Adults' Exposure to Unhealthy Food and Beverage Marketing: A Multi-Country Study in Australia, Canada, Mexico, the United Kingdom, and the United States

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ABSTRACT

Background: Food marketing increases product appeal, purchasing, and consumption, using diverse strategies and locations to reach consumers.

Objectives: The aim of this study was to examine differences in adults' self-reported exposure to various marketing strategies (brand and licensed characters, celebrities, and sponsorship of sports and cultural events) and locations (television, radio, and digital media) across 5 countries: Australia, Canada, Mexico, the United Kingdom, and the United States.

Methods: We analyzed cross-sectional survey data on self-reported exposure to food marketing strategies and locations collected in 2018 by the International Food Policy Study. Participants ($n = 21,678$) aged ≥ 18 years completed an online survey. Exposures to unhealthy food marketing strategies and locations in the prior 30 days were self-reported. Regression models examined differences in marketing exposure and locations across countries.

Results: The average number of unhealthy food marketing strategies to which participants reported being exposed ranged from 0.5 in the United Kingdom to 2.3 in Mexico. Self-reported exposure to strategies across all countries was highest for brand characters (32%), followed by licensed characters (22%). In total, the reported mean exposure of marketing locations was 1.6 in the prior month. Television was the most prevalent location (44%), followed by digital marketing (32%). Adjusted models indicated that the odds of reporting exposure to marketing strategies and marketing locations were higher for Mexico compared to the rest of the countries.

Conclusions: Adults report a variety of exposures to unhealthy food marketing in all countries, but exposure was highest in Mexico. Special attention should be paid to regulating marketing strategies, such as brand characters and licensed characters, and locations, such as television and digital marketing. *J Nutr* 2022;152:25S–34S.

Keywords: unhealthy food marketing, brand characters, licensed characters, television, radio, digital food marketing

Introduction

Obesity and other diet-related noncommunicable diseases are a great threat to public health (1). In 2005, the estimated numbers of individuals with overweight and obesity globally were 937 million and 396 million, respectively. If trends continue, models suggest there will be 2.16 billion and 1.12 billion individuals with excess weight and obesity, respectively, by 2030 (2). The unhealthy food environment has been found to be a key driver of overweight and obesity (3). In particular, the marketing of foods and beverages containing excessive amounts of energy and nutrients of concern, such as sugar, sodium, and fat (trans

and saturated), is a powerful cue encouraging unhealthy dietary behaviors (4, 5).

Marketing is any form of commercial communication designed to increase the recognition, appeal, purchase, or consumption of particular products (6). There is a growing body of literature indicating that unhealthy food and beverage marketing is pervasive on diverse media channels, such as on television (7) and the Internet (8), and across a variety of settings, such as schools and recreation centers (9, 10). While most research examining marketing targets the impact of marketing on children, the scant research available suggests a similar, albeit dampened, effect on adults (11,

12). An experimental study in adult women conducted in the Netherlands found that exposure to soda commercials while watching a movie increased sugar-sweetened beverage consumption (13). Similarly, a study conducted among adults in the United Kingdom also found that exposure to unhealthy food commercials on television heightened participants' desire to eat pizza (14), with comparable results noted in a study among adults from the United States (15).

Marketing effectiveness not only depends on exposure but also on the power of marketing to increase product appeal and consumption. Some examples of persuasive marketing strategies that increase the power of marketing to children include brand mascots (e.g., Tony the Tiger), licensed characters (e.g., from movies and television shows) (6), and premium offers (e.g., giveaways, collectibles) (16, 17). Many marketing strategies also likely appeal to adults, such as nutritional and health claims (18); however, there is scant research examining adults' exposure to and the impacts of such techniques.

In 2016, the Commission on Ending Childhood Obesity of the WHO called for a reduction in child and adolescent exposure to the marketing of unhealthy foods in all media (19). In most countries, marketing regulations are a mix of statutory and/or self regulation and only include the protection of children under 12 or 15 years old (20). Canada and Australia's advertising regulations are mixes of statutory regulations and self-regulatory codes. In Mexico, the state regulates television and cinema, but not digital media. The United States has a voluntary self-regulatory code in which committed food companies agree to only advertise "healthy foods" to children under 12 years, based on criteria defined by food industry. Currently, no food marketing regulation exists to limit marketing to adults on the various media channels they consume or in places where they gather.

Most food marketing research has examined exposure in and strategies targeted at children and adolescents. There is little information about adults' food and beverage marketing exposure and whether it differs across countries. While marketing restrictions usually apply to marketing that appeals to children, such restrictions may also influence exposure to marketing among adults. Adults make household food decisions, and parents play a critical role in food purchasing and shaping children's food preferences (21). Therefore, adult exposure to food marketing is of scientific interest due to its influence on both children and adults, given the high burdens of obesity in both populations. Cross-country comparisons can help evaluate the effectiveness of different approaches to regulating unhealthy food and beverage marketing. Hence, the aim of this study was to evaluate the differences in adults' self-reported exposure to various marketing strategies and locations across 5 countries: Australia, Canada, Mexico, the United Kingdom, and the United States.

