AdHealth: A feasibility study to measure digital food marketing to adolescents through Facebook

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Abstract

Objective: To test the feasibility of a browser extension to estimate the exposure of adolescents to food and beverage advertisements on Facebook.

Design: A Chrome browser extension (AdHealth) was developed to automatically collect advertisements seen by participants while scrolling through their personal Facebook accounts. Information was extracted by parsing the Document Object Model (DOM) tree representation of Facebook web pages, and then sending to a web server. Key information retrieved included advertisement type seen, and duration of each ad sighting. The WHO-Europe Nutrient Profile Model was used to manually classify the healthiness of the products advertised as permitted (healthy) or not permitted (unhealthy) to be advertised to children.

Setting: Auckland, New Zealand

Participants: 34 Facebook users aged 16-18 years.

Results: The browser extension retrieved 4,973 advertisements from 34 participants, of which 204 (4%) were food-related, accounting for 1.1% of exposure duration. Of those food advertisements, 98% were classified as not permitted, and 33.7% and 31.9% respectively of those featured promotional characters or premium offers. The mean hourly rate of exposure to not permitted food advertisements was 4.8 (SD = 2.5).

Conclusions: This method of using a Chrome extension to monitor exposure to unhealthy food and beverage advertisements showed that the vast majority were unhealthy products, although there were numerous challenges to implementation. The method could be used to monitor the effectiveness of statutory regulations or industry codes in protecting children and adolescents. Further efforts are needed to develop tools for use across other social media platforms and on mobile devices.

Keywords

Food marketing, digital advertising, adolescents, Facebook

Introduction

The global use of advertising through digital media continues to increase but it is virtually unregulated, especially as it affects children and adolescents, (1–3) and is scarcely monitored (4–6). Common social media platforms are Facebook, Instagram and Snapchat (4). These collect large amounts of personal use information and use specific algorithms to reach target audiences with customised messages (7). Young people as prolific users of digital media are very susceptible to this type of personalised marketing (2). It is an important, but major challenge, for society to protect vulnerable groups like children and adolescents from commercial

exploitation. In particular, food and beverage preferences and behaviours continue to develop through childhood and adolescence and can contribute to obesity and nutrition-related diseases (8,9,10–12). There is less opportunity for parents to influence exposure to marketing for unhealthy products through digital media than through broadcast media and such marketing normalises the consumption of unhealthy food and beverages (4–6,13-15).

Previous studies have shown that food and beverage advertising to children and young people through more traditional media such as television are overwhelmingly for unhealthy products (13,16–20). This is likely to be the case for marketing through digital media, as shown by a previous study of the Facebook pages of major food companies (13). New Zealand teens engage with a range of digital media platforms, with 4 in 10 currently using five or more digital media platforms (21). When asked which ones they use most often, 25% mention YouTube, followed by those mentioning Facebook and Snapchat with 23% each, and Messenger and Instagram (13% and 11%, respectively).

Research addressing this topic is difficult for multiple reasons such as a reduced ability to monitor online advertising because it is personalised, highly targeted and received through multiple personal devices. Currently in New Zealand, advertising is voluntarily regulated by the Advertising Standards Authority (ASA). Voluntary initiatives internationally poorly address digital media advertising and do not protect children and adolescents who are the most vulnerable to marketing messages (5,22,23).

The main aim of this study was to test the feasibility of monitoring the exposure of adolescents aged 16-18 years to food and beverage advertising through Facebook using a browser extension that identifies and retrieves advertising on the Facebook newsfeed of participants. A secondary aim was to evaluate the content of these promotions, and determine the healthiness of the advertised products using the World Health Organisation European Regional Office (WHO-EURO) Nutrient Profile Model (24,25).

Methods

Parental consent was required for thirteen to fifteen year olds to participate. This required a two-step recruitment phase so only sixteen to eighteen year olds were recruited. Previous protocols developed by the International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support (INFORMAS) on food and beverage marketing to children informed the approach and methods utilised (26). The aim of INFORMAS is to monitor, benchmark and support public and private sector actions to create healthy food environments, including marketing environments, and reduce obesity and non-communicable diseases and their corresponding inequalities.

