Digital food and beverage marketing appealing to children and adolescents: An emerging challenge in Mexico.

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Digital food and beverage marketing appealing to children and adolescents: An emerging challenge in Mexico

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Summary

Background: Digital food marketing is increasing and has an impact on children's behaviour. Limited research has been performed in Latin America.

Objectives: To determine the extent and nature of Mexican children's and adolescents' exposure to digital food and beverage marketing during recreational internet use.

Methods: A crowdsourcing strategy was used to recruit 347 participants during the COVID-19 lockdown. Participants completed a survey and recorded 45 minutes of their device's screen time using screen-capture software. Food marketing was identified and nutrition information for each marketed product was collected. Healthfulness of products was determined using the Pan-American Health Organization and the Mexican Nutrient Profile Model (NPM). A content analysis was undertaken to assess marketing techniques.

Results: Overall, 69.5% of children and adolescents were exposed to digital food marketing. Most frequently marketed foods were ready-made foods. Children and adolescents would typically see a median of 2.7 food marketing exposures per hour, 8 daily exposures during a weekday and 6.7 during a weekend day. We estimated 47.3 food marketing exposures per week (2461 per year). The most used marketing technique was brand characters. Marketing was appealing to children and adolescents yet most of the products were not permitted for marketing to children according to the NPMs (>90%).

Conclusions: Mexican children and adolescents were exposed to unhealthy digital food marketing. The Government should enforce evidence-based mandatory regulations on digital media.

KEYWORDS
adolescents, children, digital food marketing, food marketing, internet

1 | INTRODUCTION

Exposure to food marketing has an impact on children's and adolescents' food-related attitudes, behaviours (such as purchase and consumption) and body weight.[1,2] Food marketing exposure triggers the intake of unhealthy foods, elevating calorie intake that is not compensated for later, and therefore is linked to chronic overconsumption and weight gain.[3] In addition, such marketing has a sociocultural impact through shifting dietary norms and changing the cultural values underpinning food behaviours.[4] The food industry spends extensive resources to reach consumers from early ages[5] and ceiling effects are already found in children's recognition of food and brand logos in the preschool years.[6] The nature (creative content) of marketing is an important contributor to the persuasive effect, and marketing also affects what brands and products children request from caregivers. As a result, young people have influence over family food decisions and spending.[7] Children become fully independent consumers in the future[8] and exposure to advertisements can lead to resiliently biased product evaluations that persist into adulthood.[9] Due to these concerning effects, the World Health Organization (WHO) has made several calls (such as the Commission on Ending Childhood Obesity[10] and the Non-Communicable Diseases Action Plan 2013–2020[11]), to restrict the marketing of unhealthy foods and non-alcoholic beverages to children worldwide. However, despite such calls to action, most member states have failed to implement such policies.[10]

The combined prevalence of overweight and obesity in Mexican children and adolescents is higher than 30%.[12] This negative health outcome prompted regulations like the soda tax and warning labelling to foster healthier food environments. The Advertising Guidelines in Mexico published in 2014 regulates television, radio and cinema; nonetheless, it has a narrow limit on broadcast marketing aimed at children younger than 13 years old. Sports or soap operas are excluded from the regulation; since it is not content created for children.[13] One critical gap has been in the area of digital food marketing which is not regulated by the state. Some of the major food companies, that participate in the International Food and Beverage Alliance, have pledged to limit their marketing on the internet to children younger than 13 years old.[14] Self-regulation has been ineffective[15] and with the rise in children's digital screentime, exacerbated by the COVID-19 pandemic,[16] many transnational food companies have created and/or shifted their campaigns to digital media to promote their products.[17]

In the United States, children and adolescents use screens for around 4 and 7 h a day respectively, not including the time spent doing schoolwork or homework.[18] In Mexico, the National Survey of Audiovisual Content Consumption 2020–2021 reported that the mean time of internet use of children aged 7–11 years was 2.6 h a day during the week, and 2.7 during the weekend[19]; however, there is, to the authors' knowledge, no national estimate of internet use for adolescents. In total, 60% of Mexican children aged 6–11 years reported that they were internet users; of which 37% used social media platforms. In the case of adolescents (12–17 years), the proportions were 90% and 91%.[20] A study performed among children in Mexico found that screentime during the COVID-19 lockdown increased by 95 min/day compared to before the lockdown.[21] The pandemic has altered children and adolescents' screen and internet behaviours.[22] From a public health perspective, it is always important to effectively monitor the digital food marketing to which children are exposed to inform appropriate policy development, but this importance is further enhanced by the pandemic due to the additional time children spent in digital environments and to enable exploration of nature of marketer's response to the exceptional circumstances.

Understanding what this media use means for food marketing exposure is a particular challenge because digital media is complex, fragmented and constantly evolving using technologies that capture and collect private information from users to target the most influential and personalized marketing strategies to children and adolescents.[23] Children are vulnerable because their cognitive capacity is still immature and adolescents are susceptible to peer pressure and emotional identity-based marketing (social media and the interaction with their peers through it are considered an integral part of children's identity).[24] Currently, there is no universal age verification system, but as most platforms limit account creation to those aged 13 years and older, younger children usually create their social media accounts with false dates of birth.[25] Younger children can also use the account or/and device of someone else in the household and can access social media that do not require sign-in (e.g., YouTube and Tik Tok). The major tech platforms likely have access to proprietary data on child exposure to marketing, however, they are typically unwilling to share this information with public health researchers.[26]

Content analyses of digital spaces popular with young people provide useful data but do not elucidate measures of actual exposure.[27] Screen capture is an emerging technique that allows researchers to measure real-world exposure on young people's devices.[27] This approach has been used successfully in Canada where it was found that 72% of participants were exposed to food marketing in a 10-min period[28] and in Australia, children saw a median of 17.4 food promotions each hour on the internet.[29] However, there are no such studies in low- and middle-income countries. Therefore, the aim of this paper was to determine the extent and nature of Mexican children's and adolescents' exposure to digital food and beverage marketing during recreational internet use.

