



Adolescents' engagement with unhealthy food and beverage brands on social media

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ABSTRACT

Introduction: Food-related promotion of brands via social media represents an increasingly important youth-targeted marketing strategy, but little is known about how adolescents interact with these brands online. This study measures adolescents' social media engagement with food/beverage brands, sociodemographic differences in level of engagement, and relationships between engagement and screen time.

Methods: Cross-sectional online survey of US adolescents (ages 13–17, N = 1564), oversampled for non-Hispanic Black and Hispanic (more- and less-acculturated) participants, assessed restaurant, food, and beverage brands ever liked, shared, or followed of on social media. Multivariate logistic regression models examined associations between brand engagement, sociodemographic variables (race/ethnicity, acculturation, age, gender, and parent education), and screen time (TV and other screens).

Results: Seventy percent of adolescents reported engaging with any food/beverage brands on social media (ranging from 1 to 48), and 35% engaged with 5 + brands. Non-Hispanic Black and less-acculturated Hispanic adolescents were more likely than non-Hispanic White adolescents to engage with brands. Approximately one-half reported engaging with brands of fast food (54% of participants), sugary drinks (50%), candy (46%), and snacks (45%), while just 7% reported engaging with all other categories of food/beverage brands. Watching TV more than 2 h-per-day was associated with any brand engagement; while using other screens more than 2 h-per-day was associated with following 5 + brands.

Conclusions: Engagement with unhealthy food brands on social media is common among adolescents. Disproportionate engagement by non-Hispanic Black and less-acculturated Hispanic youth raises additional concerns. Research is needed to understand how such marketing affects adolescents' food preferences, diets, and health.

1. Introduction

Restaurant, food, and beverage advertising targeted to adolescents almost exclusively promotes energy-dense nutrient-poor products, especially fast food, sugary drinks, candy, and snacks (Frazier & Harris, 2018). Exposure to this marketing increases preferences and consumption of these products (Institute of Medicine, 2012). Although adolescents express greater skepticism towards advertising than younger children, they remain highly vulnerable to influence from food-related advertising (Brownell, Schwartz, Puhl, Henderson, & Harris, 2009; Harris & Fleming-Milici, 2019). Adolescents are also a prime target for food marketers and there are no policies to protect them from exposure to aggressive marketing campaigns for unhealthy foods and beverages in the United States (Federal Trade Commission,

2012; Harris & Fleming-Milici, 2019; Healthy Eating Research, 2015). Currently, the major U.S. self-regulatory program for food and beverage companies, the Children's Food and Beverage Advertising Initiative (CFBAI), only addresses advertising to children up to 11 years old (Council of Better Business Bureaus, 2018). Internationally, the World Health Organization (WHO) has called on countries to enact legislation to protect children (up to age 18) from unhealthy food marketing in digital media as an emerging serious threat to children's health and right to privacy (Tatlow-Golden et al., 2016).

Existing research on food marketing to adolescents has examined primarily television advertising. Greater television viewing time is associated with higher risk for poor diet and obesity, largely due to greater exposure to food and beverage advertising (Andreyeva, Kelly, & Harris, 2011; Zimmerman & Bell, 2010). However, adolescents' media

Abbreviations: Children's Food and Beverage Advertising Initiative [CFBAI], Youth Risk Behavioral Surveillance System [YRBSS]

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usage has changed substantially in recent years. Time spent watching TV has declined dramatically (Friedman, 2017), from on average 2.6 h-per-day in 2013 to 1.8 h-per-day in 2017, resulting in a 43% reduction in food-related TV ads viewed during this time (Frazier & Harris, 2018). At the same time, hours spent on digital media, including computers, tablets, and smartphones, have increased (Anderson & Jiang, 2018; Twenge, Martin, & Spitzberg, 2018). In 2014, 24% of adolescents reported being online “almost constantly;” by 2018 almost one-half reported near-constant use (Anderson & Jiang, 2018). Adolescents now spend the majority of their non-TV screen time on smartphones, and much of that time is spent on social media platforms (e.g., Instagram, YouTube, Facebook). In 2016, 82% of 12th graders reported visiting social media sites daily up from 52% in 2008 (Twenge et al., 2018).