Methods

Study design and participants
We analyzed cross-sectional survey data from the 2018 International Food Policy Study (IFPS) (22). The study was conducted in 5 countries: Australia, Canada, Mexico, the United Kingdom, and the United States. The sample included 22,824 participants aged 18 years or older who completed an online survey in 2018. Participants were recruited through the Nielsen Consumer Insights Global Panel and their partners' panels, using both probability and nonprobability sampling methods. A targeted recruitment strategy was employed, so that the percentages of participants in each sex and age group would be similar to those in the general population for each country. Data were weighted with poststratification sample weights constructed using a raking algorithm, with population estimates from the census in each country based on age group, sex, region, ethnicity (except in Canada), and education (except in Mexico). Surveys were conducted in English in Australia and the United Kingdom; Spanish in Mexico; English or French in Canada; and English or Spanish in the United States. Members of the research team who were native in each language reviewed the French and Spanish translations independently. The median time to complete the survey was 40 minutes. A full description of the study methods can be found in the International Food Policy Study: Technical Report Wave 2 (22).

Ethical considerations
Respondents provided consent prior to completing the survey. Participants received remuneration in accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes). The study received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 30829).

Exposure to marketing strategies: characters, sport teams, and events
To assess exposure to a variety of marketing strategies, participants were given examples of unhealthy foods: "unhealthy foods include processed foods high in sugar, salt, or saturated fat, such as soda/pop, fast food, chips, sugary cereals, cookies and chocolate bars." Then, they were asked: "In the last 30 days, have you seen any of the following?" They could select all the marketing strategies that applied, as listed in **Table 1**, or "none of the above." Participants who answered "don't know" ($n = 1110$) or "refuse to answer" ($n = 36$) were excluded from the analyses.

Exposure to marketing locations: media channels and settings
Additionally, exposure to food and beverage marketing was examined across media channels and settings. The question was asked as follows: "in the last 30 days, have you seen or heard any advertisements or promotions for 'unhealthy foods' in the following places?" Again, the same examples for unhealthy foods were given. Participants could select all locations that applied. The marketing locations queried are listed and defined in **Table 2**. For the analysis, some sources of exposure

TABLE 1 Marketing strategies examined in the 2018 International Food Policy Study

Marketing strategy	Question wording
Licensed characters	Unhealthy food or drinks promoted using characters from movies or television (e.g., Star Wars, Disney characters)
Brand characters	Unhealthy food or drinks promoted with characters created by food companies (e.g., Tony the Tiger, Ronald McDonald)
Celebrities	Celebrity endorsements of unhealthy food/drinks
Professional sport teams or sporting events	Professional sport teams or sporting events sponsored by unhealthy food/drink companies
Community sport teams	Children's/community sports teams sponsored by unhealthy food/drink companies
Cultural events	Cultural or community events sponsored by unhealthy food/drink companies

were collapsed into broader marketing location categories; the final categories analyzed included digital media, outdoor marketing, in supermarkets and in recreation areas, television, radio, magazine or newspaper, movies or cinema, and school/college/university. Participants could alternatively select "I haven't seen any marketing for unhealthy food in the last 30 days." Those who answered "don't know" ($n = 767$) or "refuse to answer" ($n = 37$) were excluded from the analyses. Self-reported exposure to marketing has been examined in previous IFPS research to assess promotion location and sugar-sweetened beverage intake (23) and self-reported exposure among parents (24).

Covariates
Covariates included sex (male or female), age group (18 to 29, 30 to 44, 45 to 59, or >60 years old), education (low, medium, or high), and ethnicity (majority or minority). Income adequacy was assessed with the question "thinking about your total monthly income, how difficult or easy is it for you to make ends meet?," with response options including very difficult, difficult, neither easy nor difficult, easy, or very easy. Occupation was classified as paid job, looking for job and volunteering, attending school, household work, retired, or caregiving for themselves and others, with the latter category including long-term illness, maternity leave, caregiving for children, and caregiving for others. Self-reported height and weight were used to classify participants as underweight (<18.5 kg/m^2), normal weight (18.5 to 24.9 kg/m^2), overweight (25.0 to 29.9 kg/m^2), or obese (>30 kg/m^2) using WHO BMI criteria (25).

Statistical analysis
Pearson chi-square tests were used to evaluate differences in sociodemographic characteristics by country. Prevalences and 95% CIs of estimates of exposure to marketing strategies and exposure to marketing in various locations in the prior 30 days were estimated overall and for each country. An ordinal variable called all marketing strategies was created to count the number of marketing strategies that participants reported being exposed to, ranging from 0–6. A similar ordinal variable was created for all marketing locations, ranging from 0–9. To compare exposure to marketing strategies across countries, we ran an ordered logistic regression model with all marketing strategies as the outcome variable and country as the independent variable. The same approach was followed for all marketing locations. Models are presented unadjusted and adjusted by all covariates.

