations (–6.9%, –15.8 ads/person/year).

## Discussion

Overall, children were exposed to high levels of food advertising on television, and sex differences were apparent. Compared to females, males in Vancouver and Montréal were exposed to a greater number of unhealthy food advertisements, while the opposite was found in Calgary.

### Frequency and healthfulness of exposures

Males were exposed to an average of 859 to 1494 and females to an average of 1016

to 1354 food advertisements on the 10 television stations most popular with those aged 2 to 17 years old in 2019. Within each market, both sexes were most exposed to restaurant advertising, including fast-food and sit-down restaurants, where food is typically high in sugar, fat and sodium.<sup>35,36</sup> The ubiquity of restaurant advertising is problematic given that the overconsumption of these foods can lead to the development of chronic diseases, and current consumption by Canadian children is high.<sup>37</sup> Our sample was also exposed to significantly more food advertisements classified as unhealthy, which is consistent with Canadian and international research.<sup>17–28,38,39</sup> Taken together, these findings are of concern given the demonstrated relationship between exposure to food advertising and children's dietary preferences, food intake and food purchase requests.<sup>7,8</sup> The volume of unhealthy food advertising children and adolescents view likely has a negative impact on their eating patterns and dietary choices, demonstrating a need for more stringent policies protecting them from unhealthy food advertising.<sup>5–7</sup>

### Sex differences in frequency and healthfulness

Compared to females, males in Vancouver and the Montréal English markets were exposed to between 24.5% and 27.3% more food advertisements and between 24.0% and 24.7% more advertisements

for unhealthy foods on television. These results are congruent with those of Castronuovo et al.<sup>15</sup>; this scoping review of food marketing and gender in youth found that, compared to girls, boys were more frequently exposed to food and beverage advertisements.<sup>15</sup> Although the review examined gender, the authors noted that most studies conflate sex and gender.

Experimental research indicates that food advertising influences boys' food preferences and immediate intake of food more than that of girls.<sup>40</sup> Males' greater exposures to food marketing in some Canadian cities may be attributed to their higher television viewership.<sup>16</sup> Another possibility is that food and beverage companies specifically target males via unhealthy food products. Food marketers understand the television-viewing patterns of consumers and may be trying to maintain their grip on existing customers, while broadening their appeal to other consumers based on sex. The sex differences between cities may indicate food and beverage companies utilizing different strategies in different cities or may be attributable to males' and females' different viewership patterns.

### Sex differences in marketing techniques

In this study, we found sex differences in marketing techniques, particularly in the Vancouver and Montréal English markets.

**TABLE 4**  
**Child exposure to food advertisements on the 10 most popular television stations for children 2–17 years, in Vancouver, Calgary, Montréal (English market) and Toronto, by marketing technique and sex, 2019**