Food marketers have adapted to adolescents' changing media patterns by pioneering social media marketing. In 2013, sugary drink brands placed almost 1 billion ads on both Facebook and YouTube (Harris, Schwartz, LoDolce, Munsell, & Fleming-Milici, 2014). One snack food brand placed more than 1 billion ads on Facebook in 2016, representing more than one-half of its total online advertising placements (Harris et al., 2017). The majority of food and beverage brands also maintain social media accounts, and sugary drinks, fast food, and snack brands rank among the most “liked” and most “followed” brands on Facebook (Harris et al., 2014, 2015; Harris, Schwartz, Munsell, Dembek, & Liu, 2013). Common social media marketing techniques include company-generated posts, apps, and interactive games (Freeman et al., 2014). This content is shared virally through followers' social networks, reaching followers' friends regardless of whether or not they also follow the brands. Brand followers can also post their own brand-related content to brands' social media accounts, which are then viewed and shared virally by the brands' followers. Of note, social media marketing is distributed through social media accounts maintained by the brands. It is distinct from pictures and messages regarding brands that users post on their own social media pages.

Experts raise unique concerns about marketing on social media and other forms of digital marketing for several reasons. First, it is often “disguised” as entertainment, messages from friends (e.g., shared social media posts/videos), or advice from “influencers,” and not easily recognized as advertising (Freberg, Graham, McGaughey, & Freberg, 2011; Lueck, 2015; Montgomery & Chester, 2009). Further, marketing on social media encourages adolescents to like and share brand posts with friends (Kim & Johnson, 2016). Unlike TV advertising, which viewers observe passively, users participate in the marketing of brands by sharing content virally with their friends (Montgomery & Chester, 2009). Especially for adolescents who are developmentally vulnerable to peer influence, this form of marketing may be more effective at increasing positive brand attitudes than traditional TV advertising or other advertising messages that clearly originate from the company (Calder, Malthouse, & Schaedel, 2009; Kim & Johnson, 2016).

Such online engagement has been shown to influence adolescents' attitudes toward and/or use of energy drinks, alcohol, and tobacco (Buchanan, Kelly, & Yeatman, 2017; Hoffman, Pinkleton, Weintraub Austin, & Reyes-Velazquez, 2014; Soneji et al., 2018). One study found that another form of digital marketing for unhealthy foods, influencer marketing (i.e., promotion through blogs hosted by popular online personalities), increased children's intake of unhealthy snacks (Coates, Hardman, Halford, Christiansen, & Boyland, 2019). Another study found an association between certain types of online behavior and unhealthy food consumption among youth ages 10 to 16 (Baldwin, Freeman, & Kelly, 2018). However, this study limited questions to Facebook and YouTube. It did not ask about social media engagement (i.e., liking, sharing, or following brands) on other social media platforms. Furthermore, the data were collected in 2014, and the number of social media platforms and use of social media by adolescents has grown substantially since that time (Anderson & Jiang, 2018; Twenge et al., 2018). To date, research has not examined how many adolescents engage with food and beverage brands across all forms of social media,

nor how engagement may differ by individual characteristics, including media usage, race/ethnicity, or other demographic characteristics.

1.1. Potential individual differences in social media marketing engagement

Several factors may predispose some adolescents toward greater engagement with food brands on social media. Amount of time spent on digital media is one potential factor, as increased time on digital media may provide greater opportunity to engage with brands online. However, TV viewing time could also increase social media engagement as exposure to food and beverage brands in TV advertising may prompt adolescents to engage with the same brands on social media (Turner, 2016). Marketers also report that social media amplifies the effectiveness of their traditional media advertising (including TV), by increasing ad recall, brand awareness, positive brand attitudes, and purchase intent (Tatlow-Golden, 2016). Despite declines in TV viewing among adolescents (Twenge et al., 2018), food and beverage marketers continue to dedicate 81% of their advertising dollars to TV (Frazier & Harris, 2018). In 2017, adolescents continued to view on average 9.4 food-related TV ads daily. Fast-food restaurants accounted for 31% of those ads, and candy, snacks, and drinks made up over one-quarter (Frazier & Harris, 2018).

Sociodemographic differences in media use may also lead to increased brand engagement on social media for some adolescents. Black adolescents spend more time viewing TV than their Hispanic and non-Hispanic White counterparts (Fleming-Milici & Harris, 2016). In addition, declines in time spent viewing TV from 2013 to 2017 were lower for Black versus White adolescents (−38% vs. −44%) (Harris, Frazier, Kumanyika, & Ramirez, 2019). Less parental education and lower household income are also associated with greater screen time, including TV and digital screens (Anderson & Jiang, 2018; Rideout, 2015). Time spent on social media is higher for girls than for boys (Twenge et al., 2018). In addition, Hispanic adolescents are more likely than non-Hispanic White adolescents to report using the internet “almost constantly” (54% vs. 41%) (Anderson & Jiang, 2018).