Logistic regression models were used to explore differences in self-reported exposure to each individual marketing strategy or location by country. Exposure to individual marketing strategies or marketing locations [e.g., licensed characters (0/1), brand character (0/1), and celebrity (0/1)], coded as either 1 for exposed or 0 for not exposed, was the dependent variable and country was the independent variable (reference group = Mexico). Mexico was considered the reference group because it is the only middle-income country in the sample, and preliminary analyses suggested that this country differed from the others. Nevertheless, we also assessed differences between all countries by changing the reference group. Unadjusted and adjusted logistic models were estimated. Adjusted models included all covariates described in the methods. All analyses were performed in STATA, version 14 (StataCorp, LP).

Results

A total of 21,678 participants completed the IFPS survey and were retained in the analytic sample, including 3824 (17.7%) from Australia, 4120 (19.0%) from Canada, 4094 (18.9%) from Mexico, 5224 (24.0%) from the United Kingdom, and 4416 (20.4%) from the United States. Weighted sample characteristics are presented in Table 3. Approximately half the sample was female, participants were largely from the majority ethnicity group in all countries, and one-quarter to one-third of the sample reported a high level of education in all countries (with the exception of Mexico, where 68% were highly educated). In all countries, about one-third of participants reported it was very difficult or difficult to make ends meet, one-third reported it was neither easy nor difficult to make ends meet, and one-third said it was easy or very easy to make ends meet. There were fewer older participants in Mexico and more participants in a paid job in Mexico.

Exposure to marketing strategies
Table 4 shows the prevalences of marketing strategies and locations across countries. In total, adults reported that they were exposed to an average of 1.07 marketing strategies in the prior month. The most prevalent marketing strategy reported across all countries was exposure to brand characters (32.2%),

TABLE 2 Marketing locations (media and settings) examined in the 2018 International Food Policy Study

Media/Setting	Question wording
Television	Television
Radio	Radio
Digital marketing	Online/Internet; mobile apps/video game; social media (e.g., Twitter, Facebook, Instagram); in a text message
Magazine or newspaper	Magazine or a newspaper
Outdoor marketing	Billboard or outdoor sign (e.g., posters); on buses, bus stops, and other public transport
In movies/cinema	Movies or at movie theaters
At school/college/university	School, college, or university
In supermarkets and other areas	Signs or displays in supermarkets, convenience stores, or restaurants; giveaways, samples, or special offers
In recreation areas	Recreation/community center; sports event, concert, or community event

TABLE 3 Sociodemographic characteristics of participants from Australia, Canada, the United Kingdom, the United States, and Mexico who participated in the International Food Policy Study of 2018 (n = 22,824)[1]