2 | METHODS

We conducted a cross-sectional real-time screen capture study with 347 children (6–11 years) and adolescents (12–19 years old); of them, only 264 provided internet and sociodemographic data that could be linked to their recordings via a unique ID number. Data were collected from June to December 2020 during the COVID-19 pandemic and during the strict lockdown in the country; therefore, children and adolescents were home-schooled via national television and/or the internet depending on their school policies. Data collected consisted of (i) a demographic and media use survey and (ii) screen capture recordings of participants' usual internet use on their own devices.

2.1 | Recruitment of participants

Participants were recruited using a crowdsourcing strategy. Health science professors from universities were contacted to invite their students to recruit and collect data from children and adolescents. They were given a procedure manual that included a standardized protocol and guidance for the data collection. Health science students were virtually trained on how to fill out the survey, how to use real-time screen capture software and how to record and upload videos to the cloud. The inclusion criteria were: (i) Participants should be Mexican children and adolescents aged 6–19 years old, (ii) The parent and child had to give informed consent to installing screen-capture software on their device, (iii) The children or adolescent had to own or have access to a device, (iv) The device should have at least 1.5 GB of free space and (v) The participant should have Wi-Fi at home. Students contacted their acquaintances to provide information about the study and invited them to take part. Students were also instructed not to invite any family members to participate in the study. First of all, they approached the parent or guardian and explained that they would send a link to the survey. For the screen capture, students instructed participants on how to download the screen-capture software, how to use the screen recording function, how to upload the videos and how to compress files in case they were large and took a long time to upload. All contacts with participants were done virtually or via telephone because of COVID-19's strict lockdown.

2.2 | Survey

The survey was a self-administered questionnaire examining sociodemographic characteristics like age, sex, socio-economic status, ownership of devices and internet usage. Once the parent clicked on the link with the survey, they first completed the informed consent. Next, the child or adolescent completed the assent. Socioeconomic status (SES) was estimated using information given by the parent based on the definition of the Mexican Association of Market Intelligence and Opinion Agencies. This definition is based on a statistical model, which allows grouping and classifying Mexican households into seven levels, according to their capacity to satisfy members' needs.[30] Subsequently, the seven levels were categorized as low, medium and high SES. The survey asked participants to check which devices they use to browse the internet and social media use and asked them if the device was owned, shared or borrowed. For those who owned a mobile phone, the survey asked them about the operating systems in Mexico (iOS or Android); then, a set of steps were given to objectively capture the average time of daily mobile phone use in hours and minutes. Self-reported time of internet use was measured using the question: 'On a normal weekday or school day, how much time do you spend using the internet for other things besides your homework? Responses for the amount of internet use were captured using categories (less than 1, 1, 2 and up to 10 h). The same question was presented afterwards for a "normal weekend day"'.

2.3 | Piloting

The pilot study comprised 20 participants, not included in the actual study; each participant's parent or guardian recorded and try to send recordings of 45 min of internet exposure by email or WhatsApp. As most of them reported trouble sending the recordings due to the files' heaviness, we decided to change the reception to a cloud in Google Drive. After the pilot, the researchers instructed students to send WhatsApp reminders to parents and to remind the dates of the recording and send them to the study team.

2.4 | Screen-capture of the child's usual internet activity

Parents were asked to record their child's screen during usual recreational internet activity (avoiding recording schoolwork, homework, private messaging, email, online banking and passwords) on the device they normally use (mobile phone, tablet, computer and/or laptop) in three sessions: two 15-min recordings during the week and one 15-min recording during the weekend (specific days chosen by parents). This duration was selected due to file size, participant device storage capacity and ease of transferring the files, as well as, researcher capacity for coding the marketing content. Participants could conduct these recordings on different devices (e.g., their laptop on weekdays and their mobile on the weekend day). The screen capture software used depended on the operating system of their phone, tablet or computer (AZ Screen Recorder, Screen Recorder, Apower-Rec, DU Recorder, or iPhone's own recorder). The recordings captured everything viewed by the participants including when the participant clicked, scrolled, or typed.

2.5 | Data upload

After each day of recording, parents were reminded to upload the videos. Recordings were uploaded into password-protected Google Drive folders. If the uploading was too slow, we encouraged parents to compress the files. Uploads were monitored by the team to ensure participants completed the three recordings.

2.6 | Coding of recordings data

To carry out the content analysis we employed the protocols and templates 'Monitoring of Marketing of Unhealthy Products to Children and Adolescents' from the WHO Europe Office, adapted for the Mexican context.[27] These step-by-step protocols were developed by expert marketing researchers to support countries in undertaking projects that monitor digital food marketing. Food marketing was defined as any food and beverage content, excluding alcoholic beverages and infant formulas. These encompassed paid, organic and influencer marketing. We defined each one as follows: (1) Paid marketings were

videos or images generated by the food or beverage company with a legend that mentioned 'promoted', 'paid', 'ad', 'advertisement' or similar; (2) Organic marketing meant the participant followed a brand or product, and that posts on social media were shared by the corporate account. In this classification we also considered content shared by third parties (e.g., a friend shared a brand or product post); and (3) Influencer marketing was defined as an influencer or celebrity with a verified account that explicitly marketed a brand or a food or beverage (name and logo of the product/brand). Food marketing was considered if they appeared on screen for at least 1 s.