Additional factors may increase engagement with food and beverage brands on social media by Black and Hispanic youth. Food companies disproportionately target TV advertising for fast food, candy, sugary drink, and unhealthy snack brands to Black and Hispanic youth (Harris et al., 2019). This targeted marketing of unhealthy products to Black and Hispanic youth raises public health concerns about resulting preferences for unhealthy targeted brands and their negative effects on diet-related health disparities affecting communities of color (Grier & Kumanyika, 2010; Ramirez, Gallion, & Adeigbe, 2013). Targeted marketing could also result in higher social media engagement with unhealthy food and beverage brands, which would exacerbate these effects. Language preference may also play a role for Hispanic adolescents. One study found that youth in Spanish-speaking households visited food and beverage websites at greater rates than those in English-speaking households (Hyary & Harris, 2017), which could also lead to greater engagement with brands on social media for less-aculturated compared to more-aculturated Hispanic adolescents.

1.2. The present study

It is important to document adolescents' engagement with food and beverage brands on social media; determine whether this engagement corresponds with the nutritionally poor brands that frequently target TV advertising to adolescents, including Black and Hispanic youth; and examine differences in engagement by individual characteristics. In this exploratory study, we conducted an online survey with a large national sample of adolescents to begin to answer these questions. Specific research aims included to: (a) quantify the number and types of food and beverage brands that adolescents engage with on social media; (b) identify differences in engagement by individual demographic and media usage characteristics; and (c) examine associations between

these characteristics and brand engagement. These findings will help inform future research on effects of such exposure, appropriate policies to reduce unhealthy food marketing in social media, and potential interventions and health communication campaigns to counteract the impact of this marketing.

2. Methods

We conducted an online survey with a non-probability sample of 1564 U.S. adolescents (age 13–17) during *March–May 2017*. Participants reported their engagement with (i.e., liking, sharing, following) food and beverage brands on social media; TV viewing time and other screen use; and demographic characteristics.

2.1. Sample

Two national online survey panels were used to recruit participants, including one large nationally representative panel (Innovate, 2018) and one panel of U.S. Hispanic households (Offerwise, 2019). Parents provide consent for their children to be panel members. Both panels provide their members with a variety of incentives for participation, which is entirely voluntary. Quotas were established to achieve a sample that included approximately equal proportions of respondents by gender and age. Additional quotas were established to achieve a sample of at least 330 Black participants in the nationally representative panel, and both higher and lower levels of acculturation in the Hispanic panel.

2.2. Procedure

The survey was administered using Qualtrics online software (Qualtrics, 2018). Participants in the Hispanic sample could answer each question in either English or Spanish. The study was determined to be exempt by the university's Institutional Review Board, including a waiver of informed assent by participants and consent by their parents. Prior to data collection, researchers conducted cognitive testing with a convenience sample of 10 adolescents (ages 14–17) to ensure understanding of all questions and expected completion time of 15–20 min. No changes were needed.

2.3. Measures

Participants first reported their age to screen for eligibility. They then answered questions about their screen time and social media engagement. Additional questions in the survey (not presented here) examined consumption and attitudes about specific brands/brand marketing, and perceptions of their food environment. Sociodemographic characteristics were assessed at the end of the survey.

Screen time. TV viewing and other screen use measures were based on Youth Risk Behavior Surveillance System (YRBSS) questions (Centers for Disease Control and Prevention, 2018). For TV viewing, participants reported how many hours they watch TV on an average school day. For other screen use, they reported how many hours they spend on digital media (i.e., video/computer games and other non-school-related computer, tablet or smartphone use, including texting, watching movies/TV and social media) on an average school day. "Watching movies/TV" was added to the YRBSS other screen use measure to capture this increasingly common practice (Spangler, 2016). Responses were coded as: never (0), < 1 h (0.5), 1 to < 2 h (1.5), 2 to < 3 h (2.5), 3 to < 4 h (3.5), 4 to < 5 h (4.5), and 5 or more hours (5.5).

Social media engagement. Participants first reported if they "ever liked, shared or followed any of these kinds of brands on social media" for each of the following category options: (a) "Fast-food or sit-down restaurants (for example, Taco Bell, Wendy's, Pizza Hut, Applebee's)"; (b) "Sweet or salty snacks (for example, Doritos, Oreos, Cheetos)"; (c)

"Candy (for example, Reese's, Hershey's, Snickers)"; (d) "Drinks (for example, Sprite, Pepsi, Coke, Gatorade)"; and (e) "Another type of food or drink not in the categories above." If they answered "yes" to any of these questions, participants were asked to list all brands that they engaged with in the category. Notably, this type of measure captures "top-of-mind" brands and is commonly used in communication research when behavioral measures (e.g., tracking users' actual online behavior) are not feasible (Niederdeppe, 2005). For each category and for all categories combined, participants were coded as engaging or not engaging with any brands.