Chrome Browser extension

The browser extension (AdHealth) used to collect the advertisements seen by participants when they scrolled through their Facebook Newsfeed was developed in JavaScript by the University of Auckland's Centre for eResearch(27,28). The extension was made available on the Google Chrome Web Store to download. A promotional website marketed through Facebook itself was developed to enable participants to download the extension, and after their approval, link it to their Facebook account on their personal computer. The AdHealth extension detected when users were on Facebook through the URL and which advertisements were actually seen when scrolling through their Newsfeed. The advertisements seen, including the duration of exposure (i.e. how long they were visible on the screen) were then recorded in an online database where

each user and advertisement received a unique ID. The extension only worked when the user was online using a desktop or laptop computer, not a smart phone or tablet.

The installed extension could be deleted at any time meaning participants were able to withdraw from the study. Information was extracted by parsing the Document Object Model (DOM) tree representation of Facebook web pages. The DOM tree contains all the information used by the browser to render a webpage on the screen, with tree elements closer to the root representing larger areas of the layout and elements further away from the root representing details such as text and images. Identifiers are associated with these elements which the browser extension uses to retrieve the relevant information from Facebook. This information was sent to a web server with a database, which compiled this information from all the browsers of users with AdHealth installed.

Nutritional information of the advertised products, when required for classification, was collected using the University of Auckland Nutritrack database (29) or other online sources such as from food retailers. The information collected included key macronutrients, such as saturated fat and sugar, and sodium as listed on the Nutrient Information Panels (NIP) per serving and per 100g. The advertisements in the online database were classified manually as permitted (healthy) or not permitted (unhealthy) to be advertised to children according to the WHO-EURO nutrient profile model. The WHO-EURO Model was specifically designed for the purpose of restricting the marketing of less healthy foods to children. It encompasses 17 food categories, including fruit, vegetables, and ready-made meals. Certain food categories are not permitted to be marketed to children under any circumstances. These include chocolate and confectionery, cakes and sweet biscuits, juices and energy drinks. Conversely, unprocessed meat and fish and fresh/frozen fruit and vegetables can be marketed without restriction. Maximum nutrient level cut points are applied to determine the eligibility of foods in all other categories to be marketed to children.

Recruitment

The target study population of 16-18-year olds was recruited through convenience sampling using paid Facebook advertisements and field recruitment from schools, sports clubs and community groups. Promotional materials such as videos and posters were used to explain why the study was being conducted and the technical requirements for installing the browser extension, including having a personal device running the desktop version of Google Chrome as solely operated by the adolescent, meaning that mobile devices and school devices were excluded.

Participants were recruited over a 5-month period. A koha (gift) of a $20 shopping voucher was provided to each participant who signed up during the field recruitment stage, while those who signed up during the online media recruitment stage entered a draw to win one of three $50 shopping vouchers.

Coding of advertisements

Variables of interest collected by the browser extension for each advertisement entry included userID, sessionID, adID, and URL to view the advertisement. This information was then supplemented by a research assistant manually classifying whether: the advertisement was food or not food related; the healthiness of the foods advertised according to the WHO-EURO nutrient profile model; and the display of promotional characters or premium offers within the advertisements. The key variables are described in *Table 1*. Birth date and gender were the only personal data collected from each participant. When the ad ID and/or the text or image was the

same, this meant the user saw the advertisement more than once. The advertisements appeared in either the sidebar (a panel on the right-hand side of Facebook's user screen) or the newsfeed (information within the middle of the page).

Table 1: Key variables collected for each advertisement

Key variables collected and assessed	
Browser Extension	
UserID	Distinct numerical value associated with each user (participant).
SessionID	A numerical value representing a single session, i.e. each time a user logged into and then out of facebook.
AdID	An adID linked with each advertisement entry collected within the session that a user engaged in.
Location	The location of the advertisement; either in the newsfeed or the sidebar.
SightingStart; SightingEnd	Timestamps for when the user first viewed the advertisement and when the user finished viewing the advertisement. Both used to calculate the duration of 'sighting' which was the amount of time the user viewed the advertisement.
SessionStart; SessionEnd	Timestamps for when the user first logged into and then out of their Facebook account. Both used to calculate session duration.
Birthdate, month and year	Used to ensure participant is aged 16-18.
Gender	The identified gender of each user.
Research Assistant	
AdFood	Whether an advertisement was food or non-food related.
AdType	A classification from 1-8 describing the characteristics involved in the advertisement such as type of outlet and whether a food or drink product is present.
AdRatingWHO; AdRatingFBCS	Applying the WHO-EU nutrient profile model and FBCS systems to each food-related advertisement.
Promotional Characters	A list of the different types of promotional characters e.g. cartoon/brand owned character present within the advertisement.
Premium Offers	A list of the different types of premium offers e.g. price discount present within the advertisement.