	Australia		Canada		Mexico		United Kingdom		United States		P value[2]
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Age group	—	—	—	—	—	—	—	—	—	—	<0.001
18–29 years	21.84	20.28–23.47	19.78	18.28–21.36	30.20	28.68–31.76	19.67	18.41–20.98	21.42	19.96–22.95	
30–44 years	26.66	25.11–28.28	24.89	23.43–26.42	32.09	30.51–33.73	24.62	23.29–25.00	24.93	23.46–26.47	
45–59 years	24.35	22.89–25.86	25.80	24.27–27.39	28.23	26.42–30.11	25.80	24.40–27.25	25.54	23.97–27.18	
≥60 years	27.15	25.75–28.60	29.53	27.93–31.19	9.48	8.23–10.89	29.92	28.56–31.32	28.11	26.62–29.64	
Sex	—	—	—	—	—	—	—	—	—	—	0.700
Male	49.10	47.35–50.86	49.32	47.52–51.12	47.57	45.75–49.40	48.82	47.25–50.40	48.71	46.95–50.48	
Female	50.90	49.14–52.65	50.68	48.88–52.48	52.43	50.60–54.25	51.18	49.60–52.75	51.29	49.52–53.05	
Education level (n = 22,755)	—	—	—	—	—	—	—	—	—	—	<0.001
Low	42.08	40.30–43.89	42.50	40.59–44.42	19.91	18.48–21.42	48.59	46.99–50.18	58.8	57.20–60.38	
Medium	32.22	30.67–33.82	33.25	31.73–34.80	13.24	11.95–14.63	23.06	21.89–24.28	9.77	9.13–10.45	
High	25.69	24.32–27.12	24.25	23.03–25.52	66.86	65.07–68.60	28.35	27.17–29.57	31.43	30.05–32.85	
Ethnicity	—	—	—	—	—	—	—	—	—	—	<0.001
Majority	75.49	73.63–77.26	79.30	77.79–80.72	78.80	76.10–80.50	88.81	87.67–89.86	75.26	73.70–76.75	
Minority	24.51	22.74–26.37	20.70	19.28–22.21	21.20	19.50–23.01	11.19	10.14–12.33	24.74	23.25–26.30	
Income adequacy level (n = 22,642)	—	—	—	—	—	—	—	—	—	—	<0.001
Very difficult	8.87	7.89–9.95	8.88	7.80–10.08	12.22	10.95–13.63	6.91	6.09–7.83	9.55	8.50–10.73	
Difficult	19.39	18.05–20.80	19.57	18.10–21.12	31.73	30.02–33.49	18.20	16.98–19.48	20.21	18.77–21.72	
Neither	37.45	35.75–39.18	37.09	35.35–38.86	38.79	37.03–40.59	36.59	35.07–38.13	34.21	32.54–35.91	
Easy	23.33	21.90–24.82	22.16	20.77–23.61	13.81	12.65–15.05	24.37	23.07–25.72	21.52	20.19–22.91	
Very easy	10.97	9.94–12.09	12.31	11.28–13.42	3.45	2.87–4.15	13.94	12.95–15.00	14.51	13.31–15.80	
Language	—	—	—	—	—	—	—	—	—	—	<0.001
English	100	—	82.15	80.77–83.46	0	—	100	—	91.09	90.00–92.05	
French	0	—	17.85	16.54–19.23	0	—	0	—	0	—	
Spanish	0	—	0	—	100	—	0	—	8.91	7.94–10.00	
Occupation (n = 22,713)	—	—	—	—	—	—	—	—	—	—	<0.001
Paid job	49.75	47.99–51.50	46.82	45.05–48.61	69.55	67.75–71.29	47.01	45.44–48.58	43.56	41.84–45.30	
Looking for job	8.48	7.49–9.60	7.25	6.22–8.43	5.16	4.35–6.10	6.39	5.59–7.29	7.5	6.53–8.59	
Attending school	3.17	2.52–3.99	4.51	3.78–5.36	7.33	6.54–8.19	4.36	3.77–5.03	3.97	3.30–4.76	
Household	13.45	12.25–14.75	10.31	9.17–11.57	11.73	10.48–13.11	10.62	9.63–11.69	16.51	15.15–17.96	
Retired	20.20	18.93–21.53	24.25	22.76–25.80	4.39	3.52–5.47	23.24	22.01–24.53	20.77	19.41–22.20	
Caregiving for others	4.94	4.25–5.74	6.86	5.84–8.04	1.84	1.38–2.45	8.38	7.46–9.41	7.7	6.71–8.82	
BMI categories (n = 19,860)[3]	—	—	—	—	—	—	—	—	—	—	<0.001
Underweight	3.56	2.86–4.43	3.65	2.97–4.48	2.44	1.92–3.11	3.71	3.11–4.43	3.91	3.18–4.81	
Normal weight	41.87	40.02–43.74	37.38	35.57–39.23	45.82	43.88–47.78	42.84	41.14–44.56	34.53	32.81–36.30	
Overweight	30.38	28.71–32.12	32.00	30.27–33.78	33.97	32.15–35.83	32.89	31.30–34.52	31.04	29.37–32.77	
Obesity	24.18	22.67–25.77	26.97	25.29–28.71	17.77	16.29–19.35	20.56	19.17–22.02	30.52	28.81–32.28	

[1] Data were weighted.
[2] Pearson $\chi 2$ tests were calculated to determine differences by countries and sociodemographic characteristics.
[3] The BMI categories were underweight (<18.5 kg/m²), normal weight (18.5 to 24.9 kg/m²), overweight (25.0 to 29.9 kg/m²), and obesity (>30 kg/m²).

TABLE 4 Means and prevalence of marketing strategies and locations across 5 countries from the International Food Policy Study of 2018[1]

