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Children's exposure to unhealthy food and beverage advertisements on smartphones and tablets in social media and gaming applications

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Research Highlights

STUDY 1: Marketing to Children on Social Media Applications

- 72% of participants were exposed to food marketing while using their favourite social media applications.

- The companies promoted the most frequently were McDonald's (15%) followed by Starbucks (11%), PepsiCo (9%), Mars (5%), Coca-Cola (5%) and Restaurant Brand International (5%).

- The most frequently promoted food categories were fast food (44%), sugar sweetened beverages (9%), candy and chocolates (7%), snacks (6%) and alcohol (5%).

- According to the Pan American Health Organization Nutrient Profile Model (PAHO NPM), 85% of food and beverage products were categorized as ultra-processed and 97% were deemed high in fat, sodium, or free sugars.

- We estimated that children likely see food marketing in social media apps 111 times per week on average. On a yearly basis, this means that children likely see an average of 5772 instances of food marketing per year in these applications.

STUDY 2: Marketing to Children on Gaming Applications

- A total of 10 food advertisements were seen by participants. The most frequently advertised food category was fast food (n=7).

- According to the PAHO NPM, four of the six products (66%) advertised were categorized as ultra-processed and were deemed high in fat, sodium, or free sugars.

- We estimated that children likely see on average 2.8 food ads per week playing gaming apps. On a yearly basis, this means that children see on average about 145 food advertisements in gaming apps.

- Twelve gaming apps (9%) featured food themes and 66% (n=8) of them featured foods that could be considered unhealthy including candy, chocolate, cakes, cookies, soft drinks, ice cream, and fast-food. These apps were played by 16% of participants.

Background

Childhood obesity in Canada has increased two-fold since the 1970's while obesity among adolescents has tripled in the last 30 years (1-2). The dietary behaviors of Canadian youth are also poor and characterized by excessive intake of sodium and sugar, and low consumption of fruit and vegetables (3-5). To improve children's diets and curb obesity, the World Health Organization has urged countries to adopt policies that limit children's exposure to marketing that promotes unhealthy foods and beverages that are high in fat, sodium and sugar (6). Such action has been recommended because an extensive body of research has shown that food marketing contributes to childhood obesity and shapes children's dietary behaviors by influencing their short-term food intake, their food preferences and their food purchase requests (7-10).

In Canada, except for Quebec, food and beverage advertising to children is self-regulated by 18 large companies that participate in a voluntary initiative called the Children's Food and Beverage Advertising Initiative (CAI) (11). Eight participating companies have committed to exclusively advertise "heathier" products to children under 12 years old in schools and in various media, including the Internet and on mobile devices, while the remaining eleven companies have pledged to not advertise to children at all when certain conditions are met (11). Research evaluating the CAI has concluded that it is not protecting children sufficiently from unhealthy food and beverage advertising on television (12-16) or in digital media (17). This lack of effectiveness has been attributed to several factors including its voluntary nature, its use of high audience thresholds and lenient nutrition criteria as well as its limited scope (12,13,16).

Children and teens are increasingly being targeted by digital food marketing on desktop computers, tablets or smartphones (18-21). Recent research conducted in Canada has demonstrated that there is a large volume of unhealthy food advertisements on child and adolescent preferred websites (17,22). Very little research has examined other forms of digital marketing such as advertising that is integrated into applications (apps) favoured by children and teens, and text and e-mail advertisements (20). Yet, the potential of marketers to reach Canadian children and youth online and on mobile devices is great as one quarter (24%) of fourth and fifth graders own a cell phone or a smartphone and almost a third (31%) have regular access to someone else's phone (23). By grade 7, half (52%) of children own a phone and at least two thirds (67%) use social media (23).

The primary objective of this research was to examine children's exposure to food and beverage marketing on smartphones and tablets in free social media applications (study 1) and in free gaming applications (study 2). The secondary objective was to examine the healthfulness of this food marketing. It was hypothesized that the frequency of food and beverage advertising in free gaming and social media apps would be high and that the healthfulness of the foods and beverages advertised would be poor, as research has shown in other media.

STUDY 1 – EXPOSURE TO FOOD MARKETING IN SOCIAL MEDIA APPLICATIONS

Methods

A total of 101 children and adolescents (ages 7-16) were recruited from 4 community centres in Ottawa in various socio-economic communities. Using the smartphone or tablet that they usually use during their leisure time, participants were asked to use two of their favourite social media apps for 2 periods of 5 minutes, choosing from a list of 5 social media apps deemed to be the most popular among young people (Facebook, Instagram, Snapchat, Twitter and YouTube). Participants also wore Tobii Pro Glasses 2 (https://www.tobiipro.com/) which recorded what they saw while using the apps. These recordings were later reviewed to identity instances of food marketing. In addition, a survey was completed about each child's sociodemographic characteristics (e.g. age, gender, ethnicity), their use of mobile devices and social media applications. Children aged 6 to 11 years were asked to complete this questionnaire with their parents. Each child was compensated for their participation with a $10 gift card from a grocery store, dollar store, toy store or cinema.

Content analysis of social media apps and instances of food marketing advertisements
The video footage of each app used by participants was analyzed for the presence of food marketing including: (1) food advertisements (2) user-generated food marketing (3) celebrity-generated food marketing or (4) food marketing embedded in other web content (see Table 1).