Classification of ads

The healthiness of each food product was classified using the WHO-EURO Nutrient Profile Model which is suitable to assessing packaged food products marketed to young people in New Zealand (25,30).

Advertisements consisting of a product that was not specific enough to be classified (i.e. lacking required nutritional information) were deemed 'non-specified'. Advertisements which did not include a specific product and instead promoted a food or beverage brand were classified as 'brand advertisements'. Products advertised where the products' food category is omitted from the WHO nutrient profile guidelines were classified as 'non-applicable', for example protein shakes and powders. If multiple products were in one advertisement, then all the included products had to meet the nutrient profile thresholds to be deemed permitted. If at

least one product was not permitted, then overall the advertisement would be classified as not permitted. A protocol was developed based on prior work by INFORMAS, to document and explain the decisions made during data analysis including classifying the healthiness of the food and drink advertisements (26,31).

Data analysis

The data was analysed using SPSS for key indicators to describe the users and advertisements: the number of users and their total exposure time, the number and proportion of permitted and not permitted food advertisements, the exposure time to permitted and not permitted food advertisements, the proportion of not permitted and permitted food advertisements with promotional characters and/or premium offers, and the proportion of advertisements seen by more than one user. Promotional characters included cartoon/company owned characters, licensed characters, amateur sportspersons, non-sports celebrities, movie tie-ins, famous sportspersons, 'for kids' messaging and premium offers included game and app downloads, contests, 'Pay 2 take 3' or other, '20% extra' or other, limited edition offers/products, social charities, gifts or collectibles, price discounts, or loyalty programs.

Duplicates and advertisements seen by only one user were included to ensure the complete picture of advertisements seen by users was analysed. All results, such as exposure duration, were analysed by userID and sessionID. The advertisements not for foods or beverages were used to calculate the proportion of all advertisements that were for food and beverages. The frequency of food advertisements was used to calculate the number of advertisements seen by more than one user. Advertisement entries with the same adID and/or text and image of the advertisement that had a different userID were counted. If the same advertisement entry was seen more than once, it was counted according to the number of entries associated with that particular advertisement. A small number of advertisement entries (n=38) did not have any data for the variables 'sessionend' and 'sightingend', which means the duration of session and/or exposures was unable to be determined. This occured when participants either did not officially log out of their Facebook account or the computer screen of participants was abruptly turned off.

Results

Exposure to advertisements

A total of 34 adolescents aged 16-18 participated in the study, with four percent of the total advertisements (n = 4,973) seen being food-related (204 advertisements). The total number of days of participation was 1535 days, with a range of 1 to 200 days.

Total time spent by users on Facebook across sessions was 164.1 hours, with 34.4 (17%) hours of this time being allocated to users viewing and being exposed to advertisements. Two-thirds (139, 68.1%) of food-related advertisements were located within the newsfeed and the remaining (65, 31.9%) were located in the sidebar. The mean exposure to food advertisements was 5.9 (SD = 2.5) and 4.8 (SD = 2.5) for not permitted food advertisements per hour of Facebook use.

The most frequent brands/companies targeting users across all food-related advertisements were Burger King (18%), Nutri-Grain (10.8%), Dominos (9.4%), Coca-Cola NZ (7.9%), and Japan Crate (7.2%) (*Figure 1*).