	All countries (n = 22,824)		Australia (n = 4103)		Canada (n = 4397)		Mexico (n = 4135)		United Kingdom (n = 5549)		United States (n = 4640)		P value[2]
	% or mean	95% CI	% or mean	95% CI	% or mean	95% CI	% or mean	95% CI	% or mean	95% CI	% or mean	95% CI	
Marketing strategies													
Number of marketing strategies exposure, mean and 95% CI	1.07	1.04–1.09	0.77	0.72–0.81	0.88	0.83–0.92	2.27	2.21–2.33	0.52	0.49–0.55	1.08	1.04–1.14	<0.001
Licensed characters, %	22.50	21.85–23.14	14.67	13.45–15.97	19.10	17.70–20.57	46.68	44.85–48.51	11.45	10.46–12.50	24.26	22.81–25.76	<0.001
Brand characters, %	32.16	31.45–32.89	22.28	20.85–23.78	26.78	25.22–28.38	64.92	63.10–66.68	17.20	16.05–18.39	34.72	33.08–36.39	<0.001
Celebrity, %	18.44	17.85–19.05	12.19	11.08–13.40	13.08	11.89–14.36	43.68	41.86–45.51	9.18	8.32–10.11	17.62	16.37–18.93	<0.001
Professional sport teams, %	20.42	19.80–21.05	16.99	15.70–18.35	17.38	16.06–18.78	41.21	39.41–43.03	9.59	8.71–10.54	20.77	19.44–22.16	<0.001
Community sports teams, %	6.86	6.48–7.26	6.66	5.85–7.56	6.31	5.47–7.25	14.08	12.85–15.40	2.97	2.49–3.52	5.81	5.07–6.64	<0.001
Cultural or community events, %	6.52	6.14–6.91	4.30	3.66–5.03	5.37	4.60–6.25	17.22	15.84–18.68	1.81	1.44–2.24	5.66	4.92–6.51	<0.001
Marketing locations													
Number of marketing locations exposure, mean	1.63	1.60–1.67	1.40	1.34–1.46	1.37	1.31–1.44	2.79	2.70–2.88	1.11	1.06–1.16	1.68	1.61–1.74	
Television, %	44.02	43.25–44.80	41.85	40.13–43.57	37.77	36.03–39.53	62.11	60.29–63.88	34.78	33.31–36.28	46.84	45.08–48.59	<0.001
Radio, %	12.91	12.39–13.44	12.13	11.01–13.34	10.39	9.31–11.57	24.55	22.98–26.17	6.42	5.65–7.27	13.38	12.28–14.56	<0.001
Digital marketing, %	32.86	32.14–33.59	24.96	23.43–26.54	27.73	26.15–29.36	62.82	60.99–64.61	19.74	18.51–21.01	33.72	32.11–35.35	<0.001
Magazine/newspaper, %	15.98	15.43–16.54	12.67	11.59–13.82	13.85	12.67–15.12	25.8	24.19–27.46	12.36	11.40–13.39	16.5	15.33–17.73	<0.001
Outdoor marketing, %	17.53	16.95–18.12	16.23	14.97–17.57	13.47	12.30–14.71	29.10	27.45–30.80	14.88	13.80–16.01	15.39	14.20–16.66	<0.001
Movies/cinema, %	10.05	9.59–10.51	7.57	6.70–8.54	8.18	7.28–9.17	20.83	19.38–22.36	4.91	4.30–5.61	10.52	9.55–11.57	<0.001
School/college/university, %	4.40	4.09–4.73	2.28	1.78–2.90	2.58	2.07–3.20	12.88	11.72–14.14	1.87	1.49–2.33	3.49	2.91–4.16	<0.001
Supermarkets, %	18.34	17.75–18.93	16.14	14.95–17.38	17.64	16.30–19.05	25.89	24.49–27.54	13.25	12.25–14.31	20.32	18.99–21.70	<0.001
Recreation, %	7.62	7.23–8.02	6.52	5.70–7.44	6.40	5.61–7.28	15.56	14.27–16.93	3.25	2.76–3.82	7.90	7.09–8.79	<0.001

[1] Data were weighted.
[2] Pearson χ2 tests were calculated to determine differences by countries and each marketing strategy.

followed by licensed characters (22.5%). The average numbers of strategies reported by participants across countries ranged from 0.5 in the United Kingdom to 2.3 in Mexico. Mexico had a higher prevalence of exposure to brand characters (64.9%) compared to all other countries. In contrast, the United Kingdom had a lower prevalence of exposure to licensed characters than the other countries (11.45%).

Estimates from separate ordered logistic regression and logistic regression models examining exposure to marketing strategies across countries are shown in Table 5. Exposure to all marketing strategies and to individual marketing strategies differed by country, education level, ethnicity, and income adequacy. Participants in Mexico were more likely to report more exposure to marketing strategies and more likely to report being exposed to more individual marketing strategies compared to the rest of the countries. The only exception was for marketing via community sports teams when compared to participants in Australia, Canada and the United States. Participants in Australia, Canada, and the United States were more likely to report more exposure to all marketing strategies and to individual marketing strategies compared to the United Kingdom. Participants in the United States were more likely to report exposure to all marketing strategies and to licensed characters, brand characters, celebrities, and professional sports teams than participants in Australia and Canada. However, Australian participants were more likely to report exposure to marketing via community sports teams than those in the United States. Canadian participants were more likely than those in Australia to report exposure to all marketing strategies, as well as to licensed characters and brand characters. Unadjusted models are presented in **Supplemental Table S1**.

Across the entire sample, the adjusted model indicated that participants with the highest level of education were more likely to report exposure to marketing strategies compared to those with lower education [adjusted OR (AOR), 1.33; 95% CI: 1.23–1.43]. Minority participants were more likely to report exposure compared to those from the ethnic majority group (AOR, 1.20; 95% CI: 1.10–1.31). Participants who reported the greatest ease in making ends meet were less likely to report exposure to marketing strategies compared to those who reported the greatest difficulty in making ends meet [AOR, 0.83 (95% CI: 0.72–0.96); data not shown].

Exposure to marketing locations
In total, participants across all countries reported seeing advertisements or promotions for unhealthy foods in an average of 1.63 locations (95% CI: 1.60–1.67 locations) in the prior month (Table 4). Mexico reported the highest mean exposure, with 2.79 locations. Overall, television was the most prevalent location of marketing exposure (44.02%) across countries, followed by digital marketing (32.86%); school/college/university was the least prevalent location (4.40%). Mexico had the highest reported prevalences of exposure to television (62.11%) and to digital marketing (62.82%) compared to all other countries.