We coded for participant interaction when the participant 'liked', reacted, interacted, tagged a friend, or shared the digital ad or social media post. We also captured marketing techniques like the presence of packaging, product image, brand characters, use of COVID-19, holidays, etc. The research team used previous research to classify marketing as appealing to children or adolescents,[31,32] and during the pilot study a list of items was developed from the analysed marketing that could be considered appealing to children or adolescents. Based on these sources, we classified as appealing to children when the marketing exposure or ad used drawings, magic, fantasy, animals, smiles, legs, hands and/or arms, cartoons or licensed characters (e.g., the Minions), or when the marketing exposure displayed games or toys, or movie characters, among others. Marketing was considered appealing to adolescents when the exposure or ad displayed celebrities, TV personalities and sportspersons, or when the message (visual or audio) was about adventure, fashion, leadership, popularity, flirting or friends, among others. The variables of marketing appealing to children and appealing to adolescents were not mutually exclusive. A comprehensive list of marketing techniques can be found in Table S1.

Each recording was viewed and analysed by one of 16 trained coders (undergraduate nutrition students). Coders were provided with a procedure manual that included variables, codes and definitions; each code had images of real-life examples taken from social media. The researchers and coders revised and analysed seven videos together during Zoom calls to make sure all understood the codes and agreed with the definitions. During the sessions, discrepancies were resolved with real-life examples. Then, we randomly selected recordings from 15 participants, all 16 coders did the content analysis and researchers checked for consistency across all coders. This process was performed during October and November of 2020. The interrater reliability was calculated using Gwet AC2 statistic with the Agreestat software (Agreestat 2013.1, Advanced Analytics, Gaithersburg, United States of America). Consistency was reached with an interrater reliability of 0.82 for marketing variables (Kappa coefficient).

2.7 | Nutrient Profiling of marketed foods and beverages

We collected nutrition information from products' official websites where these were available. If not, we consulted, in order of priority, Mexican supermarket websites, the *Base de Alimentos de México* (BAM)[33] and the What's in the Foods You Eat tool of the United States Department of Agriculture.[34] When information was available by portion size, we converted it into calories or g/100 g. Information collected included calories, sugars, added sugars, total fat, saturated fat, trans fat and sodium. We also estimated free sugars according to the Pan American Health Organization (PAHO) Nutrient Profile Model (NPM).[35] When the marketing exposure displayed more than one product, we captured the nutritional information of the first product from left to right (this applied to meal bundles or combos), or if the marketing exposure contained different flavours nutritional information was taken from the original flavour. When it was a brand marketing exposure that did not display any product, we did not include any nutrition information (12% of the total sample).

We classified food and beverage products according to the food categories of the WHO Regional Office for Europe NPM[36]; however, we included categories pertinent to Mexican food availability (Mexican food, corn products, instant soups). To determine if products were unhealthy or had excess, we used two NPMs: (1) the PAHO Nutrient Profile Model (NPM); and (2) the Mexican front of package label NPM. NPMs are a tool to classify processed foods and beverages that are in excess of critical nutrients; and therefore, are considered unhealthy and should not be marketed to children. We used the PAHO NPM because it is a policy tool to help restrict food marketing, and we also used the Mexican NPM because it is the current system enforced by the government to assess the quality of packaged foods and beverages. The PAHO NPM is classified as excessive if sodium accounts for ≥1 mg of sodium per 1 kcal, free sugars ≥10% of energy, total fat ≥30% of energy, saturated fat ≥10% of energy and trans-fat ≥1% of energy.[35] The Mexican NPM is considered stricter[37] since it incorporates cut-off points for energy (≥275 kcal for solids or ≥70 kcal for liquids) and for sodium (≥350 mg and ≥45 mg for non-caloric beverages).

2.8 | Statistical analysis

Daily food marketing exposure was estimated by considering the number of food marketing exposures per 45-min period and considering the time per day participants reported using the internet excluding school and homework. Analyses were conducted for the overall sample, for weekdays and weekend days and for children and adolescents. The exposure was also extrapolated to an hour, the week (exposure to food marketing on a weekday * 5 weekdays + exposure to food marketing on a weekend * 2 weekend days), and calculated yearly considering 52 weeks for the year 2020 as per the method of Potvin Kent.[28]

Descriptive statistics (frequencies and percentages) were used to describe socio-demographic characteristics, internet and device use, marketing strategies, food categories and the excess of calories and nutrients of concern. We used Shapiro–Wilk to determine normality and presented median and percentiles when a variable was not normally distributed. The difference between children's and adolescent's ages was tested using the Wilcoxon rank sum. We used Student's *t*-tests to compare the time of mobile phone use between

children and adolescents, and Chi-squared tests to explore differences between children and adolescents in categorical variables.

2.9 | Covariates

Covariates included sex (male or female), age group (children 6 to 11 and adolescents 12 to 19 years) and ethnicity (majority or minority). Minority was considered when the participant reported speaking an indigenous language. Participants' weight and height were reported by their parents. Subsequently, Body Mass Index (BMI) *z*-score was calculated by sex and age using WHO criteria,[38] with categories of normal weight (<=1SD), overweight (> + 1SD), and obesity (> + 2SD). All analyses were conducted using Stata 14 and a p value <0.05 was considered statistically significant.