Table 1. Definitions of types of food marketing

	Definition
Food advertisements	Banner and video ads or companies' posts on social media either shared by their corporate account or other social media users.
User-generated food marketing	A picture or video uploaded and shared by a social media user that promoted a food brand or product.
Celebrity-generated food marketing	Branded food products or logos that are seen in content produced and shared by well-known figures on social media.
Food marketing embedded in other content	Food marketing seen in recipe videos, art and craft videos and other entertainment content.

The instances of food marketing were categorized as promoting either a specific product or a brand (if they featured only a company logo or an unidentified branded food item). They were also categorized by food company, and by food category.

Nutritional analysis
The nutrition information of promoted foods was preferrentially taken from the Canadian company websites folllowed by the Nutrition Facts table found in store, U.S. company website, or the Canadian Nutrient File. Information collected included energy (calories), total fat (g), saturated fat (g), trans fat (g), sodium (mg), carbohydrates (g), fibre (g), sugar (g), and protein (g) per serving size.

The healthfulness of promoted foods was assessed using the Pan American Health Organization Nutrient Profile Model (PAHO NPM) (27). All product ads were classified according to whether they were excessive in total fat (if total fat accounted for ≥ 30% of total calories), saturated fat (≥10% of total calories), trans fat (≥1% of total calories), sodium (≥ 1 mg per 1 calorie), and free sugars (≥10% of total calories) (24). They were also classified as excessive or not in one of these nutrients.

Statistical analysis
Data was analyzed using SPSS 24.0 (IBM, 2017). Descriptive statistics were used to describe participants' characteristics, which app they used during the study, the time they usually spend using mobile devices and applications as well as their exposure to food marketing.

Using data from the entire sample, the weekly exposure to food marketing was calculated by multiplying the average number of food marketing instances seen per participant per minute and multiplying it by the average length of time children spend using social media apps over 5 typical weekdays and 2 typical weekend days.

Results

Characteristics of participants
Overall, 101 children and adolescents participated in the study. Their sociodemographic characteristics are presented in Table 2.

Media use
As shown in Table 3, on a typical weekday, participants reported spending on average 31 (SD = 53) minutes using a tablet and 86 (SD = 108) minutes using a smartphone during their leisure time. On a typical weekend day, the average time spent using a tablet and smartphone reached one hour or more (66 (SD = 108) minutes and 124 (SD =138) minutes, respectively).

Social media apps used by participants
 For this study, the most frequently used social media app was YouTube (n=65) followed by Instagram (n=51), Snapchat (n=41), Facebook (n=12) and Twitter (n=4).

Table 2. Socio-demographic characteristics of participants (N=101)

Characteristics	n (%)
Gender	
Male	44 (44)
Female	56 (55)
Does not identify as male or female	1 (1)
Age (years)	
7-12	54 (53)
13-16	47 (47)
Race	
White	71 (70)
Black	10 (10)
Other	20 (20)
Language[‡]	
French	16 (16)
English	84 (84)
Annual household income[§]	
Less than $50,000	10 (10)
$50,000-$99,999	15 (15)
$100,000 and over	56 (55)
Do not know	1 (1)
Refused to answer	19 (19)

[‡]Language in which the survey was completed
[§]Income before taxes and deductions

Table 3. Participants' use of tablets, smartphones, gaming apps, and social media apps during their leisure time

	Weekday		Weekend day	
Time Spent	Median (range)	Mean (SD)	Median (range)	Mean (SD)
Using a tablet	0 min (0-5 hr)	30 min (53 min)	30 min (0-12 hr)	65 min (1.8 hr)
Using a smartphone	45 min (0-8 hr)	86 min (1.8 hr)	60 min (0-10 hr)	124 min (2.3 hr)
Playing a gaming app	30 min (0-6.5 hr)	41 min (1.0 hr)	60 min (0-7 hr)	73 min (1.4 hr)
Using a social media app	30 min (0-7 hr)	65 min (1.35 hr)	60 min (0-11 hr)	103 min (2 hr)

Children's exposure to food marketing
Seven out of ten participants (72%) were exposed to food marketing while using their favourite social media applications. Collectively, participants viewed 215 instances of food marketing. In terms of frequency, participants were exposed between 0 to 12 times and an average of 2.1 (SD=2.6) times per 10-minute period.

Of the 215 exposures to food marketing that were identified in this study, about half (51%) of these instances were food advertisements, 18% and 11% were user- and celebrity-generated, respectively, and the remaining (20%) were embedded in other web content. More than two thirds of food marketing exposures (72%) featured products while 28% promoted brands. The most promoted companies were McDonald's (15%) followed by Starbucks (11%), PepsiCo (9%), Mars (5%), Coca-Cola (5%) and Restaurant Brand International (5%). The most frequently promoted food categories were fast food (44%), sugar sweetened beverages (9%; of which 63% were soft drinks, 32% were iced tea, and 5% were sweetened milk alternatives), candy and chocolates (7%), snacks (6%) and alcohol (5%). Examples of the food marketing seen by participants are presented in Appendix 1.

Healthfulness of promoted food and beverages
As for the healthfulness of promoted products (n=147), according to the PAHO NPM, 85% of food and beverage products were categorized as ultra-processed and 97% were deemed excessive in either fat (total, saturated or trans), sodium, or free sugars (Table 4).