Researchers reviewed the brands listed in the open-ended text responses and recorded the actual brands and number of brands named in each category and in total. If participants listed a type of food (e.g., popcorn, iced tea, pretzels, or hamburgers) without a brand name, it was not counted. In addition, brands of fast food, drinks, snacks, or candy that were listed in the "other types" category were re-categorized into the appropriate category. Engagement with 5 or more brands across all food and beverage categories was also coded.

Sociodemographic characteristics. Participants reported their gender, age, race/ethnicity, and the highest level of education for parents/guardians living with them. Participants who identified as Latina/Latino also completed the Short Acculturation Scale for Hispanics (SASH). SASH measures acculturation according to language choice in reading and speaking (generally), speaking at home, thinking, and speaking with friends using 5-point Likert scales ranging from 1 (only Spanish) to 5 (only English) (Ellison, Jandorf, & Duhamel, 2011; Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987).

2.4. Statistical analyses

One-way analysis of variance (ANOVA) assessed differences in screen time between sociodemographic groups and chi-square analyses assessed differences in social media engagement ($p < .05$). Separate multivariate logistic regression models estimated adjusted odds ratios and 95% confidence intervals for 1) engagement with at least one brand of fast food, drinks, snacks or candy, and 2) engagement with 5 + brands (across all categories). Sociodemographic and screen time variables were included in each model. All analyses were conducted using IBM SPSS 24.

3. Results

Of the original sample of 1963 participants, 20% initiated but did not complete the survey or had implausible or automated responses. The final dataset included 1564 respondents, with approximately equal samples by age and gender (53% girls; $M = 15.1$ years, $SD = 1.4$) (Table 1). Approximately two-thirds of participants' parents had completed some college or more. Due to recruiting procedures, the sample was highly diverse; two-thirds identified as Black or Hispanic. A SASH summary score of 2.99 out of 5 is the recommended cutoff to identify less-acculturated Hispanics. However, this sample of adolescents who self-identified as Latino/a had relatively high SASH scores ($M = 3.64$ $SD = .95$). Therefore, we utilized a median split and classified participants scoring 3.5 or lower as less-acculturated. Other research has altered this cutoff to optimize the use of the SASH scale (Hamilton et al., 2009). On average, participants reported 2 h 30 min of TV viewing plus 3 h 23 min of other screen use per school day. Based on the distribution of the data, participants were divided into approximate tertiles for low, medium, and high TV viewing time and other screen use.

3.1. Engagement with brands on social media

Energy drink brands ($n = 92$) were listed most frequently in the "other types" category and were re-categorized as drinks. The remaining "other" brands ($n = 134$) included frozen/prepared foods, ice cream, cereal, yogurt, alcohol, and convenience store brands. Nearly all

Table 1
Sample descriptives.

	Freq	Percent
Male	733	46.9%
Female	831	53.1%
Age		
13 years	267	17.1%
14 years	285	18.2%
15 years	337	21.5%
16 years	333	21.3%
17 years	342	21.9%
Parent education ^a		
High school or less	467	29.9%
Technical school, some college	365	23.3%
College grad or more	670	42.8%
Race/ethnicity ^b		
White, non-Hispanic	521	33.3%
Black, non-Hispanic	337	21.5%
Hispanic, less-aculturated	339	21.7%
Hispanic, more-aculturated	336	21.3%
TV viewing time (average on a school day)		
Low = 0 to < 2 h	621	39.7%
Moderate = 2 to < 4 h	408	26.1%
High = 4 h or more	535	34.2%
Other screen use (average on a school day)		
Low = 0 to < 2 h	367	23.5%
Moderate = 2 to < 4 h	601	38.4%
High = 4 h or more	596	38.1%

Note.

^a 4% not sure.

^b 2% mixed race/ethnicity, non-Hispanic.

brands listed as “drinks” were sugary drinks. Therefore, we renamed the drinks category as “sugary drinks,” and the 21 non-sugary drink brands listed (i.e., water and diet soda) were added to the “other” category. In total, participants listed over 550 different food-related brands that they followed on social media, including over 100 brands each for sugary drinks, snacks and candy and over 200 different fast food and other restaurants. Table 2 lists the brands mentioned by 50 or more respondents within each category.

The majority (70%) of adolescents surveyed reported that they engaged with at least one food or beverage brand on social media, ranging from 1 to 48 brands named ($M = 6.2$, $SD = 5.4$) (Table 2). Approximately one-third (35%) engaged with 5 or more brands. For individual categories, 53% of participants reported engaging with at least 1 fast food brand ($M = 2.5$, $SD = 1.8$), while 45% to 50% engaged with sugary drink, candy, and snack brands (averaging approximately 2 brands in each category). Just 7% of participants reported engaging with brands in any other food category.