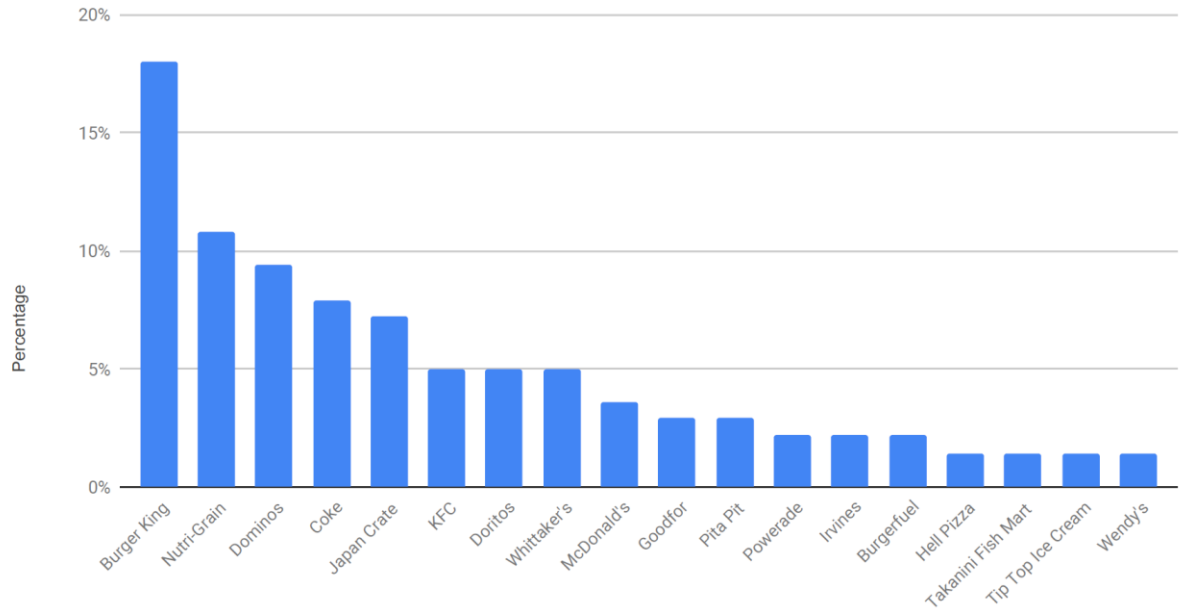

Figure 1: Most frequent food brands exposing their advertising to New Zealand adolescents on Facebook

According to WHO-EURO nutrient profile model, 166 (81.4%) were for not permitted foods, 3 for (1.5%) permitted foods and 20 (9.8%) were brand related over the study period. Once excluding the brand related advertisements 98.22% and 1.78% of food-related advertisements had a not permitted food advertisement and permitted food advertisement respectively. The product details were not specified in twelve (5.9%) advertisements and 3 (1.5%) were non-applicable (coffee, tea, protein powder, protein shakes etc.). The mean exposure time to unhealthy (not permitted) food advertisements on the users' screen was 32 seconds on average.

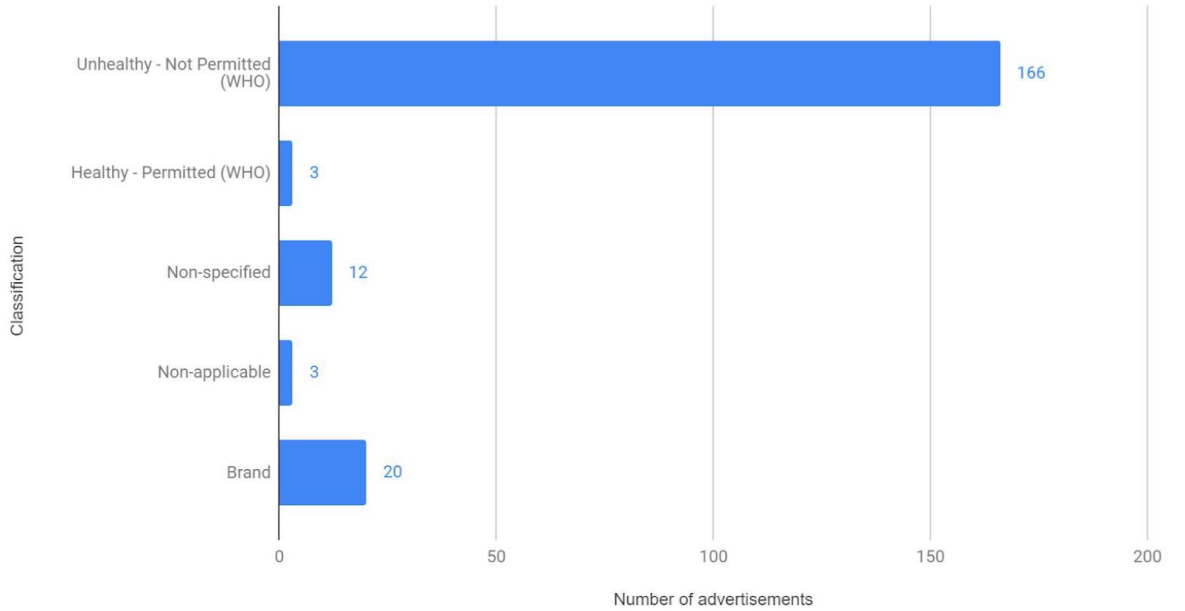

Figure 2: Classification across all advertisement entries by WHO-EURO nutrient profiling model