Estimates from separate ordered logistic regression and logistic regression models examining exposure to marketing locations across countries are shown in Table 6. Exposure to marketing locations varied across countries. Participants in Mexico were more likely to report exposure to all marketing locations and each individual location than participants in all other countries. Participants in the United States were more likely to report exposure to all marketing locations than those in Australia, Canada, and the United Kingdom.

TABLE 5 Adjusted odds ratios of country comparisons for being exposed to marketing strategies ($n = 21,678$)[1]

Country comparison[2]	All marketing strategies,[3] AOR (95% CI)	Licensed characters,[3] AOR (95% CI)	Brand characters,[3] AOR (95% CI)	Celebrities,[3] AOR (95% CI)	Professional sports teams,[3] AOR (95% CI)	Community sports teams,[3] AOR (95% CI)	Cultural or community events,[3] AOR (95% CI)
Australia vs. Canada	0.85 (0.76–0.94)	0.69 (0.60–0.79)	0.77 (0.68–0.87)	0.90 (0.77–1.05)	0.97 (0.84–1.11)	1.10 (0.90–1.36)	0.84 (0.66–1.05)
Australia vs. Mexico	0.22 (0.18–0.28)	0.26 (0.19–0.34)	0.20 (0.15–0.25)	0.26 (0.19–0.35)	0.37 (0.28–0.50)	1.17 (0.79–1.74)	0.47 (0.31–0.72)
Australia vs. UK	1.45 (1.32–1.60)	1.25 (1.08–1.44)	1.36 (1.21–1.54)	1.28 (1.10–1.50)	1.90 (1.66–2.20)	2.19 (1.74–2.75)	2.41 (1.82–3.20)
Australia vs. US	0.60 (0.54–0.66)	0.52 (0.46–0.60)	0.54 (0.48–0.60)	0.63 (0.55–0.72)	0.78 (0.69–0.89)	1.25 (1.01–1.54)	0.80 (0.63–1.00)
Canada vs. Mexico	0.26 (0.21–0.32)	0.38 (0.29–0.49)	0.26 (0.20–0.32)	0.29 (0.22–0.38)	0.38 (0.29–0.50)	1.06 (0.73–1.55)	0.56 (0.38–0.83)
Canada vs. UK	1.71 (1.55–1.90)	1.82 (1.58–2.09)	1.77 (1.57–2.00)	1.43 (1.22–1.67)	1.97 (1.70–2.27)	1.99 (1.57–2.53)	2.89 (2.17–3.83)
Canada vs. US	0.71 (0.64–0.78)	0.76 (0.67–0.86)	0.69 (0.62–0.78)	0.70 (0.61–0.81)	0.80 (0.71–0.91)	1.13 (0.91–1.40)	0.96 (0.77–1.19)
Mexico vs. UK	6.60 (5.29–8.24)	4.80 (3.63–6.34)	6.93 (5.37–8.95)	5.00 (3.65–6.70)	5.11 (3.82–6.85)	1.87 (1.24–2.81)	5.14 (3.26–8.10)
Mexico vs. US	2.72 (2.20–3.34)	2.01 (1.56–2.59)	2.72 (2.15–3.46)	2.43 (1.84–3.20)	2.08 (1.60–2.72)	1.06 (0.74–1.51)	1.70 (1.17–2.49)
UK vs. US	0.41 (0.37–0.45)	0.41 (0.36–0.47)	0.39 (0.35–0.44)	0.49 (0.42–0.57)	0.41 (0.36–0.47)	0.57 (0.45–0.72)	0.33 (0.25–0.44)

[1] ORs were estimated using ordered logistic regression models and logistic regression models. Abbreviation: AOR, adjusted OR.
[2] The second category is the reference group.
[3] Models were adjusted for age, sex, education level, ethnicity, income adequacy, language, occupation, and BMI.

TABLE 6 Adjusted odds ratios of country comparisons for being exposed to marketing locations (n = 21,678)[1]