3.2. Sociodemographic differences

Non-Hispanic Black adolescents (hereinafter Black adolescents) reported watching significantly more TV than non-Hispanic White adolescents (hereinafter White adolescents), approximately 1 additional hour-per-day (Table 3). Although Hispanic and White adolescents reported similar TV viewing times, both Black and Hispanic adolescents (including less- and more-aculturated groups) had significantly higher other screen use compared to White adolescents (16 and 34 additional minutes daily, respectively). Older adolescents (15–17 years) also spent 30 more minutes-per-day using other screens than younger adolescents (13–14 years), but TV viewing times did not differ between age groups. Screen use did not differ by gender or parent education. TV viewing time and other screen use were moderately correlated ($r = .30$, $p < .001$).

Black and less-aculturated Hispanic adolescents were significantly more likely to engage with food brands on social media (81% and 73%, respectively) compared to White adolescents (61%). However, there

Table 2
Reported social media engagement with food-related brands.

Engagement	% of total (N = 1564)	Mean (SD)	Min-max	Median
With any food brands	69.8%	6.21 (5.44)	1–48	4
With 5 + food brands	34.8%	9.84 (5.62)	5–48	8
By category and brand ^a				
Fast food	54.2%	2.49 (1.82)	1–14	2
% of total (n = 848)				
McDonald's	39.2%			
Taco Bell	28.1%			
Pizza Hut	21.7%			
Wendy's	21.1%			
Burger King	14.4%			
Applebee's	10.1%			
Dominoes	7.8%			
Chick-fil-A	6.4%			
Subway	6.1%			
Sugary drinks	49.8%	2.02 (1.56)	1–14	1
% of total (n = 779)				
Coke	43.3%			
Pepsi	35.0%			
Gatorade	25.4%			
Sprite	21.8%			
Dr Pepper	13.1%			
Mtn Dew	11.9%			
Powerade	6.7%			
Candy	46.4%	1.97 (1.47)	1–12	1
% of total (n = 726)				
Hershey	36.9%			
Snickers	36.2%			
Reese's	27.5%			
M&M	11.0%			
Kit Kat	10.5%			
Twix	8.7%			
Skittles	7.3%			
Snacks	45.0%	1.92 (1.36)	1–13	1
% of total (n = 704)				
Doritos	46.3%			
Oreos	30.5%			
Cheetos	30.2%			
Lays	16.3%			
Other ^b	7.0%	1.33 (0.84)	1–8	1

Note.

^a Brands listed by 50 or more respondents.

^b Includes brands of frozen/prepared foods, cereal, ice cream, yogurt, water, diet soda, alcohol, and other brands.

were no significant differences between White and more-aculturated Hispanic adolescents. Engagement with 5 + brands was also significantly higher for Black versus White adolescents, for girls, and for adolescents with less-educated parents. There were no other significant sociodemographic differences in TV viewing or screen use.

Table 3
Differences in media use and brand engagement by sociodemographic characteristics.

		Media use			Brand engagement	
		N	TV viewing time hrs:min, mean (SD)	Other screen use hrs:min, mean (SD)	% engaging with any brands	% engaging with 5 + brands
Total		1564	2:30 (1:30)	3:23 (1:37)	69.8%	34.8%
Race/ethnicity	White, non-Hispanic ^a	521	2:23 (1:24)	3:07 (1:32)	61.4%	29.9%
	Black, non-Hispanic ^b	337	3:19 (1:25)^{a,c,d}	3:28(1:31)^a	81.0%^{a,d}	39.5%^a
	Hispanic, less-acculturated ^c	339	2:14 (1:31)	3:23 (1:40)^a	73.2%^a	36.3%
	Hispanic, more-acculturated ^d	336	2:10 (1:27)	3:41 (1:40)^a	69.3%	36.3%
Age	13 to 14 ^a	552	2:30 (1:27)	3:03 (1:34)	69.0%	32.8%
	15–17 ^b	1012	2:30 (1:32)	3:33 (1:36)^a	70.3%	35.9%
Sex	Male ^a	733	2:37 (1:29)	3:17 (1:36)	69.7%	31.4%
	Female ^b	831	2:25 (1:31)	3:28 (1:38)	70.0%	37.9%^a
Parent education (highest attained)	High school or less ^a	467	2:27 (1:32)	3:21 (1:43)	71.0%	36.6%
	Some college or technical ^b	365	2:29 (1:31)	3:27 (1:38)	72.1%	40.8%^c
	College degree or higher ^c	670	2:37 (1:28)	3:19 (1:37)	68.8%	30.3%

Note: superscript letters indicates significant difference after Tukey's multiple comparison for means and Bonferroni correction for percentages, $p < .05$.