Table 4. Healthfulness of branded products seen by children when using social media apps according to PAHO NPM (N=215)

	All sources of exposure n (%)
Level of processing	
Minimally processed	20 (14)
Processed	2 (1)
Ultra-processed	126 (85)
Nutritional analysis‡	
Excessive in total fat	97 (66)
Excessive in saturated fat	84 (57)
Excessive in trans fat	26 (18)
Excessive in sodium	79 (54)
Excessive in free sugars	72 (49)
Excessive in at least one nutrient	142 (97)

‡based on the PAHO NPM

Estimated weekly exposure to food and beverage advertisements in social media applications
We estimated that children see on average 0.21 instances of branded content per minute on free social media applications or 111 instances of food marketing per week. On a yearly

basis, this means that children may see an average of 5772 instances of food marketing in social media apps.

STUDY 2 – EXPOSURE TO FOOD ADVERTISING IN GAMING APPLICATIONS

Methods

The methodology of this study was very similar to the study on social media applications. In the gaming app study, a total of 93 children and adolescents (ages 6-16) were recruited from 5 community centres in Ottawa. Each child played their two favorite free gaming apps for five minutes each, using the smartphone or tablet they usually use. While playing these games, they wore Tobii Pro Glasses 2 (https://www.tobiipro.com/) and the recordings from these sessions were then reviewed to identity food marketing instances that appeared during the period of gaming-app use. Each child completed the same sociodemographic survey that was previously described and was compensated for their participation as per the previous study.

The methodology regarding the content analysis of gaming app footage and the advertisements seen, the nutritional assessment of promoted foods, the estimation of exposure and the statistical analyses were replicated as per the previous study.

Results

Characteristics of participants
Overall, 93 children and adolescents participated in the study (see Table 5).

Media use
On a typical weekday, participants reported spending on average 34 (SD = 55) minutes using a tablet and 40 (SD = 100) minutes using a smartphone during their leisure time. On a typical weekend day, the average time spent using a tablet and smartphone exceeded an hour (74 (SD = 95) minutes and 60 (SD =137) minutes, respectively). As for the use of gaming apps, participants reported playing them for an average of 28 (SD=35) minutes on typical weekdays and 60 (SD=57) minutes on typical weekend days.

Gaming-apps played by participants
A total of 138 unique free gaming apps were played during the study (see Appendix 2 for a list of these games). Twelve gaming apps (9%) featured food themes (as shown in Table 6) and 66% (n=8) of them featured foods that could be considered unhealthy including candy, chocolate, cakes, cookies, soft drinks, ice cream, and fast-food. These food themed gaming apps were played by 16% of participants (n=15).

Frequency and healthfulness of food advertising
A total of 10 food ads were identified on the 138 unique free gaming apps. Six ads featured products and four were brand ads. The most frequently advertised food category was fast

food (n=7). Four of the six products (66%) advertised were categorized as ultra-processed and were deemed excessive in fat, sodium, or free sugars according to the PAHO NPM.

Table 5. Socio-demographic characteristics of participants (N=93)

Characteristics	n (%)[†]
Sex	
Boy	42 (45)
Girl	51 (55)
Age (years)	
6-12	85 (91)
13-16	8 (9)
Race	
White	72 (77)
Other	21 (23)
Language[‡]	
English	67 (72)
French	26 (28)
Annual household income[§]	
Less than $50,000	9 (10)
$50,000 -$99,999	12 (13)
$100,000 and over	58 (62)
Do not know	2 (2)
Refuse to answer	12 (13)

[†]Percentages may not add up to 100 due to rounding

Table 6. Gaming-apps that featured food themes

App name	Number of participants who played these apps	Food category
Candy Crush Saga	3	Candy and Chocolate
Fruit Ninja	2	Fruit
Shopkins	2	Mixed (Cakes, Cookies, Pretzels, Milk, Flour, Sugar, Eggs, Salt, Fruit)
Hay Day	1	Fruit and Vegetables
Cooking Fever	1	Fast food (Burger, hot dog, fries, soda)
Mouse Maze	1	Cheese
Ice Cream Jump	1	Ice cream
Dr. Panda Ville	1	Mixed (Cookies, Candy, Fruit, Vegetables, Bread)
My Talking Angela	1	Mixed (Fruit, Chocolate, Bread/Pastry)
Cotton Candy – Cooking game	1	Candy
Candy Crush Soda Saga	1	Candy and Soft Drinks
Merge Farm	1	Fruit and Vegetables

Estimated weekly exposure to food and beverage advertisements on gaming applications
The 10 food ads identified in this study were viewed by 6 participants (7% of our sample) on 6 different gaming apps including Flow Free, Dunk It, Kizi Dynamons, Despicable Bear, Flappy Dunk, and BLOCK! Hexa Puzzle! Based on the total frequency of food advertisements identified in the study, we estimated that children see on average 0.01075 ads per minute of free gaming-app use or 2.8 food ads per week on average. On a yearly basis, this means that children see on average about 145 food advertisements per year in gaming apps.

Discussion

STUDY 1 – EXPOSURE TO FOOD MARKETING IN SOCIAL MEDIA APPLICATIONS

As hypothesized, children and youth were frequently exposed to food and beverage marketing while using their favourite social media apps for 5 minutes each and most of these instances featured products considered less healthy and high in fat, sodium or free sugars. The promotion of such products is worrisome, given that the majority of Canadian children and youth consume higher levels of sodium and sugar than national dietary guidelines recommend (3, 4) and the persistence of these dietary behaviours into adulthood also increases children's risk of developing obesity and other diet-related chronic diseases (25-27).

