



# Hooked on Junk: Emerging Evidence on How Food Marketing Affects Adolescents' Diets and Long-Term Health

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## Abstract

**Purpose of Review** Examine current research on how adolescents are influenced by junk food marketing; inform proposed policies to expand food marketing restrictions to protect children up to age 17.

**Recent Findings** Previous food marketing effects research focused primarily on TV advertising to younger children. However, recent research with adolescents demonstrates the following: (a) unique effects of food marketing on adolescents; (b) extensive exposure to social media and other digital marketing “disguised” as entertainment and messages from peers; (c) adolescents’ still-developing and hypersensitive reward responsivity to appetitive cues; and (d) disproportionate appeals to Black and Hispanic youth, likely exacerbating health disparities affecting their communities.

**Summary** Adolescents may be even more vulnerable to junk food marketing appeals than younger children. Additional research on how food marketing uniquely affects adolescents and efficacy of potential solutions to protect them from harm are critical to support stronger restrictions on junk food marketing to all children.

**Keywords** Food marketing · Adolescents · Eating behaviors · Reward responsivity · Social media marketing · Racial/ethnic targeted marketing

## Introduction

Worldwide, marketing for junk food—predominantly fast food, sugary drinks, and high-fat/sugar snacks—surrounds young people, fueling a crisis of poor diet, overweight, and long-term negative health outcomes [1, 2]. The World Health Organization has called for government regulations to restrict food and beverage marketing to children (including adolescents up to age 17) as a global health priority for preventing noncommunicable diseases [3, 4]. Yet, most countries have ceded responsibility for reducing child-directed junk food marketing to industry, primarily through

self-regulatory policies [5, 6]. Perhaps not surprisingly, industry self-regulations contain numerous loopholes and have not demonstrably reduced most types of food marketing directed to children, nor substantially improved the nutrition of marketed products [7]. The age of children covered by self-regulation presents one of the most problematic loopholes; existing policies do not cover adolescents above age 11 or 12. Even the most stringent existing government regulations, including in Chile [7] and the UK [8], only limit unhealthy food marketing to children up to age 12.

We propose that this policy focus on junk food marketing to younger children only is based on common misunderstandings and outdated theories about how food marketing works. In fact, the application of current psychological theories to explain how marketing affects consumers of all ages suggests that adolescents may be particularly vulnerable to influence; which also makes them an especially attractive target for junk food companies. Furthermore, many common marketing techniques used to promote junk food appear designed specifically to deactivate adolescents’ critical responses, thus effectively reducing their ability and motivation to resist.

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## Theoretical Models of Food Marketing Effects

The rationale for existing industry and government policies to regulate food marketing to younger children only is based largely on communications research conducted in the 1970s. Numerous studies demonstrated that children do not have the ability to actively defend against influence from biased information (such as marketing) until age 11 or 12 [9]. This research also posited that adolescents have the cognitive ability to resist unwanted influence, which “inoculates” them from harmful effects.

However, more recent research indicates that the ability to resist does not make adolescents immune to junk food marketing for several reasons. First, food marketing affects much more than attitudes and purchases of marketed brands—the effects intended by marketers. Based on a systematic review, Kelly and colleagues propose a hierarchical framework to explain how the effects of repeated exposure to food marketing extend beyond brand-specific preferences and lead to overconsumption of the nutrient-poor calorie-dense foods marketed most extensively (i.e., junk food, also known as high fat, sugar, salt, and non-core foods) [10]. In their model, intermediate outcomes of marketing exposure provide early indicators of long-term negative outcomes, including dietary and health impact. Potential mediators of long-term effects include ad and brand awareness; attitudes, preferences, purchase intent and purchase (of brands and categories); and eating behaviors more broadly (e.g., increased calories consumed). The model also proposes that marketing affects these outcomes in both children and adults.

In addition, early models of food marketing effects proposed a conscious rational route from exposure to persuasion [9]. However, junk food marketing rarely presents rational arguments intended to persuade at a conscious level. Rather, it implies emotional benefits from consumption, exemplified by successful adolescent-targeted campaigns such as “Open Happiness” (sugary soda), “You’re Not You When You’re Hungry” (candy bar), and “Win from Within” (sports drink). By repeatedly pairing brands with entertaining and attractive stimuli, marketing creates positive emotional responses that transfer to the brand, outside of conscious awareness [11]. These positive associations strengthen over time with repeated marketing exposure. Thus through classical conditioning, marketing creates positive brand images and preferences that lead to brand purchase and consumption [12].

The Food Marketing Defense Model (FMDM) provides a framework to understand how emotional marketing also affects food preferences and eating behaviors more broadly and how to effectively defend against harmful influence [12]. It proposes four necessary conditions: (1) conscious awareness of marketing attempts, (2) understanding how one is affected, (3) cognitive ability and resources to defend against influence

at the time of exposure, and (4) motivation to defend against influence. According to FMDM, it would be impossible for anyone to effectively defend against the hundreds of exposures to marketing messages encountered daily.