2.10 | Ethical considerations

Participants received an e-book called '*Las aventuras de Dulce Clarita*' for their participation. In order to protect their privacy and confidentiality, we used ID numbers to store data. The study was performed according to the Belmont principles and the ethical guidelines of the United Nations International Children's Emergency Fund. The Committees of Research, Ethics and Biosafety of the Mexican National Institute of Public Health reviewed and approved the study (board number: 1648).

3 | RESULTS

3.1 | Sample description

Table 1 shows the socio-demographic characteristics of the 264 participants. Half of the participants were children, and half were males. The majority of participants (68.9%) were of high socioeconomic status and almost all were from a majority ethnicity group (98.8%). There was a higher proportion of children with obesity (12%) compared with adolescents (2%). We were unable to match the screen recording and survey information for participants who did not correctly provide their mobile phone numbers ($n = 83$). Overall, 244 h and 13 mins of screen recordings were uploaded. Most participants reported using the internet on weekdays and on the weekend for more than 3 h per day, although the proportion reporting this level of use was higher for adolescents compared to children (Chi-squared = 17, $p < 0.001$). The most used device was the mobile phone (81.1%). Children reported using tablets more (44%); adolescents reported more use of their mobile phones (88%). More adolescents reported owning a mobile

TABLE 1 Frequencies and percentages of sociodemographic characteristics of Mexican children and adolescents.

	Total ($n = 264$)	Children 6–11 years ($n = 130$)	Adolescents 12–19 years ($n = 134$)	p values[a]
Age, years (median, p25–75)	12 (8.5–17)	8 (7–10)	17 (14–18)	0.001[b]
Sex				
Female	131 (49.6)	69 (53)	64 (47.8)	0.388
Male	133 (50.4)	61 (47)	70 (52.2)	
Socioeconomic status				
Low	4 (1.5)	2 (1.5)	2 (1.5)	0.970
Middle	65 (24.6)	31 (23.9)	34 (25.4)	
High	182 (68.9)	90 (69.2)	92 (68.7)	
Missing	13 (4.9)	7 (5.4)	6 (4.5)	
Self-reported BMI				
Normal weight	106 (40.2)	35 (26.9)	71 (53.0)	0.001
Overweight	41 (15.5)	22 (16.9)	19 (14.2)	
Obesity	19 (7.2)	16 (12.3)	3 (2.2)	
Missing	98 (37.1)	57 (43.9)	41 (30.6)	
Ethnicity				
Minority	2 (0.8)	2 (1.5)	0	0.219
Majority	261 (98.8)	128 (98.5)	133 (99.2)	
Refuse to answer	1 (0.4)	0	1 (0.8)	

Note: It was only possible to collect internet and sociodemographic data from 264 participants since their information could be linked to screen-capture recordings via a unique ID number.

Abbreviation: BMI, Body mass index.

[a]Differences were tested with Chi-squared.

[b]We used the Wilcoxon rank-sum test to test the equality of medians.

TABLE 2 Internet and devices use of Mexican children and adolescents ($n = 264$).

	Total	Children *n* (%)	Adolescents *n* (%)	*p* values[a]
Internet use weekdays				
2 h or less	83 (31.6)	59 (45.4)	24 (18.1)	0.001
3–5 h	113 (42.9)	44 (33.9)	69 (51.9)	
6 h or more	67 (25.5)	27 (20.7)	40 (30.0)	
Internet use weekend				
2 h or less	72 (27.4)	50 (38.5)	22 (16.5)	0.001
3–5 h	102 (38.8)	46 (35.4)	56 (42.1)	
6 h or more	89 (33.8)	34 (26.1)	55 (41.4)	
Mobile devices use[b]				
Computer	46 (17.4)	21 (16.2)	25 (18.7)	0.592
Laptop	109 (41.3)	35 (26.9)	74 (55.2)	0.001
Tablet	81 (30.7)	57 (43.9)	24 (17.9)	0.001
Mobile phone	214 (81.1)	95 (73.1)	119 (88.8)	0.001
Mobile phone use ($n = 214$)				
Owned	142 (66.4)	32 (33.7)	110 (92.4)	0.001
Shared	10 (4.7)	8 (8.4)	2 (1.7)	
Borrowed	62 (28.9)	55 (57.9)	7 (5.9)	
Time of mobile phone use (hour and minutes)[c]				
iOS ($n = 37$)	5.1 ± 1.9	4.6 ± 3.5	5.1 ± 1.8	0.69
Android ($n = 32$)	4.8 ± 2.4	4.2 ± 3.0	5.0 ± 2.2	0.40

Note: It was only possible to collect internet and sociodemographic data from 264 participants since their information could be linked to screen-capture recordings via a unique ID number.
[a]Differences were tested with Chi-squared.
[b]Mobile devices' use is not mutually exclusive since participants reported using several devices.
[c]Mean and standard deviation were calculated and differences were tested with the Student's *t*-test.

phone (92%) compared to children (34%) (Chi-squared = 82, p < 0.001) (Table 2).

3.2 | Extent of food and beverage marketing exposure and engagement

In total, 69.5% of participants were exposed to at least one instance of food and beverage marketing during the 45 min of screen time. The mean time of food marketing exposure was 1 min and 10 s per 45 min of internet exposure. Children were exposed to a median of 30 s more of digital food marketing compared to adolescents. Most of the recordings were issued during the afternoon. Most of the marketing to which children and adolescents were exposed was paid (62%), followed by organic (30%) and influencer (9%). In total, 7% of participants liked, reacted, or interacted with at least one marketing exposure. Children interacted more (5%), while adolescents interacted less (0.4%). Participants were exposed to a median of 2.7 food marketing exposures per hour during a weekday and weekend day. Children had more exposures per hour compared to adolescents (4 vs. 2.7 during a weekday) and (4 vs. 1.3 during a weekend day) ($p < 0.05$). We estimated a median of 8 daily exposures during a weekday and 6.7 during a weekend day. Based on these rates, it was estimated that children and adolescents would be exposed to a median of 47.3 food marketing exposures per week (median of 2461 ads per year) (Table 3).