This study also shows that food and beverage marketing is reaching children and youth on social media apps through various means including advertisements, celebrity- and user-generated content and other web content that may not appear to be advertising. In fact, we estimated that children and adolescents may be exposed to these various forms of food marketing on average 111 times per week based the average time they spend using social media apps over typical weekdays and weekends. This represents an annual exposure to 5772 food marketing instances in social media apps. This level of exposure may greatly influence children's perception of a normal diet (28) as well as their food preferences, food purchases and food intake (7-10).

The companies participating in the Children's Food and Beverage Advertising Initiative (CAI) are advertising in social media apps used by children however, we were unable to determine if these ads were linked specifically to the Canadian subsidiaries of these companies. Pledges made under the CAI only apply to media where children make-up 25-35% of visitors and these thresholds would not be met on social media apps which appeal to a mixed audience. Also, given that three of the five social media apps used in this study require, in theory, users to be older than 12 years old to have an account and access their platform's content, CAI companies may likely assume that all users on these platforms are at least 13 years old. Our research results show that children need protection on applications even where they are not the primary intended audience.

STUDY 2 – EXPOSURE TO FOOD ADVERTISING IN GAMING APPLICATIONS

Contrary to what was hypothesized, children were not frequently exposed to food and beverage advertisements while playing their favorite gaming apps for 5 minutes each. Despite the low level of food advertising, most ads that were seen were for fast food restaurants and were considered unhealthy and high in fat, sodium or free sugars. On a weekly basis, we estimated that children and adolescents may see on average 2.8 food ads per week based the average time they spend playing gaming apps on typical weekdays and weekends. This represents an annual exposure of 145 food ads per year which is significant when one considers children's accumulated exposure to food and beverage advertising in other media as well. Our research results also show that the companies participating in the CAI are not advertising to any extent in gaming apps used by children in Canada.

Few children reported using apps of food and beverage companies. However, 16% of our participants used gaming apps that featured food themes, most of which (66%) were unhealthy. The use of gaming apps with food themes likely serves to reinforce the normalization of junk food and merits further study.

Limitations and Strengths
It is important to consider the limitations of these studies when interpreting their results. For instance, children's use of social media and gaming applications were reported by participants or their parents. The reported time spent using these apps may therefore be under- or over- estimated. In the completed survey, participants were also asked about their use of "non-gaming apps" rather than their use of social media apps. In addition, both studies only examined the food marketing seen by participants during 10 minutes of app use and most study participants were from higher income households. Because of all the factors cited above, our estimate of children's exposure to food marketing in social media and gaming applications is subject to some error and may not be representative of the food marketing exposure of all Canadian children. Despite these limitations, this research is the first to measure children's exposure to unhealthy food marketing in applications used on mobile devices. Another significant strength of the study was that participants were asked to use the mobile device they typically use during their leisure time. By doing so, our measure of food marketing exposure captured ads that could have been the result of behavioral targeting (i.e. advertisements tailored to participants' previous online activities).

Conclusion
Our research results reinforce the importance of including digital media when crafting regulations to limit food and beverage marketing to children, and considering digital media like social media applications that target the general population but remain popular with children. Clearly children are being exposed to unhealthy food advertising in these media and food and beverage restrictions that consider the full breadth of digital marketing will ensure that children's health is protected.

Appendix 1: Screen shots of food marketing seen on social media sites by study participants


Figure 1. Post published by Torri Webster on Instagram that was viewed by a female participant aged 15


Figure 2. Post published by Rosanna Pansino on Instagram that was viewed by a 13-year-old female participant

Rosanna Pansino is an American baker who is most known for her series Nerdy Nummies, one of the most popular baking shows on YouTube. She has 3.4 million followers on Instagram.

Torri Webster is a young Canadian actress most known for her role in a YTV teen sitcom. She has 297,000 followers on Instagram.