Country comparison[2]	All marketing locations,[3] AOR (95% CI)	Television,[3] AOR (95% CI)	Radio,[3] AOR (95% CI)	Digital marketing,[3] AOR (95% CI)	Magazine /newspaper,[3] AOR (95% CI)	Outdoor marketing,[3] AOR (95% CI)	Movies/cinema,[3] AOR (95% CI)	School/college /university,[3] AOR (95% CI)	Supermarkets,[3] AOR (95% CI)	Recreation,[3] AOR (95% CI)
Australia vs. Canada	1.05 (0.95–1.16)	1.22 (1.10–1.36)	1.18 (1.00–1.40)	0.80 (0.71–0.91)	0.91 (0.78–1.05)	1.18 (1.02–1.36)	0.86 (0.71–1.02)	0.81 (0.57–1.14)	0.86 (0.75–0.98)	1.05 (0.85–1.28)
Australia vs. Mexico	0.34 (0.28–0.41)	0.58 (0.46–0.74)	0.66 (0.47–0.92)	0.23 (0.18–0.30)	0.35 (0.26–0.47)	0.36 (0.25–0.50)	0.22 (0.14–0.35)	0.27 (0.15–0.50)	0.23 (0.15–0.33)	0.34 (0.21–0.56)
Australia vs. UK	1.28 (1.18–1.40)	1.37 (1.24–1.51)	1.91 (1.60–2.28)	1.26 (1.12–1.42)	1.05 (0.91–1.20)	1.08 (0.95–1.23)	1.53 (1.26–1.86)	1.07 (0.76–1.50)	1.29 (1.13–1.46)	2.03 (1.63–2.54)
Australia vs. US	0.75 (0.68–0.82)	0.83 (0.75–0.91)	0.88 (0.76–1.03)	0.60 (0.53–0.67)	0.72 (0.62–0.82)	1.01 (0.88–1.15)	0.64 (0.54–0.76)	0.60 (0.44–0.83)	0.70 (0.62–0.79)	0.78 (0.65–0.94)
Canada vs. Mexico	0.32 (0.27–0.39)	0.47 (0.38–0.59)	0.56 (0.41–0.76)	0.29 (0.22–0.37)	0.38 (0.29–0.51)	0.30 (0.22–0.42)	0.26 (0.17–0.40)	0.34 (0.19–0.59)	0.26 (0.19–0.38)	0.33 (0.21–0.52)
Canada vs. UK	1.22 (1.11–1.34)	1.12 (1.01–1.24)	1.62 (1.34–1.95)	1.57 (1.39–1.77)	1.15 (1.00–1.33)	0.92 (0.80–1.06)	1.79 (1.48–2.17)	1.33 (0.96–1.84)	1.50 (1.31–1.72)	1.95 (1.55–2.44)
Canada vs. US	0.71 (0.65–0.78)	0.68 (0.61–0.75)	0.75 (0.64–0.88)	0.74 (0.66–0.83)	0.79 (0.69–0.90)	0.85 (0.74–0.99)	0.75 (0.63–0.88)	0.75 (0.56–1.01)	0.82 (0.72–0.93)	0.74 (0.62–0.90)
Mexico vs. UK	3.78 (3.11–4.60)	2.36 (1.86–3.00)	2.91 (2.07–4.08)	5.48 (4.23–7.10)	3.03 (2.25–4.09)	3.04 (2.16–4.29)	6.94 (4.38–11.00)	3.95 (2.18–7.16)	5.69 (3.89–8.31)	5.91 (3.59–9.72)
Mexico vs. US	2.20 (1.83–2.64)	1.42 (1.14–1.78)	1.34 (0.98–1.82)	2.59 (2.04–3.30)	2.07 (1.57–2.73)	2.83 (2.04–3.93)	2.89 (1.87–4.47)	2.23 (1.31–3.79)	3.09 (2.13–4.47)	2.26 (1.42–3.61)
UK vs. US	0.58 (0.53–0.63)	0.60 (0.54–0.66)	0.46 (0.39–0.55)	0.47 (0.42–0.53)	0.68 (0.60–0.78)	0.93 (0.81–1.06)	0.42 (0.35–0.50)	0.57 (0.42–0.77)	0.54 (0.48–0.62)	0.38 (0.31–0.47)

[1] ORs were estimated using ordered logistic regression models and logistic regression models. Abbreviation: AOR, adjusted OR.
[2] The second category is the reference group.
[3] Models were adjusted for age, sex, education level, ethnicity, income adequacy, language, occupation, and BMI.

However, no differences were observed for exposure to outdoor marketing between US participants and those in Australia or the United Kingdom, and no differences were found for exposure to marketing on the radio between US and Australian participants. Participants in Australia and Canada were more likely to report exposure to all marketing locations and most individual locations compared to participants in the United Kingdom, except that there were no differences in exposure to marketing in magazine/newspapers, outdoors, and in school settings in Australia compared to the United Kingdom and no differences when comparing exposure to marketing in magazine/newspapers and outdoor marketing in Canada compared to the United Kingdom. Compared to Canadian participants, those in Australia were more likely to report exposure to marketing on television, but less likely to report exposure to digital marketing. Unadjusted models for marketing locations are shown in **Supplemental Table S2**.

Female participants had lower odds of reporting exposure to marketing locations (AOR, 0.90; 95% CI: 0.85–0.96), and participants with the highest level of education were more likely to report exposure to marketing locations compared to those with lower education (AOR, 1.33; 95% CI: 1.24–1.43; data not shown).

Discussion

Overall, this study found that adults across Australia, Canada, Mexico, the United Kingdom, and the United States report considerable amounts of exposure to unhealthy food and beverage marketing strategies and locations. The most prevalent marketing strategy reported was the use of brand characters. Television was the most prevalent marketing location reported, followed by digital marketing. However, the level of reported exposure to strategies and locations varied across countries.