3.3 | Nature of food and beverage marketing exposure

Table 3 shows the product-related strategies. The most used were product images, packaging images and consumption or purchase incentives. As for persuasive strategies, participants were most exposed to brand characters, followed by celebrities and competitions or contests. Half of the marketing was appealing to children (51%), while 48% was considered appealing to adolescents.

3.4 | Healthfulness of marketed foods

Figure 1 shows the most frequently marketed food categories. Ready-made foods, cakes and sweet biscuits, chocolate, energy bars and desserts, savoury snacks, sugar-sweetened drinks and edible ices accounted for 69% of the products marketed on the internet to children and

TABLE 3 Exposure to digital food marketing and techniques in the screen capture study of Mexican children and adolescents ($n = 347$).

	All participants Mean [min–max]	Children	Adolescents	*p* value
Mean time of exposure to food marketing in 45 minutes of internet use per participant (minutes and seconds)	1.1 [0.01–21.2]	1.5 [0.01–7.7]	1.2 [0.01–21.2]	0.23
	Median [p25–75]			***p* value**
Time of internet exposure, excluding homework (minutes)	45 [43.6–46.9]	45 [44.1–47.6]	45 [42.9–46.6]	0.24
Estimated exposure of food or beverage marketing (per hour)				
Weekday	2.7 [0–9.3]	4 [1.3–12]	2.7 [0–8]	0.02
Weekend day	2.7 [0–8]	4 [0–14.7]	1.3 [0–8]	0.03
Estimated daily exposure to food or beverage marketing[a]				
Weekday	8 [0–27]	8 [1.3–29.3]	7.3 [0–26.6]	0.47
Weekend day	6.7 [0–29]	8 [0–32]	6.7 [0–24]	0.34
Estimated weekly exposure to food or beverage marketing	47.3 [0–177]	48 [6.7–172]	45.3 [0–181]	0.47
Estimated yearly exposure to food or beverage marketing	2461 [0–9187]	2496 [0–8944]	2357 [0–9395]	0.47
Frequency (percentage)				***p* value**
Time of the day screen capture was conducted				
6 am to 12 pm	37 (13.5)	9 (9.6)	28 (15.6)	0.42
12:01 pm to 16 pm	67 (24.5)	28 (29.8)	39 (21.7)	
16:01 pm to 20 pm	91 (33.2)	30 (31.9)	61 (33.9)	
20:01 pm to 24 pm	79 (28.8)	27 (28.7)	52 (28.9)	
	All participants Frequency (percentage)	**Children**	**Adolescents**	
Exposure to food and beverage digital marketing	241 (69.5)	89 (75.4)	152 (66.4)	0.08
Participants liked, reacted or interacted with digital marketing	25 (7.2)	12 (10.2)	13 (5.7)	0.13
Exposure to digital food marketing				
Paid marketing	215 (61.9)	81 (68.6)	134 (58.6)	0.10
Organic marketing	104 (29.9)	48 (40.7)	56 (24.5)	0.01
Influencer marketing	31 (8.9)	13 (11.0)	18 (7.9)	0.33
Digital marketing techniques				
Invitation to interact	84 (24.2)	33 (28.0)	51 (22.3)	0.24
Packaging image	211 (60.8)	80 (67.8)	131 (57.2)	0.06
Product image	219 (63.1)	82 (69.5)	137 (59.8)	0.08
Consumption or purchase incentive	209 (60.2)	81 (68.6)	128 (55.9)	0.02
Brand character	86 (24.8)	34 (28.8)	52 (22.7)	0.21
Licensed character	35 (10.1)	13 (11.1)	22 (9.6)	0.67
Celebrity	63 (18.2)	24 (20.3)	39 (17.0)	0.45
COVID-19	36 (10.4)	16 (13.6)	20 (8.7)	0.16
Holidays	31 (8.9)	10 (8.5)	21 (9.2)	0.83
Competition or contests	45 (13.0)	17 (14.4)	28 (12.2)	0.57
Physical activity	35 (10.1)	14 (11.9)	21 (9.2)	0.43
Marketing appealing to				
Children	177 (51.0)	69 (58.5)	108 (47.2)	0.05
Adolescents	169 (48.7)	66 (55.9)	103 (44.9)	0.05
Social media ($n = 1592$)[b]				
Instagram	700 (43.9)	270 (43.8)	430 (44.1)	0.01
Facebook	571 (35.9)	243 (39.5)	328 (33.6)	
YouTube	260 (16.3)	78 (12.7)	182 (18.7)	
TikTok	38 (2.4)	18 (2.9)	20 (2.1)	

(Continues)

TABLE 3 (Continued)

	All participants Frequency (percentage)	Children	Adolescents
Twitter	8 (0.5)	3 (0.5)	5 (0.5)
Online games	10 (0.6)	1 (0.2)	9 (0.9)
Websites	3 (0.2)	3 (0.5)	0
Other	2 (0.1)	0	2 (0.2)

[a]Daily exposure to marketing was calculated using the time (hours) participants reported using the internet excluding school and homework.
[b]Social media sample size was larger because it considered all marketing exposures ($n = 1592$).