There were promotional characters on 56 (56/166, 33.7%) of the non-permitted food advertisements with a cartoon/brand owned character (26/56, 46.5%) and/or non-

sports/historical event/festival (18/56, 32.2%) being the most common promotional character types. Less common promotional characters were characters for kids, movie tie-ins, sports events and a famous person. There were 53 (53/166, 31.9%) instances of premium offers: price discount (23/53, 43.4%), gift or collectable (12/53, 22.6%), limited edition (12/53, 22.6%), and Buy 2 Get 1 Free or similar (6/53, 11.3%). Within permitted food advertisements (n=3), there was only one instance of a promotional character and none of premium offers.

Exposure per user

In total, users engaged in 3645 Facebook sessions (mean per user = 107; range from 1 to 1185; SD = 266), with a total Facebook time for all users across sessions of 9848 minutes (mean per user = 290; range from 0.09 to 2471.76, SD = 668). Total exposure time for all users across advertisement exposures within these sessions was 2061 minutes (Mean per user = 61; Range = from 0.008 to 682.15; SD = 152). Within the exposure time to advertisements among users, 98.9% and 1.1% was for non-food and food related advertisements respectively. For food-related advertisements this translates to 23 minutes, and of this, 18 minutes (99.8% of total food-related exposure time) was for unhealthy (not permitted) advertisements. This contrasts to 0.04 minutes (0.2% of total food-related exposure time) for healthy (permitted) advertisements in exposures across all users. Of the 23 minutes the remainder was 2.9 minutes for brand advertisements, and 0.7 minutes for non-applicable and non-specified advertisements each.

Discussion

Despite a small overall percentage of advertisements seen by adolescents through Facebook being food-related, the vast majority of these advertisements were for unhealthy food and beverages. The absolute number of 166 not permitted advertisements is also important to consider, with users exposed to an average of 4.8 (SD = 2.5) not permitted food advertisements per hour of Facebook use. This is one of the first studies to test a method of electronically collecting exposure of unhealthy food advertisements as experienced by adolescents through a social media platform (Facebook). The challenges with implementing this method were the recruitment of participants and the relatively narrow scope of social media coverage (only Facebook through a computer). While a minority of advertisements were food related, those advertisements were overwhelmingly for food and beverage products classified as unhealthy by WHO-EURO nutrient profile model. There was a high use of promotional characters (33.7%) and premium offers (31.9%) in the unhealthy food advertisements. The mean exposure time to unhealthy food advertisements on the users' screen was 32 seconds per user or 1% of total Facebook time.

Other studies using a range of methods to investigate food and beverage marketing on various digital media platforms also found the majority of ads to be for unhealthy foods. A 2019 study assessed the frequency and healthiness of food marketing seen by children and adolescents aged 7-16 years on digital media apps including Facebook, Instagram, Snapchat, Twitter, and YouTube (3). Of 108 participants, 72% were exposed to food marketing, with adolescents being particularly targeted. The highest promoted products were unhealthy products including fast food.3 A New Zealand study (20) found food marketing on Facebook to be comprehensive with some marketing techniques unique to Facebook. Two researchers became 'fans' of 20 major food brands and products, monitoring their 'newsfeed' and 'posts'. A New Zealand study of websites of food brands popular with children and adolescents, rather than digital media pages, found a variety of marketing techniques and features were used similar to the current study(32). The overall mean exposure to unhealthy food advertisements of 4.8 was slightly lower

compared to literature on food advertising in traditional media such as television advertising (18). Vandevijvere et al., (18) reported 9.1 as the mean hourly rate of unhealthy food advertising. This is an important consideration but is likely due to the associating limitations of our methods such as being limited to desktop and laptop computers.