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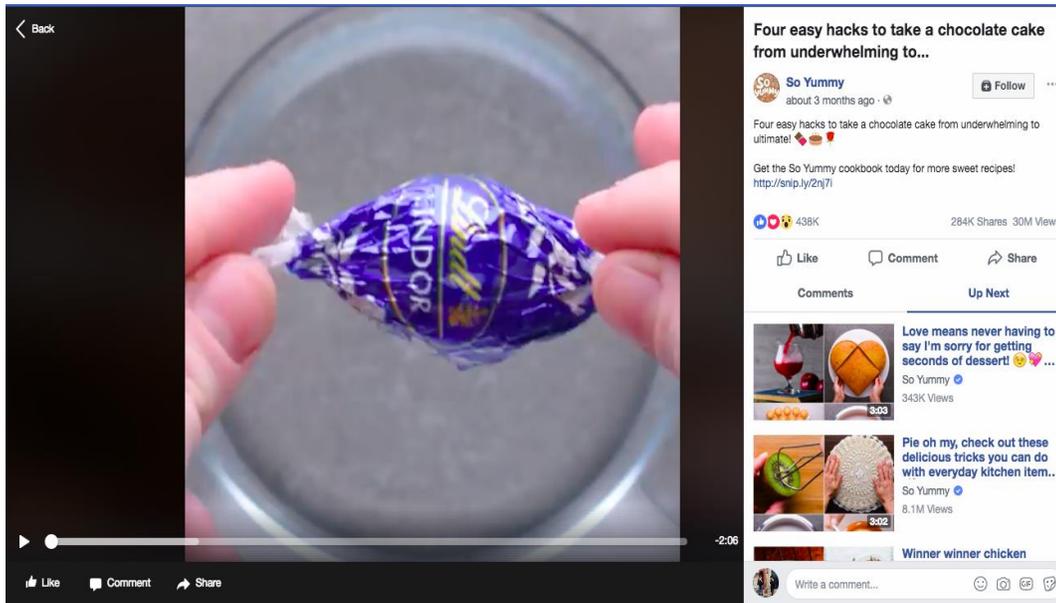
Figure 3. Screenshots of a recipe video posted by So Yummy which was viewed by a female participant aged 12 on Facebook
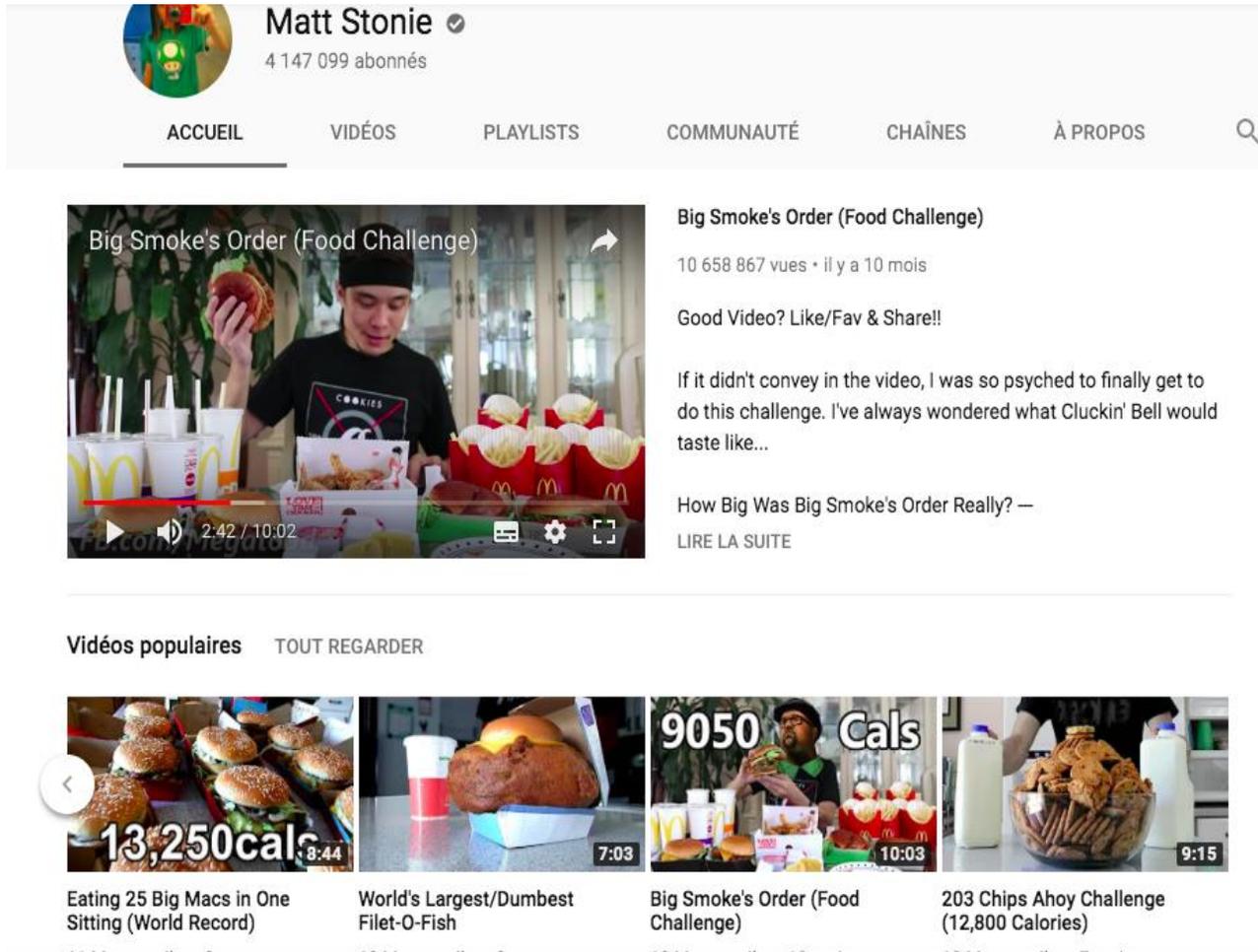
Figure 4. Sample of content posted by Matt Stonie on YouTube, a channel that a male participant aged 15 scrolled through for a prolonged period seeing several thumbnails featuring branded foods (e.g. McDonald's burger and fries, & Sunny Select Honey)**. Matt Stonie** is a competitive eater. His YouTube channel has more than 4 million subscribers.