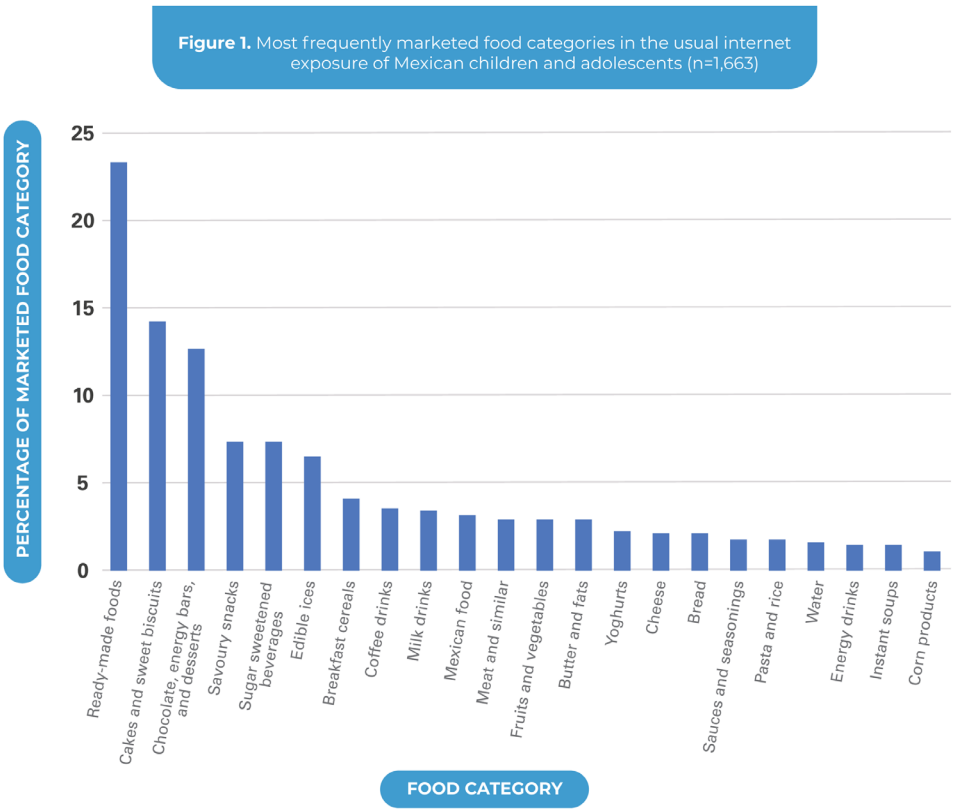

FIGURE 1 Most frequently marketed food categories in the usual internet exposure of Mexican children and adolescents ($n = 1663$).

adolescents. Table 4 shows the proportions of products that exceed nutrition criteria. According to the PAHO NPM, 93.3% of the promoted products had at least one excess nutrient of concern and were therefore not permitted for marketing to children. From the products, 52% exceeded the free sugars cut-off point, 61% exceeded the total fat cut-off point, 54% exceeded the saturated fat cut-off point, 4% exceeded the trans-fat cut-off point and 48% exceeded the sodium cut-off point. The Mexican NPM classified 8.7% of the promoted products with zero warning labels, while 91.3% were classified with at least one warning label and their packaging cannot display any marketing to children. Almost 60% exceeded the calorie cut-off point. Half of the products (52% and 54%) exceeded the sugar and saturated fat cut-off point respectively, 4% exceeded the trans-fat cut-off point and 40% exceeded the sodium cut-off point. We found that more adolescents were exposed to products high in calories compared with children (Chi-squared = 9.1, $p < 0.05$).

4 | DISCUSSION

This study highlighted that most children and adolescents (69.5%) were exposed to unhealthy food marketing during their typical recreational internet activity excluding schoolwork. Our frequency of exposure is similar to findings in a study performed in Canada where 72% were exposed to digital food marketing.[28] In our study it was estimated that children and adolescents see 47.3 food marketing exposures per week (2461 exposures per year). The study undertaken in Australia estimated a higher exposure, children would be exposed to a median of 168 food promotions per week.[29] On the other hand, the results obtained in Canada estimated that children and adolescents see food marketing 30 to 189 times per week respectively[28]; however, they calculated means and the present study medians because our data were not normally distributed.

TABLE 4 Percentage of products found on the screen capture of the children and adolescents' internet exposure that exceed the criteria of different Nutrient Profile Models.

Pan American Health Organization Nutrient Profile Model	Number of products[a]	Products that exceed the cut-off point Frequency (Percentage)			
		All participants	Children	Adolescents	*p* values
Free sugars	1459	761 (52.2)	284 (50.2)	477 (53.4)	0.23
Total fat	1578	964 (61.1)	369 (60.3)	595 (61.6)	0.60
Saturated fat	1566	843 (53.8)	328 (53.9)	515 (53.8)	0.99
Trans fat	545	21 (3.9)	10 (4.9)	11 (3.2)	0.33
Sodium	1572	746 (47.5)	291 (48.3)	455 (47.0)	0.62
($n = 1587$)					
1 excess		400 (25.2)	165 (26.9)	235 (24.2)	0.60
2 excesses		381 (24.0)	148 (24.1)	233 (24.0)	
3 excesses		628 (39.6)	236 (38.4)	392 (40.3)	
4 excesses		71 (4.5)	27 (4.4)	44 (4.5)	
5 excesses		1 (0.1)	1 (0.2)	0 (0)	
Compliant with criteria		106 (6.7)	37 (6.0)	69 (7.1)	
Mexican nutrient profile model (Phase 1)					
Calories	1573	938 (59.6)	340 (55.9)	598 (62.0)	0.02
Sugars	1459	755 (51.8)	281 (50.0)	474 (53.1)	0.20
Saturated fat	1566	843 (53.8)	328 (53.9)	515 (53.8)	0.98
Trans fat	545	21 (3.9)	10 (4.9)	11 (3.2)	0.33
Sodium	1572	634 (40.3)	253 (42.0)	381 (39.3)	0.30
($n = 1592$)					
1 excess		301 (18.9)	118 (19.2)	183 (18.8)	0.06
2 excesses		648 (40.7)	272 (44.2)	376 (38.5)	
3 excesses		422 (26.5)	154 (25)	268 (27.5)	
4 excesses		82 (5.2)	22 (3.6)	60 (6.2)	
Compliant with criteria		139 (8.7)	50 (8.1)	89 (9.1)	