Moreover, adolescents may be disproportionately impacted by junk food marketing. In response to restrictions on food marketing to younger children, companies increasingly market sugary drinks, fast food, candy, and sweet and salty snacks directly to adolescents [2], accompanied by large investments in market research to ensure its effectiveness [13]. This marketing often conveys brands as cool, daring, fun, attractive, athletic; characteristics that specifically appeal to young people. Furthermore these messages often appear disguised as entertainment and/or messages from peers, such as social media, product placements, influencers, celebrities, and sponsorships, to mask their persuasive intent and deactivate skeptical responses [14]. In addition, although adolescents are capable of critically evaluating advertising messages, age-appropriate developmental processes of identity development, self-presentation monitoring, and conformity to peer groups, can make them less motivated to resist [15]. Therefore, junk food marketing to adolescents may work because it is designed specifically to take advantage of adolescents’ unique developmental vulnerabilities.

## Literature Review

A growing body of literature demonstrates these vulnerabilities and highlights the urgent need for policies to address the harmful impact of junk food marketing aimed at adolescents. Early food marketing research primarily focused on younger children and TV advertising. However, more recent research also examines effects on adolescents and increasingly focuses on digital marketing, especially in social media, which disproportionately appeals to adolescents. Moreover, emerging research demonstrates that adolescents may be less able to defend against influence due to their neurobiological development [16–19]. Finally, evidence shows that junk food marketing targeting Black and Hispanic youth has increased in recent years and likely exacerbates health disparities affecting communities of color.

## Food Marketing Effects on Adolescents

A systematic review of research on media food marketing conducted with older children and adolescents found 28 studies that primarily assessed TV media in high-income countries, although the majority of studies examined pre- and early adolescents (8–14 years) [20••]. Meta-analysis of the high-quality studies demonstrated small effects of marketing exposure on recall, positive attitudes, intent to eat, purchases or requests, and consumption of junk food; as well as more

negative attitudes about healthy foods. Notably, findings were similar for all age groups, including older adolescents.

Further, despite their more-developed cognitive abilities to critically assess and defend against persuasive messages, the majority of US adolescents (61%) report that food advertising makes them want to try the advertised foods, while only approximately one-third indicated they do not trust advertising messages [21]. In addition, positive attitudes and trust in food advertising are associated with more frequent consumption of junk food, including sugary drinks, candy, cookies, and chips [21, 22]. Similarly, a UK study found that adolescents' reported exposure to junk food marketing in the past month was associated with higher weekly consumption of most junk food categories [23]. In that study, adolescents reported the highest exposure to TV ads, social media, and price offers for junk food.

Companies' increased investment in marketing to adolescents presents perhaps the most convincing evidence that junk food marketing to adolescents works. Following implementation of US food industry self-regulation in 2006, the proportion of food companies' youth-directed marketing targeted specifically to adolescents increased, and there was a 60% increase in marketing expenditures on new media (including mobile devices and social media) [2]. In addition, adolescents' exposure to TV food advertising increased by 23% from 2007 to 2011 [24]. Since 2012, adolescent exposure to food advertising on TV has declined due to substantial reductions in time spent watching traditional TV, but fast food, candy, sugary drinks, and salty snacks continue to represent three-quarters of the food ads they see on TV [25].

### Social Media and Other Digital Marketing

The downward trend in TV viewing by adolescents has been accompanied by an increase in time spent online, especially on social media. Ninety-five percent of teens report having access to a smartphone, and 43% report checking social media hourly or "almost constantly" [26, 27]. Marketing via social media amplifies the effects of TV advertising on brand recall, liking, and reach, at a much lower expense than traditional advertising [10, 28]. Social media content, such as company-generated posts, apps, and interactive games [29], is shared virally through followers' social networks, regardless of whether their friends also follow the brands. Companies also hire online celebrities (vloggers, influencers, or brand ambassadors) to promote brands by weaving branded messages into their own content. Therefore, social media and other types of digital marketing are often "disguised" as entertainment or messages from friends (e.g., shared social media posts/videos), or embedded in personal stories or as advice from "influencers," and thus not easily recognized as advertising [30–34]. Even when adolescents reported being aware of advertising on social media sites, they were unable to

recognize commercial messages, such as sponsored posts, upon exposure [35].

Food and beverage companies have been at the forefront of marketing to reach adolescents on social media [35]. Adolescents are highly engaged with food brands on social media which, as with traditional advertising, primarily promote junk food [36, 37, 38]. In a US survey of adolescents, 70% reported that they liked, shared, or followed at least one food or beverage brand on social media; and one-third reported engaging with five or more brands (39). Another study found that adolescents were more likely to share posts for junk food than for healthier foods (40). Furthermore, sugary drinks, fast food, candy, and snack brands rank among the most "liked" and "followed" brands on Facebook and other social media [39–42].