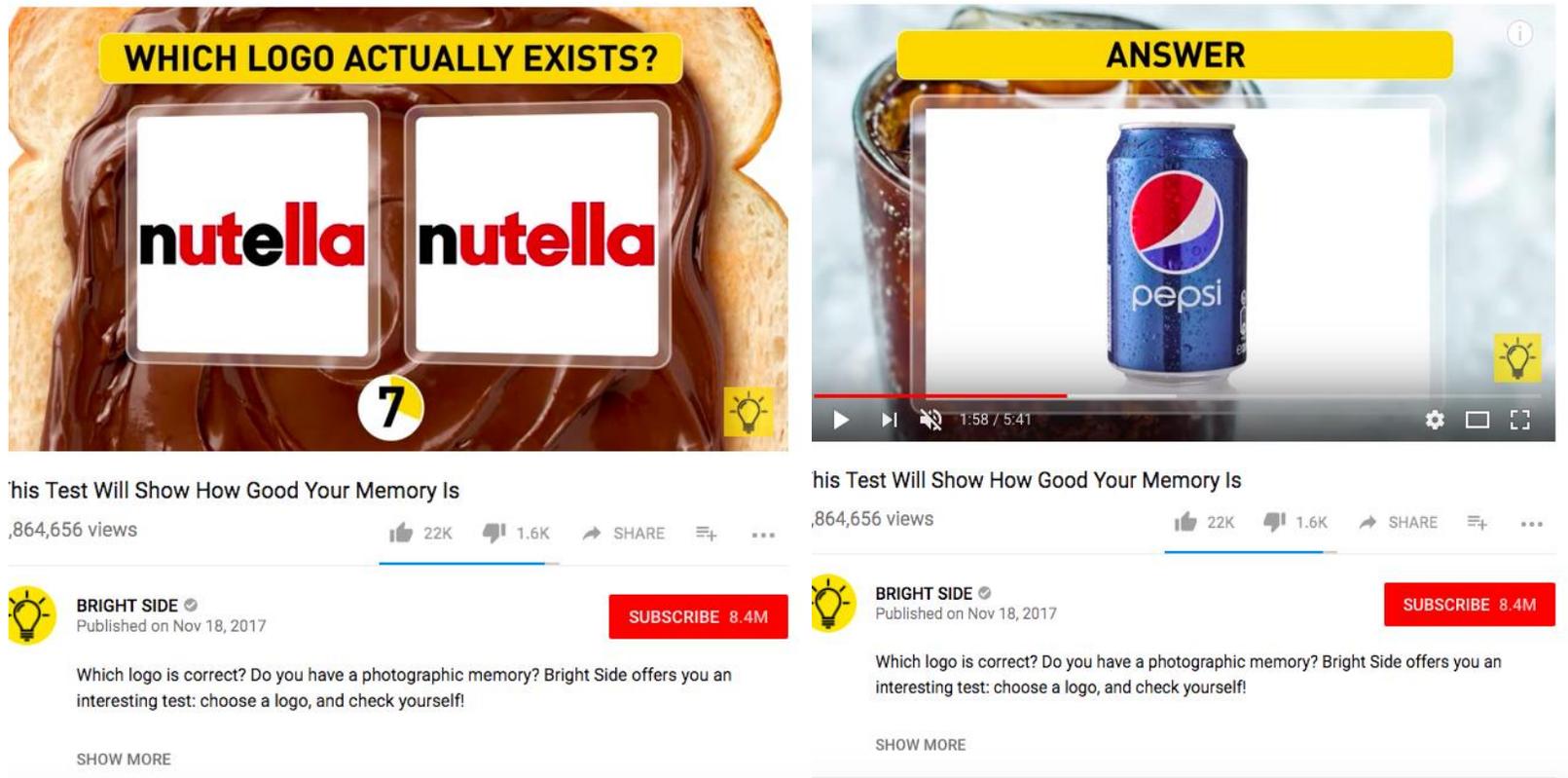
Figure 5. Screenshots of a YouTube video published by Bright Side watched in its entirety by a male participant aged 11. This video featured logos and branded products of numerous companies such as Burger King, Nutella, Pepsi, Nestlé, Estrella, Nescafé, Danone, Knorr, Nestea and Snickers
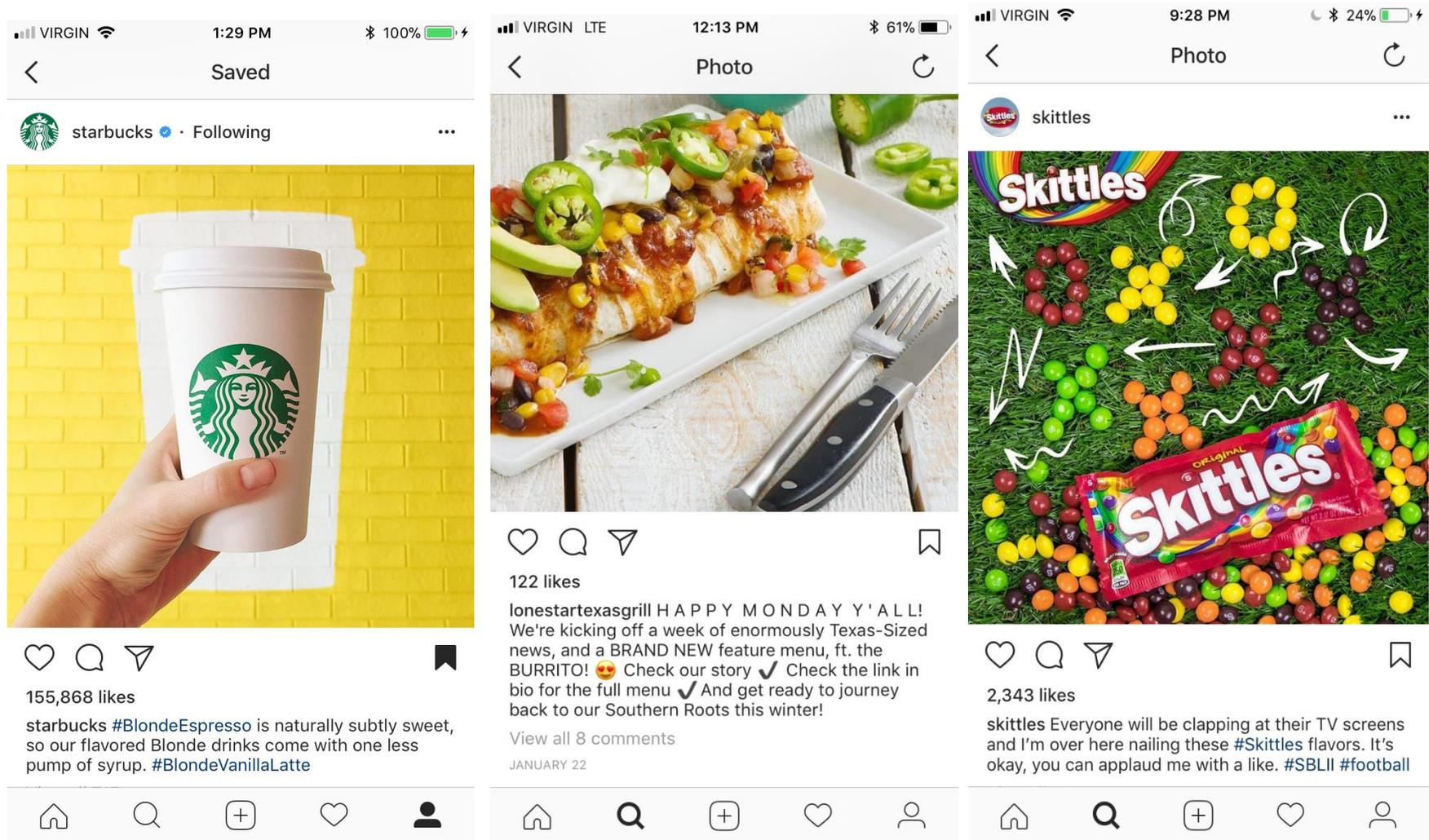
Figure 6. Various advertisements seen by participants while using the Instagram app