[a]We had missing information for nutrients of concern hence the number of products varies.

Different methods and marketing concepts can partially explain diverse results between studies. These differences serve to highlight the importance of standardized protocols for facilitating comparisons across time and regions. The WHO protocols and templates ensure methods and systematic variables to build up digital media studies.[27] Other explanations for the differences are The different time periods (the present study was conducted during the COVID-19 pandemic), and sample characteristics (the present study was performed in a low- and middle-income country).

More than 93% of food marketing exposures were for items not recommended for marketing to children according to the PAHO NPM. These findings are similar to a study in Canada which found that 97% of food marketing was excessive in at least one nutrient of concern,[28] and in Australia where 99.5% would not be permitted to be marketed to children using the WHO Nutrient profiling classification.[29] The differences in proportions might be explained by the fact that the Canada study applied the PAHO NPM regardless of the processing level and the Australia study used the European profile which uses cut-off points by food categories to determine if marketing should be permitted. Overall, our results can be attributable to several factors, including the digital content consumed by participants, their internet behaviour (gaming, social media, brand browsing, etc.) and targeting practices of the food industry and social media companies. These companies and tech platforms use children's data to personalize marketing; therefore, marketing can be directed to certain age groups, gender, ethnicity, or neighbourhood.[39] We found that more children were exposed to organic marketing, product image and consumption and purchase incentives compared with adolescents. This may reflect differences in platform use between the two groups, and/or may be indicative of the techniques used to target marketing to specific age groups.

Our paper found that children were more exposed (75.4%) than adolescents (66.4%); however, in Canada, findings indicated the opposite,[28] this might be due to the differences in marketing practices deployed by industry. Our results are problematic from a public health perspective as children are particularly vulnerable to marketing

influences due to their immature cognitive capacity to interpret commercial messages,[40] even when it is explicitly stated that it is paid.[41] Most social media sites have declared that the user has to be older than 13 years old to access; however, this study showed that children and adolescents are using social media regardless of this rule. In addition, adolescents are also affected by marketing, studies have shown that they are susceptible due to their psychological and neurological stage,[23] and they are susceptible to peer pressure and identity-based marketing.[23,26] Despite this, current regulations in most countries, including Mexico, aim to protect children younger than 12 or 13 years old. The food industry targets children and adolescents with marketing techniques designed to persuade them to purchase and/or consume their products. Some of the techniques found were: brand characters, celebrities, competitions or contests and licensed characters. Brand characters are a powerful influence on children's food preferences and intake.[42] In addition, in our study we found buy one sugary beverage and get one free, and celebrities/athletes promoting energy beverages and breakfast cereals. No research about the impact of price promotions on the internet was found; however, in retail outlets, it has been shown that price promotions (e.g., buy one get one free) can influence purchasing, and this also increases consumption.[43] Celebrity or athlete endorsements are often associated with energy-dense, nutrient-poor foods.[44]

The brands most prevalent were: Nescafe, Bimbo, Monster Energy, Doritos and Bubbaloo. This may indicate a lack of compliance with a self-regulatory commitment called the International Food and Beverage Alliance, where most of the food manufacturers pledged to stop food marketing directed to children when the products are considered not healthy according to food industry criteria. However, evidence has pointed out the inefficiency of self-regulation.[15] Readymade foods were the category with the highest frequency of products marketed to children and adolescents on the internet. It is not possible, from these data, to determine if this finding is attributable to the COVID-19 lockdown period. However, some studies have pointed out that the marketing of such products increased during the pandemic.[45,46]

The use of references to COVID-19 was present. Some studies have highlighted that unhealthy products and brands are the COVID-19 pandemic promote their products on social media; most of them are using messages about community support, donations and isolation activities.[17,47] Food companies may want to be perceived as part of the solution and as a companion to their consumers during the lockdown. The term 'COVID-washing' (similar to the term 'health-washing') refers to the dissemination of symbolic information about the activities of food companies that promote and sell unhealthy food products to associate their brands with contributions to health and wellbeing. This has the potential to disguise the negative health effect of unhealthy foods.[46]