3.3. Associations with brand engagement

After controlling for age, race/ethnicity, gender, and parent education, greater TV viewing predicted engagement with all categories of brands, as well as engagement with 5 + brands (Table 4). Compared to low TV viewers (< 2 h/day), moderate TV viewers (2- < 4 h/day) were 1.5–1.7 times more likely to engage with fast food, sugary drink, snack, and candy brands, and high TV viewers (4 + hrs/day) were approximately twice as likely. High TV viewers, but not moderate TV viewers, were also more likely to engage with 5 + brands. In contrast, moderate

and high levels of other screen use (2 + hrs/day) were associated with increased odds of engaging with 5 + brands. High other screen use also increased the odds of engaging with fast food and snack brands compared to low other screen use, but other screen use was not associated with engagement with any other individual product categories.

After controlling for media use and other sociodemographic characteristics, Black adolescents were also more likely than White adolescents to engage with at least one snack brand, but differences in engagement with other categories of brands or with 5 + brands were not significant. In addition, less-acculturated Hispanic adolescents (but

Table 4
Logistic regression models predicting brand engagement.

		Engaged with any brand(s) in this category											
		Fast food		Sugary drinks		Snacks		Candy		Other		Engaged with 5 + brands	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
TV viewing time	Low (< 2 h)	Referent											
	Moderate (2 to < 4 h)	1.69	1.30, 2.21	1.73	1.32, 2.26	1.58	1.21, 2.06	1.53	1.18, 2.00	1.05	0.60, 1.83	1.33	0.99, 1.77
	High (4 + hrs)	2.29	1.75, 3.00	2.24	1.71, 2.92	2.02	1.55, 2.64	1.93	1.48, 2.51	1.59	0.97, 2.62	1.71	1.30, 2.25
Other screen use	Low (< 2 h)	Referent											
	Moderate (2 to < 4 h)	1.23	0.93, 1.62	1.11	0.84, 1.46	1.27	0.96, 1.68	1.09	0.82, 1.43	1.75	0.93, 3.28	1.68	1.23, 2.92
	High (4 + hrs)	1.65	1.23, 2.22	1.24	0.93, 1.66	1.53	1.14, 2.05	1.25	0.94, 1.68	1.78	0.94, 3.37	2.17	1.58, 3.00
Race/ethnicity	White non-Hispanic	Referent											
	Black non-Hispanic	1.33	0.98, 1.78	1.31	0.98, 1.75	1.35	1.01, 1.80	1.21	0.91, 1.62	1.02	0.58, 1.78	1.31	0.97, 1.78
	Hispanic, less-acculturated	1.36	1.01, 1.83	1.48	1.12, 1.99	1.57	1.17, 2.10	1.47	1.10, 1.97	0.99	0.56, 1.75	1.27	0.93, 1.73
	Hispanic, more-acculturated	1.07	0.80, 1.43	0.97	0.72, 1.29	1.09	0.81, 1.46	0.92	0.69, 1.23	1.13	0.65, 1.97	1.21	0.89, 1.66
Age	13–14 years	Referent											
	15–17 years	1.1	0.88, 1.39	0.94	0.75, 1.17	1.18	0.95, 1.48	1.04	0.83, 1.30	1.76	1.09, 2.84	1.00	0.79, 1.26
Gender	Male	Referent											
	Female	0.9	0.72, 1.12	0.92	0.74, 1.14	1.11	0.90, 1.38	1.17	0.94, 1.45	1.75	1.14, 2.70	1.31	1.04, 1.64
Parent education	High school or less	Referent											
	Some college or technical	1.02	0.76, 1.37	1.00	0.75, 1.34	1.18	0.89, 1.58	1.01	0.76, 1.34	0.79	0.46, 1.36	1.17	0.87, 1.57
	College degree or higher	0.84	0.65, 1.08	0.84	0.65, 1.08	0.99	0.77, 1.27	0.98	0.76, 1.26	0.85	0.53, 1.36	0.76	0.58, .99

Note: Bold indicates significance $p < .05$, OR = adjusted odds ratio, CI = confidence intervals.

not more-acculturated Hispanic) were more likely than White adolescents to engage with at least one fast food, sugary drink, snack, or candy brand. Older adolescents and girls were more likely to engage with brands in the “other” category. Girls were also more likely than boys to engage with 5 + brands, as were adolescents whose parents had a high school diploma or less compared to those with college-graduate parents. There were no other differences in brand engagement by race/ethnicity or other characteristics. However, when we removed TV viewing time from the models, Black adolescents were significantly more likely than White adolescents to engage with one or more brands in all categories and 5 + brands in total. Therefore, difference in TV viewing times appears to explain greater brand engagement for Black than for White adolescents.