Figure 7. Various advertisements seen by participants while using the Instagram app
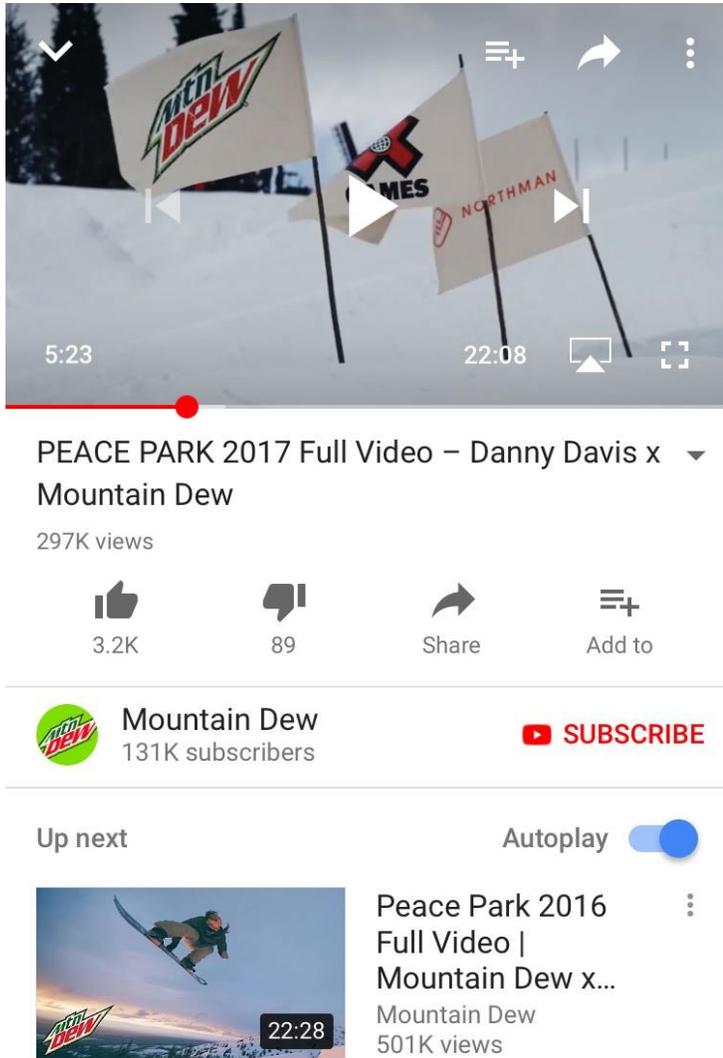
Figure 8. YouTube video on the Mountain Dew Channel watched for by a male participant aged 16.
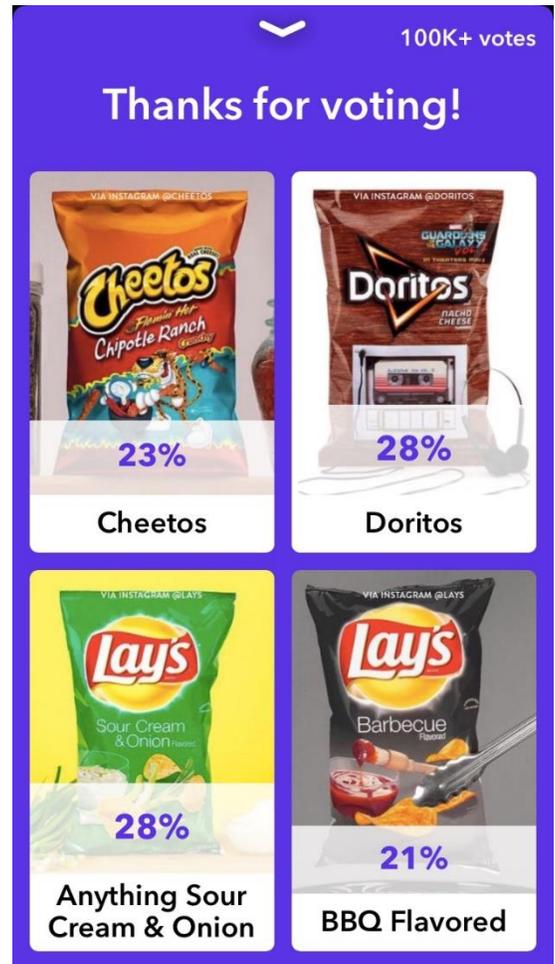
Figure 9. Sample content from the Tastemade subscription page on Snapchat (March 15, 2018)