We found that influencer marketing was the category with the least exposure (8.9%). Other studies found a higher proportion; for example, one study found that 17% consisted of celebrity-generated content,[28] and others found that half of the promotions were earned media impressions, including posts by web-based influencers and celebrities.[29] Nowadays, influencer marketing is growing, it was estimated that by 2022 the influencer marketing industry will expand to $16.4 billion.[48] Brands are using influencers as part of their campaigns. Influencers are also known as YouTubers, or vloggers who give advice, recommend, or influence their followers to use and/or purchase a good or service, they can reach a certain type of audience and have credibility among themselves.[49] A qualitative study found that YouTubers elicited particularly sympathetic attitudes in their subscribers[50] and randomized trials have found that influencer marketing increase children's immediate food intake.[41,51] Some efforts have been made to regulate this. For example, the United Kingdom's self-regulatory codes include paid marketing in social media, influencers should indicate the selling intent; however, the effectiveness of such disclaimers is uncertain and indeed a UK study found that disclaimers of paid marketing in influencers' videos increased children's immediate snack intake.[41]

5 | STRENGTHS AND LIMITATIONS

This is the first study in Latin America to estimate child and adolescent exposure to digital food marketing. The rigour and originality of the investigation in a low and middle-income country, like Mexico, shows that international WHO protocols and methods can be applied with the resources and workforce available.[27] The training and coding processes could facilitate comparison with future studies in the same or different populations. Previous studies in high-income countries only captured social media or included a smaller sample size ($n \approx 100$). The present study captured actual screen exposure in a large sample size (>300 participants) including recreational internet usage. However, certain limitations must be acknowledged. We do not have information about the ownership of the device used for recordings, this might have altered the extent and nature of the marketing since we know marketing uses digital footprint and profiles to personalize ads and target users. Data collection was carried out during the COVID-19 pandemic and as a result, children and adolescents had to be home-schooled and spent a larger amount of time online due to the strict lockdown. Although this may have inflated self-reported internet use, resulting in higher estimations of weekly and annual marketing exposure, we note that Demers-Potvin et al. estimated even higher total self-reported screen time (9.7 h mean hours/week) in Mexican children and adolescents aged 10–17 years[52] in a similar time period (screen time includes television).

Median marketing exposure was estimated based on the self-report of internet users rather than using an objective approach, and the self-report might be accurate.[53] Our results only reflect digital food marketing exposure on the device participants chose to record; although they were instructed to follow their typical internet activity patterns, exposure rates may have differed if other devices were used for the recordings, and if participants were exposed to various screens at the same time,[54] reflectings widespread habit of multi-device usage. Exposure to food marketing may have been further underestimated as we only considered out-of-school screen time; however,

children are likely exposed to food marketing while engaging in school-based internet activities.

A further, key way in which our findings are likely to underestimate the unhealthiness of exposure lies in the fact that we did not analyse the nutritional information of brands (12% of the total sample) because this type of marketing did not include a product per se. The potential impact of brand marketing should be acknowledged because children reach ceiling levels of unhealthy food brand logo recognition before they even start school.[6] In addition, when marketing displayed more than one product, we captured the nutritional information of just one. Finally, we note that the study's participants were mostly from high and medium SES which is not representative of the Mexican population. Our results may therefore not be generalizable to the entire Mexican population.

6 | RECOMMENDATIONS FOR FUTURE STUDIES

Since the internet is widely used by children and adolescents, it is highly desirable to regularly monitor and assess their exposure to digital food marketing, especially because the pandemic has further underlined that screens and the internet are a substantive and growing part of everyday life. It is also highly desirable that future studies follow the same methodology and operationalize the variables in the same way to facilitate comparisons of the different constructs of food marketing (organic, earned media, celebrity or user-generated content), and any change in this over time.

7 | IMPLICATIONS FOR PUBLIC POLICY

Some countries have implemented digital marketing regulations. Chile stated that advertising of unhealthy food and beverages must not be targeted at children across different media including the internet.[55] In the province of Quebec in Canada, food marketing to children less than 13 years old has been prohibited under the Consumer Protection Act (CPA), and the United Kingdom proposed a 9 pm watershed to ban all paid junk food marketing.[56] This regulation seems to be comprehensive; however, is awaiting implementation. Arguably, no country has yet implemented effective mandatory digital food marketing restrictions. Some technically cover it (e.g., Chile, Quebec), while other countries/regions have industry self-regulation (e.g., the United Kingdom, the Canadian Children's Food and Beverage Advertising Initiative, and the International Food and Beverage Alliance[57–59]) that has been shown to be insufficient. It is a challenge but the current study provides yet more evidence of why effective action is needed.

In Mexico, the current General Health Law regarding Advertising regulates television, radio and cinema and the regulation only seeks to protect children younger than 13 years old. In August 2022, the Regulations of the General Health Law on Advertising were amended. The regulation mentions that authorities (The Ministry of Health and the Federal Commission for the Protection against Sanitary Risks) should expedite a permit to advertise foods and non-alcoholic beverages on the internet and digital platforms, and also should expedite a permit to directly or indirectly promote the use, sell and consumption, when the label of the said products includes the warning labelling system, in accordance with the corresponding standard. This permit should adhere to the principle of the best interest of children, referred to in Article 4 of the Political Constitution of the United Mexican States.[60]

Digital marketing is individualized and delivered to certain groups. For this reason, the State should enhance the current regulations and enforce regulations in which social media and tech platforms stop collecting and using minors' data for commercial purposes. Currently, the Mexican Federal Law on the Protection of Personal Data does not limit companies' ability to collect online data from minors (younger than 13 years).

Mexican children and adolescents were highly exposed to unhealthy food marketing on the internet excluding schoolwork. Digital food marketing exposure included a large variety of persuasive strategies like brand characters, celebrities and competitions. While children were more exposed to food marketing, adolescents were also targeted and they should be considered in regulations. Overall, these data can be used to support policy makers to implement stricter marketing regulations.

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CONFLICT OF INTEREST STATEMENT

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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