Mexicans reported greater exposure to all marketing strategies and locations compared to participants in all of the high-income countries. Exposure to marketing strategies and locations might be more prevalent in Mexico, as transnational companies may be attempting to expand their markets in middle- and low-income countries. Research comparing food marketing between higher- and lower-income countries found that 3 of the largest food and beverage companies (Coca-Cola, McDonald's, and Kentucky Fried Chicken) advertise less healthy products more frequently and engage in more philanthropic activity in China, India, Mexico, and the Philippines compared to in wealthier countries, where they showcase a healthier portfolio (26, 27). Though marketing regulations are targeted at children, differences in country regulations may help explain the differences in exposure. In the United Kingdom, as part of an action plan to halt obesity, a new marketing regulation will ban television marketing and online marketing before 21:00 (28). In Canada, the province of Quebec has a law that restricts all commercial advertising targeted to children under age 13 in all media and child settings (29).

The most prevalent marketing strategies reported were exposure to brand and licensed characters. Brand characters are developed to strengthen loyalty between the consumer and the brand (17); that brand loyalty is likely to last and be passed down from parents to their children (30, 31).

Television was reported as the most prevalent source of marketing exposure identified by participating adults, followed by digital marketing. Digital marketing is defined as promotional material delivered through a digital medium, such

as a smartphone, tablet, or computer, that seeks to maximize impact through targeted content based on user profiles (32). It is a relatively newer form of marketing that is increasingly recognized as an important and significant source of exposure to unhealthy food advertising. The rise of digital marketing is worrisome, as studies have found that the majority of food and beverages advertised via digital media are high in energy, sugar, salt, and saturated fat (33, 34). Evidence from Canada found 14.4 million food advertisements on adolescents' top 10 preferred websites in a 1-year period; the most advertised food categories were cakes, cookies, ice cream, cold cereal, restaurants, and sugar-sweetened beverages (8). However, an assessment of the advertising on websites that appeal to adults is lacking.

Regarding marketing locations, the current regulations (voluntary or mandatory) in the assessed countries are only designed to protect young children and are limited to settings where young children gather (35), but adults in this study reported marketing in schools, colleges, and universities. These results may be indicative of noncompliance in Mexico, where such marketing in schools is not permitted (36,37), although these regulations do not extend to college and university settings.

Adult exposure to marketing has the potential to influence other age groups' perceptions and intentions to purchase/consume products (38). For instance, adults who are parents make food choices/purchases for their children. Indeed, a study on parents of preschool children found that characters on product packages can influence the healthfulness perception of a product (39). If parents are highly exposed, this means that children can be indirectly reached by unhealthy food and beverage marketing. No country currently regulates food marketing to adults or in places where adults gather, even though marketing is an established driver of the obesity epidemic (40). Policies aimed at adults may not be politically feasible in most countries, but it is critical to assess the impact of marketing on adults' unhealthy food consumption and to rethink how adults' exposure might affect children, since the latter are vulnerable and not always aware of the intent of commercial messages (41).

Mexico has a statutory regulation that limits marketing to children on television, but the regulation only applies during broadcasts targeted to children, which means that sports and soap operas can advertise unhealthy food and beverages when children may also be watching (42). As such, programs that are not targeted toward children can still appeal to children, such as professional sports and reality television, but these are largely excluded from mandatory or voluntary marketing restrictions. The present study showed that >40% of Mexican adults reported seeing unhealthy food marketing in professional sports teams, meaning children are also likely exposed, since sports are aired at peak viewing times for children and the regulation to protect them does not cover televised sports. Broader policy responses, such as watershed bans during hours when children are likely to be watching TV or across all digital media—such as the approach taken by the United Kingdom—may be more effective in reducing exposure in both adult and youth populations.

Strengths and limitations

To date, this study is the most comprehensive multi-country investigation of self-reported exposure to food marketing strategies with a large sample size, and it also includes countries with different income levels and food marketing policies, which allows for interesting comparisons. However, this study is also subject to a variety of limitations. First, the Mexico sample had higher levels of education compared to the national average (43). The exposure to marketing strategies was also self-reported by participants, and may be subject to recall bias, such that participants may be exposed to more advertising than they can recall. Marketing is ubiquitous and targeted (44), and self-reported exposure is unable to capture unconscious, implicit, or emotional effects (45). However, self-reported exposure to marketing has been shown to be correlated with objective measures of exposure (46). It should also be noted that the effects of exposure to unhealthy food and beverage marketing on actual consumption were not assessed and are beyond the scope of this evaluation.

To effectively reduce the exposure and power of unhealthy food and beverage marketing, governments in Australia, Canada, Mexico, the United States, and the United Kingdom should establish strong, comprehensive statutory regulations and ongoing monitoring of such marketing. These data also flag the need for research looking at public perceptions of restricting unhealthy food marketing to adults and the impacts of such marketing might have on food purchases and consumption. Our data might encourage policymakers in all countries to consider prohibiting the use of certain marketing strategies (brand and licensed characters that are highly recalled) and regulating advertising in specific locations (television and digital marketing). Ideally, this should be led by governments, as self-regulatory initiatives across various countries have been shown to be ineffective (47).

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