Branded content posted by Tastemade was viewed by 12 participants. Many large food, beverage and alcohol companies including Unilever, General Mills, Bacardi, Anheuser-Busch, Mondelez International, Pepsico, Nestlé, Diageo, Starbucks coffee and Coca-Cola, advertise through this subscription page in Snapchat.

Appendix 2: Number of times a gaming app was played by participants, and presence of food advertising and food themes in these apps

Gaming app	Number of times gaming app was played by participants	Food advertising	Food theme
Subway Surfers	11		
Color Switch	7		
Rider	4		
Snake vs Block	4		
Bike Race	3		
Candy Crush	3		✓
Clash of Clans	3		
Clash Royal	3		
Flow Free	3	✓	
Roblox	3		
Shopkins	3		✓
Slither.io	3		
Bowmasters	2		
Cut the Rope	2		
Dumb Ways to Die	2		
Fruit Ninja	2		✓
Geometry Dash	2		
Geometry Dash Meltdown	2		
Jet Pack Joy Ride	2		
Talking Tom Gold Run	2		
White Tiles 4	2		
Agar.io	1		
Agent Dash	1		
Amazing Brick	1		
Ambulance Blocky	1		
Ballz	1		
Baseball Stars	1		
Basket and Ball	1		
Batman Movie	1		
Battle Bay	1		
Bejeweled Classic	1		
Bike Rivals	1		
Black Jack	1		
Block Puzzle Plus	1		
Block! Hexa Puzzle!	1	✓	
Boom Beach	1		

Brawl Stars	1		
Bubble Shooter	1		
Candy Crush Soda	1		✓
Catch Up	1		
Clumsy Ninja	1		
Cooking fever	1		✓
Cotton Candy - Cooking Game	1		✓
Cow Evolution	1		
Creator Island	1		
Cribbage	1		
CSR	1		
CSR2	1		
Cute Bones	1		
Despicable Bear	1	✓	
Diep.io	1		
Dino Hunter	1		
Disney Crossroad	1		
Dr. Panda Ville	1		✓
Dragon City	1		
Dragon Hills	1		
Dream League Soccer	1		
Drive Ahead	1		
Drive Ahead! Sports	1		
Dune	1		
Dunk It	1	✓	
Extreme Car Driving Simulator	1		
Faily Brakes	1		
Fairy	1		
Fall Down 2	1		
Fashion Frenzy	1		
Fire Rides	1		
Fish Out of Water	1		
Flappy Dunk	1	✓	
Flip Diving	1		
Flow (rap)	1		
Gogo Gadget	1		
Grumpy Cat	1		
Gunship Battle	1		
Happy Hop	1		
Happy Wheels	1		
Hay Day	1		✓

Hungry Shark	1		
Ice Cream Jump	1		✓
Idle Miner	1		
Kizi Castle Dash	1		
Kizi Dynamons	1	✓	
Lego City 2	1		
Lego Juniors	1		
Lep's World	1		
Lords Mobile	1		
MaddenNFLFootball2	1		
Make up 2	1		
Matchington	1		
Merge Farm	1		✓
Mini Bow Maker	1		
Minion Rush	1		
Modern Air Combat	1		
Mouse Maze	1		✓
My Talking Angela	1		✓
Need for Speed - No Limits	1		
Ninja Run Jump	1		
Ninjago Movie	1		
Olaf's Adventures	1		
Paper.io	1		
Piano Challenges	1		
Piano Tiles	1		
Piano Tile 2	1		
Assassin's Creed Pirates	1		
Pocket Locket	1		
Pokemon Duel	1		
Protect	1		
Puzzle Dom	1		
Recolor	1		
Red Ball 4	1		
Roll the Ball	1		
Rolling Sky	1		
Sand Box	1		
Seekers Notes	1		
Skip Bow	1		
Sling Kong	1		
snails.io	1		
snake.io	1		
Snuffy's Safari	1		

Solitary	1		
Sonic	1		
Stak	1		
Star Sk8ter	1		
Stick War	1		
Stickman Warriors	1		
Sudoku	1		
Temple Run	1		
Temple Run 2	1		
Turbo Dismount	1		
Turretz	1		
Type Shift	1		
UFB - Game of the Final Fight Champion	1		
Uphill Rush	1		
Word Connect	1		
Word Crush	1		
Word Search	1		
Wordscapes	1		
World Maps	1		

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