Marketing technique	Vancouver				Calgary				Montréal English				Toronto			
	Ads/person/year <sup>a</sup>		Rel diff, %	Abs diff	Ads/person/year <sup>a</sup>		Rel diff, %	Abs diff	Ads/person/year <sup>a</sup>		Rel diff, %	Abs diff	Ads/person/year <sup>a</sup>		Rel diff, %	Abs diff
	Female	Male			Female	Male			Female	Male			Female	Male		
Child actor	206.2	262.9	27.5	56.7	284.4	168.9	−40.6	−115.5	271.8	334.2	23.0	62.4	282.5	275.3	−2.5	−7.2
Child-appealing product	346.6	435.0	25.5	88.4	456.1	275.3	−39.6	−180.8	450.1	531.1	18.0	81.0	423.5	438.1	3.4	14.6
Child-appealing characters	263.3	321.9	22.3	58.6	351.0	218.6	−37.7	−132.4	326.6	390.9	19.7	64.3	336.5	343.9	2.2	7.4
Child language	58.2	73.2	25.8	15	90.0	51.5	−42.8	−38.5	88.9	92.6	4.2	3.7	81.5	88.4	8.5	6.9
Child-appealing special effects	304.4	372.9	22.5	68.5	391.1	241.2	−38.3	−149.9	365.1	442.5	21.2	77.4	368.0	372.0	1.1	4.0
Child themes	136.6	167.1	22.3	30.5	167.5	101.7	−39.3	−65.8	179.5	196.4	9.4	16.9	173.2	189.2	9.2	16.0
Use of spokes-characters	197.2	250.7	27.1	53.5	266.8	160.8	−39.7	−106	261.1	309.0	18.3	47.9	249.3	258.6	3.7	9.3
Use of licensed characters	4.6	6.1	32.6	1.5	4.6	3.1	−32.6	−1.5	6.3	6.1	−3.2	−0.2	4.7	6.8	44.7	2.1
Cross-promotions	19.2	22.3	16.1	3.1	27.0	20.4	−24.4	−6.6	20.8	26.3	26.4	5.5	32.3	31.5	−2.5	−0.8
Child incentives	12.2	14.5	18.9	2.3	16.2	10.2	−37.0	−6.0	16.5	15.5	−6.1	−1.0	18.3	18.5	1.1	0.2
Teen actor	140.9	169.7	20.4	28.8	191.9	119.7	−37.6	−72.2	180.0	221.6	23.1	41.6	170.3	171.2	0.5	0.9
Teen language	17.4	21.5	23.6	4.1	29.1	18.1	−37.8	−11	30.2	29.3	−3.0	−0.9	30.2	37.6	24.5	7.4
Teen music	32.9	38.5	17.0	5.6	51.3	29.7	−42.1	−21.6	52.3	52.7	0.8	0.4	48.9	59.0	20.7	10.1
Teen themes	195.4	233.1	19.3	37.7	271.6	176.6	−35.0	−95	241.1	291.5	20.9	50.4	251.4	263.7	4.9	12.3
Teen incentives	5.2	5.7	9.6	0.5	10.6	7.5	−29.2	−3.1	8.9	12.2	37.1	3.3	7.9	8.8	11.4	0.9
Teen humour	28.9	34.7	20.1	5.8	45.1	27.5	−39.0	−17.6	42.9	49.4	15.2	6.5	38.5	42.8	11.2	4.3
Contest/sweepstakes	29.9	34.2	14.4	4.3	39.5	26.8	−32.2	−12.7	34.3	43.5	26.8	9.2	48.4	48.0	−0.8	−0.4
Celebrity endorsement	37.3	41.3	10.7	4	46.0	32.1	−30.2	−13.9	50.6	67.9	34.2	17.3	66.2	68.3	3.2	2.1
Parent–child situations	176.4	223.6	26.8	47.2	232.1	140.4	−39.5	−91.7	219.9	291.0	32.3	71.1	227.8	212.0	−6.9	−15.8
Health appeal	347.6	440.9	26.8	93.3	459.6	287.6	−37.4	−172	372.4	470.2	26.3	97.8	404.3	405.9	0.4	1.6
Price promotion	280.0	334.9	19.6	54.9	364.3	242.2	−33.5	−122.1	285.4	364.2	27.6	78.8	357.6	356.1	−0.4	−1.5
Calls to action	380.5	470.7	23.7	90.2	540.5	349.6	−35.3	−190.9	424.0	557.4	31.5	133.4	485.4	481.9	−0.7	−3.5

**Abbreviations:** abs diff, absolute difference (males compared to females); ads, advertisements; GRP, gross ratings point; rel diff, relative difference (males compared to females).

<sup>a</sup> Calculations based on GRPs for children aged 2–17 years.

Although differences between sexes were seen across all food marketing techniques, compared to females, males in these two markets were exposed to between 90.2 and 133.4 more calls to action, between 93.3 and 97.8 more health appeals and between 81.0 and 88.4 more child-appealing products (because of the type/nature of the product, e.g. its shape, colour and/or design). Calls to action may encourage children to access food company websites, buy an item or engage with interactive

content, such as advergames, surveys and polls<sup>41</sup>. This technique is of concern given children's and adolescents' attraction to online spaces and the amount of time they spend online.<sup>42</sup> Our results show that males in Vancouver and the Montréal English market were exposed to more health appeals that are attractive to children<sup>43</sup> and may be misleading them into thinking a product is healthy; this is troubling given males' greater intake of ultra-processed foods compared to females' intake.<sup>4</sup>

Marketing techniques create appealing, relatable content that captures a viewer's attention through gender roles and stereotypes or other characteristics.<sup>44</sup> For example, a 2019 Rudd Center for Food Policy and Obesity report stated that food advertising directed at ethnic minorities is on the rise, and that advertising that is created for and directed at specific ethnic groups has negative health impacts, particularly among minority ethnic groups.<sup>45</sup> This form of targeted marketing is a

public health issue, as it propagates health inequalities.<sup>45</sup> The presence of food advertising targeted at ethnic minorities, combined with our research results, underscores the demographically driven nature of corporate marketing strategies that may lead to negative health outcomes.