4. Discussion

These findings demonstrate widespread engagement with food and beverage brands on social media among adolescents (ages 13–17). Approximately two-thirds of adolescents in this study reported engaging with at least one food-related brand, while approximately one-third reported engaging with 5 or more brands. Approximately one-half of participants reported engaging with brands in the fast food, sugary drink, snack, and candy categories, while just 7% reported engaging with brands in all other food-related categories. These same categories also represent the majority of TV food-related advertising viewed by adolescents (Frazier & Harris, 2018; Harris et al., 2019).

Engagement with brands on social media was related to media use. Amount of time spent watching TV and time spent using other screens were independently associated with a higher likelihood of engaging with 5 + brands, while moderate and high TV viewing was related to engagement with fast food, sugary drink, snack, and candy brands. Greater odds for adolescents with high versus moderate TV viewing in all categories suggests a potential dose-response relationship. However, the relationship between other screen use and brand engagement followed a different pattern. High (but not moderate) other screen use predicted engagement with fast food and snack brands only. These findings suggest that exposure to TV advertising may have a stronger influence on social media brand engagement than time spent on digital media overall.

Greater social media engagement with unhealthy food brands by non-Hispanic Black and less-acculturated Hispanic adolescents also raises concerns due to diet-related health disparities affecting communities of color (Kumanyika & Grier, 2006; Ramirez et al., 2013). Differences in levels of brand engagement between Black and White adolescents appear to be driven by differences in time spent viewing TV. In this study, on average Black adolescents viewed approximately one more hour of TV each day than White adolescents viewed, which corresponds to differences found in previous studies (Fleming-Milici & Harris, 2016; Harris et al., 2019). The bivariate analyses showed significantly greater engagement with brands among Black versus White adolescents. However, when the analyses controlled for TV viewing time, differences in brand engagement between Black and White adolescents were no longer significant. This finding suggests that brand engagement differences may be due to greater exposure to food-related TV advertising by Black compared to White adolescents (Harris et al., 2019). In 2017, Black adolescents (13–17 years) viewed on average 17.1 total TV food ads-per-day compared to 7.8 ads-per-day for White adolescents. Specifically, Black adolescents viewed 111% more TV ads for fast food, 135% more ads for sugary drinks and snack foods, and 160% more candy ads (Harris et al., 2019).

In contrast, after controlling for TV viewing and other screen time, less-acculturated Hispanic adolescents remained more likely than White adolescents to engage with brands on social media. However, these differences were not found for more-acculturated Hispanic adolescents, although both less- and more-acculturated Hispanic adolescents reported spending more time using other screens compared to White

adolescents. The acculturation scale we used primarily measures language preference (Marin et al., 1997). Therefore, this finding corresponds to previous research showing that Hispanic youth in Spanish-speaking households visit food and beverage websites at greater rates than those in English-speaking households (Hyary & Harris, 2017). It also raises concerns about potential effects of targeted food marketing to Hispanic youth in Spanish-language media, which almost exclusively promotes unhealthy food and beverage brands (Harris et al., 2019). These results also underscore the need to measure language preferences when assessing Hispanic adolescents' media use and dietary behaviors.

Of note, younger (ages 13–14) adolescents reported spending less time using other screens compared to older adolescents (ages 15–17), but the age groups did not differ in their reported engagement with brands. This finding indicates that younger teens may use other screens differently, possibly in ways that provide greater opportunity to engage with food brands. It also raises concerns because early-adolescence may be a time when youth are especially vulnerable to this form of influence. Younger adolescents are less likely to recognize advertising that occurs online (OFCOM, 2017). In addition, they are at the peak of susceptibility to peer influence (Steinberg & Monahan, 2007). Therefore, social media messages that appear to come from friends or provide access to friends' online behavior through their social media accounts may take advantage of young adolescents' unique vulnerability to peer influence and encourage greater engagement with brands.