The experience of implementation and associating limitations

This relatively low exposure to food advertisements could be due to the adolescents within the study interacting more with the non-food advertisements. There is an absence of literature on how stimulating adolescents and children find food advertisements compared to non-food advertisements to validate this conclusion. There is therefore a gap in the literature requiring attention among researchers. Overall, strengths included that the Google Chrome browser extension was simple to use, and suitable as this was the most commonly used web browser by the target audience. Also, despite some inconsistencies of the data collected by the extension, it was comprehensive and simple to interpret. This extension can further be applied to other web browsers such as Mozilla Firefox and Microsoft Edge using the Google Application Programming Interface.

This pilot uncovered significant lessons to be considered for larger studies. Firstly, the recruitment process for participants proved challenging, and would be more so for recruiting younger participants. Online advertising for study participants was largely ineffective and more successful recruitment involved visiting schools to recruit participants in-person. The AdHealth web extension was not available for mobile devices or tablets which required individuals to bring their own laptop to the recruitment session. This did not commonly occur so an alternative option was for the individual to send a screenshot to the research assistant showing that the extension was installed on their computer and linked to their Facebook account for verification purposes.

Assessing advertisements only on Facebook feeds provides a limited snapshot of exposure. Young people also use other digital media platforms such as Snapchat and Instagram (2). Broadening the AdHealth extension to these additional digital media platforms is potentially feasible. However, platforms, such as Snapchat, require access through a mobile application, which does not allow people to add extensions. To mitigate this, a separate mobile application would need to be developed that accesses people's accounts on their digital media application and gives permissions for the application to collect information on the advertisements seen by the user. These components would be added to the tracking technology used in the AdHealth extension. Enabling these higher privileges demands a high degree of trust between participants and researchers and safeguards for personal data security. A potential option is for participants to install an alternative digital media app to use in place of the original digital media application for the duration of the study to enable the study to be conducted with a mobile device on which this age group is likely to spend more time on digital media.

The capability of the browser extension to provide the quantitative data required for this study was mixed in the developmental stages before the pilot started. A substantial number of advertisements did not have a userID or sessionID because Facebook's code structure was constantly changing, meaning that the browser extension needed to be consistently altered to ensure that the extension functioned to retrieve the required information. Therefore the browser extension or tool needs to be constantly monitored and changed where necessary. Obtaining the participant's age was not always possible due to the settings some users have on their Facebook accounts. It is critical to know the participant's age for monitoring food marketing to children. This could be obtained during the consent process.

The extension provided limited information for the sidebar location compared to newsfeed location of advertisements, which is vital as one in three food-related advertisement were found in the sidebar. This impacted the ability to classify the healthiness of sidebar advertisements, for example, finding the nutritional information for a product in a sidebar advertisement was more difficult than for a newsfeed advertisement. This limitation of information is likely to be under the control of the programmers at Facebook. The web links to the advertisement entries' pictures or videos expired so entries needed to be captured immediately by downloading or saving the pictures or videos of the advertisements and inserting detailed comments within the database to describe the nature of the advertisement.

A limitation of this study is that the age bracket of 16-18 year olds was too narrow, as research has shown that food and digital marketing is more pervasive among younger adolescents and children (5,32,33). Although this might be due to the dominance of literature assessing food marketing that predominately involves children not teenagers. Younger children are more vulnerable to online advertising and companies use the users personal data to target them (5,13,34,35). Meanwhile this personal data is not available to researchers to expose this problem, shown in the difficulty of obtaining ethics approval for this pilot when involving a younger target audience. For future research, this means different recruitment and consent processes will be needed to study the exposures in these younger populations.

The WHO CLICK tool was recently developed to assist the monitoring of digital marketing of unhealthy products to children and proposes screen recording of smartphone activity over several days. It could be considered for future research. This will be useful given the amount of time 16-18 year olds spend on digital devices such as smartphones and tablets compared to computers, and other digital media platforms such as Instagram (2). Smartphone ownership for teenagers has been found to be nearly universal regardless of gender, ethnicity or socioeconomic background (36). Access to computers is less universal and varies by income. It is likely that the results significantly underestimate our samples' and potentially adolescents' overall exposure to digital food marketing.

Conclusion

Almost all the food advertisements viewed by adolescents in this study were for unhealthy products, despite the minority of advertisements being food related. Since the majority of advertisements are now placed through digital media, monitoring systems across the popular digital media platforms are essential. Further development and testing of monitoring tools like AdHealth is needed. Governments have a responsibility to not only protect children from commercial exploitation but also to monitor the compliance of companies with government regulations and policies on marketing to children. The responsibility for funding the development of these monitoring tools should also sit with governments.

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