Obesity is a result of a plethora of factors, including exposure to unhealthy food advertising via different media and settings.<sup>46</sup> While broadcast television remains an important source of exposure to unhealthy food advertising, children are also exposed to food advertising on digital platforms such as streaming television.<sup>23,47</sup> This is worrisome as digital advertising can be targeted to specific viewers using behavioural targeting; it is also cost-effective and more difficult to regulate.<sup>42</sup> Future research should consider examining children's and adolescents' exposure to food advertising on streaming services, by sex, particularly as many such services now offer cheaper subscriptions that include advertising content.<sup>47</sup>

### Strengths and limitations

This study has several limitations. First, we were confined to Numerator's method of measuring advertising exposure. For example, Numerator's GRP data record exposure to a maximum of three products per advertisement. Any advertisement featuring four or more products was limited to a weighting multiplier of 3. Second, the unit of analysis we used in this paper was based on the GRP of advertisements, which is a measure used by advertisers to determine the reach of an advertisement. Because GRPs represent the proportion of an audience in the population that viewed advertisements and are not an individual-level measure of exposure, we were unable to perform any statistical tests.

Third, we were unable to examine sex differences in exposure of children aged 2 to 11 years and adolescents aged 12 to 17 separately as sample sizes were too small for reliable viewership estimates. In addition, while the use of gender-based targeting is a known practice, this study could not establish whether the sex differences observed in exposure to marketing techniques stem from targeting by food companies or from differential television-viewing habits, as male children in Canada watch more television compared to female children.<sup>16</sup> Further, we recorded the presence of various characters or

endorsers (e.g. child actors, celebrities) in food advertising, but did not record their sex or gender; doing so would have provided greater insight into the targeted audience of advertisements.

Fourth, this study did not include all food categories or television stations monitored by Numerators and/or Numeris. Our findings only apply to the 57 food categories and the 10 stations we examined in this study. Fifth, sex and gender are often conflated. Sex was the variable we used for this study; however, it is likely that food companies target individuals based on gender stereotypes, that is, social constructs rather than biological sex. Additional research exploring gender could provide greater insights into how food companies target children and adolescents.

Lastly, nutritional information was missing for 52% of advertisements. Missing data were largely due to brand advertising and high numbers of restaurant products for which nutritional information was unavailable.

Despite limitations, this is the first Canadian study to explore sex differences in children's and adolescents' exposure to food advertisements on television, using a full year of data, to eliminate seasonal bias, and across four major markets in Canada's most populous provinces.

### Conclusion

Television is a powerful source of exposure to unhealthy food advertising for children and sex differences are evident in some regions. Though research is needed in more media and other settings, public health authorities designing policies that restrict food advertising to children need to consider that some groups may be more vulnerable to unhealthy food marketing and its health impact. Monitoring of television advertising to children and adolescents would benefit from sex- and gender-based analysis so that effective policies can be designed to protect males and females equally.

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### Conflicts of interest

In 2018, EP received a small honorarium from the Stop Marketing to Kids Coalition, a coalition of non-governmental health organizations, for reviewing policy recommendations and supporting evidence. In 2020, EP and JSG were employed by Health Canada, on a casual basis, to support research into food marketing in Canada. EP is supported by the Canada Graduate Scholarship to Honour Nelson Mandela awarded by CIHR.

All other authors have no conflicts of interest.

### Authors' contributions and statement

MPK – Funding acquisition; MPK and JSG – Conceptualization, Methodology; JSG – Project administration; MPK – Supervision; JSG, MW, JSG, MB, DW, EP, LR, MP, LV, CM and ML – Data curation; JSG – Data analyses; MPK – Data interpretation; MPK, AA, JSG, EP, AO and LR – Writing – Original draft; All authors – Review and editing. All authors read and approved the final manuscript.

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