4.1. Study limitations and future research

This study provides preliminary evidence of U.S. adolescents' high levels of social media engagement with unhealthy food and beverage brands, as well as differences by individual characteristics and potential explanations for these differences. However, this research has some limitations. The cross-sectional design does not allow for conclusions about causal effects of media use or the direction of influence for other associations with brand engagement. In addition, data are self-reported and thus subject to memory and self-presentation biases. Furthermore, the direction of these biases may differ by individual, depending on adolescents' attitudes about the value they place on media usage (either positive or negative). However, the YRBSS standard measures used for TV viewing and other screen use have been tested elsewhere for reliability (Schmitz et al., 2004). Moreover, the open-ended response used to identify brands that participants ever liked, shared, or followed does not capture frequency or recency of engagement, nor does it capture an exhaustive list of all of the food and beverage brands with which an individual has interacted with on social media. However, this format captures “top-of-mind” brands and is commonly used in communication research when behavioral measures (e.g., tracking users' actual online behavior) are not feasible (Niederdeppe, 2005). Furthermore, research shows this type of measure likely underreports adolescents' total engagement with all food-related brands (Niederdeppe, 2005).

Another limitation is that we did not assess participants' BMI as a potential individual factor influencing social media brand engagement. For example, adolescents in obesity treatment reported engaging with branded social media, which increased their desire to consume these foods (Holmberg, Berg, Dahlgren, Lissner, & Chaplin, 2018). However, previous research with adolescents has shown that weight status does not moderate these types of responses to food advertising (Yokum, Gaerhardt, Harris, Brownell, & Stice, 2014). For example, in a study of neural activation in response to food commercials, all adolescents (regardless of weight status) were more likely to recall food ads than non-food ads (Gaerhardt, Yokum, Stice, Harris, & Brownell, 2014). Furthermore, obese relative to lean adolescents exhibited less activation in regions of the brain implicated in attention and reward during exposure to food relative to non-food commercials. Self-reported height and weight also underestimate overweight prevalence, with bias by sex and weight status (Sherry, Jefferds, & Grummer-Strawn, 2007). However, future research on social media brand engagement should assess

whether reported engagement differs by weight status.

Future research is also needed to better understand drivers of brand social media engagement and its impact on adolescents' diets and health. The finding that TV viewing may influence social media brand engagement more than other screen use is intriguing. While TV remains the dominant marketing channel because of its reach, scale, and emotional power (Turner, 2016), exposure to TV advertising may also prompt consumers to visit brands' social media pages online and/or increase their interest in engaging with content that is shared with them virally (Turner, 2016). Another consideration is that time spent on other screens includes activities with the opportunity for food marketing exposure (e.g., ads on social media, websites, commercial apps), but could also include other activities that do not involve marketing (e.g., texting, non-commercial games). Therefore, future research should assess the activities that adolescents engage in when they spend time on other screens. The results of this study also suggest that time spent on TV viewing and other types of screens should not be combined into a single media use variable.

Research is also needed to understand the underlying reasons for high levels of social media brand engagement by some groups, including Black, less-acculturated Hispanic, and younger adolescents. As noted, previous research has suggested potential reasons why less-acculturated Hispanic and younger adolescents may be more influenced by social media. However, these hypotheses should be tested in future research. The finding that Black adolescents were not more likely to engage with brands on social media than White adolescents, after controlling for TV viewing time, was somewhat unexpected. Previous research has shown that fast food, candy, sugary drink, and unhealthy snack brands also disproportionately target Black youth with culturally specific messages designed to appeal to them, such as the use of Black athletes and other celebrities, music, scholarships, and local sponsorships (Grier & Kumanyika, 2008; Harris et al., 2019). Researchers posit that these targeted messages also increase the appeal of these brands to Black youth (Grier & Kumanyika, 2008). Therefore, it will be important to better understand how targeted messages and exposure may interact to influence Black youths' attitudes about unhealthy brands targeted to them.

Finally, this study does not examine the impact of adolescents' social media engagement with unhealthy food brands. Future research should assess how this engagement may contribute to high rates of consumption of the unhealthy categories of foods that the majority of adolescents are following on social media (Powell & Nguyen, 2013; Reedy & Krebs-Smith, 2010), including whether marketing to adolescents increases their preferences for these products, normative beliefs about consuming them, and understanding of the consequences of their consumption. Research is also needed to understand whether engagement with primarily unhealthy brands on social media also negatively influences attitudes about healthier products, as well as how to effectively offset the influence of this marketing.

5. Conclusions

This study provides a current examination of the extent and types of food and beverage brands that adolescents engage with on social media. Further investigation into the effects of social media engagement with food and beverage brands is needed. However, high engagement with unhealthy food brands overall, including by young adolescents, raises considerable concerns about consequences for adolescents' health. In addition, greater engagement among Black and less-acculturated Hispanic adolescents further supports public health concerns about the impact of food marketing on diet-related health disparities affecting communities of color. These findings support the need for policies to address youth-targeted marketing in all its forms, including TV advertising and social media (Tatlow-Golden et al., 2016).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2019.104501>.

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