According to FMDM, recognition of persuasive intent is necessary, but not sufficient, to defend against the influence of junk food marketing. Even when adolescents recognize branded social media as marketing, this marketing tactic likely deactivates their motivation to resist, thus increasing its effectiveness. Food marketers generate "earned media" (e.g., reposts, shares, likes, and user-generated content) through their own social media accounts [43], and adolescents are active participants in this process [29]. One study found that user-generated posts had a greater impact on adolescents' intent to purchase and consume energy drinks compared to brand-generated posts [44]. Another study found that adolescents attended to food and beverage social media posts from peers for a longer time than similar posts from celebrities or companies, and they liked their peers more when they posted about unhealthy foods in social media accounts [45]. Viral marketing that appears to be generated by peers may be more effective as adolescents trust their online peers more than they trust companies. Research also suggests that adolescents use branded social media as a way to try on new identities and communicate them to their peer network [46].

### Neurobiological Development and Unique Vulnerabilities

Due to their still-developing cognitive abilities, adolescents also may be less able to defend against influence from junk food marketing even when they recognize these persuasive attempts and are motivated to resist. During adolescence, brain regions involved in processing reward and appetitive cues are fully developed and relatively hypersensitive, whereas brain regions involved in inhibitory control remain less developed [17, 47]. Thus, teens may be less able to resist rewarding cues compared to younger children as well adults [48–50]. Food advertisements are full of rewarding cues, often repeatedly paired with highly enticing junk food images, including brand logos and contexts or slogans promising fun, excitement, and other rewarding outcomes (e.g., popularity,

accomplishments). Since adolescence is characterized with a particularly responsive reward circuitry to appetitive environmental cues, these ads may inordinately appeal to this age group. Further, elevated reward activation in adolescence is associated with better reinforcement learning and episodic memory for rewards [51]. Consequently, adolescents may more readily learn to associate these positive outcomes with junk food.

Recent neuroimaging studies have begun to explore neural responses to food and sugar-sweetened beverage ads to better understand how they impact eating behavior and obesity in children and adolescents. Fast-food commercials and logos compared to non-food commercials and logos elicit greater attention- and reward-related neural response [52, 53••, 54]. Moreover, Coke advertisements compared to non-food advertisements elicited greater visual-, taste-, and reward-related neural response [55]. Critically, reward-related neural response to fast-food commercials that featured unhealthy products (e.g., crispy chicken sandwich vs. a salad) predicted higher caloric intake (particularly of unhealthy foods) in a simulated fast-food restaurant [53••] and greater weight gain [56] in adolescents. Of note, although fast-food relative to non-food commercials resulted in greater attention- and reward-related neural response in adolescents, self-reported liking for unhealthy food products in the fast-food commercials was significantly lower than self-reported liking for the non-food products featured in the control commercials [53••]. This finding highlights the likelihood that these biological effects of fast-food commercials may occur outside of conscious awareness.

Although research on the influence of healthier food advertising is limited, healthier food commercials may also prime desire for unhealthy food options and occur regardless of motivation to resist. Gearhardt and colleagues found that adolescents who exhibited greater reward-related neural responses to fast-food commercials featuring healthier foods (e.g., salads, smoothies) consumed more *unhealthy* (but not healthier) food in a simulated fast-food restaurant [53••]. Another study conducted with children similarly demonstrated that playing an online game that incorporated either energy-dense snack or fruit brands both increased consumption of energy-dense snacks, but not fruit [57]. Possible explanations are that logos and branding featured in healthier food commercials still triggered associations with primarily unhealthy brands, or that food cues trigger consumption of highly palatable foods but not more nutrient-dense (and healthier) foods. Therefore, preliminary evidence of adolescents' neural responses to advertising indicate that this age group may be more responsive to the rewarding cues presented in junk food marketing and less able to resist, compared to adults and to younger children.

## Disproportionate Impact on Youth of Color

Existing research demonstrates that junk food marketing likely affects most adolescents, but public health experts raise additional concerns about marketing targeted to Black and Hispanic youth. These youth experience higher rates of obesity and diet-related diseases compared to non-Hispanic White youth [58]. Black youth also consume more calories, sodium, and added sugar from junk food compared to Hispanic and non-Hispanic White youth [59], and Black and Hispanic adolescents consume more sugar-sweetened beverages [60]. Perhaps not coincidentally, youth of color also receive a “double-dose” of junk food marketing through greater exposure in the media and their communities [61]. The sheer volume of marketing they encounter daily may make it even more difficult to actively defend against these persuasive attempts. Furthermore, targeted marketing that incorporates culturally relevant messages that appear to speak to them directly may effectively deactivate skeptical responses and reduce their motivations to resist influence.

Black adolescents see more than twice as many TV food ads compared to White adolescents [25], due to greater frequency of food ads on Black-targeted and youth-targeted TV networks they are more likely to watch [62]. Furthermore, the gap appears to be widening. Junk food advertising on Black-targeted TV increased by more than 50% from 2013 to 2017, as did disparities between Black and White youth exposure to TV food ads [25]. Fast-food restaurants, candy, unhealthy snack foods, and sugary drink brands represent more than 80% of food advertising expenditures on Black-targeted and Hispanic-targeted TV channels. Youth of color, especially those in low-income neighborhoods, also experience more junk food marketing in their communities. Compared to non-Hispanic neighborhoods, Hispanic neighborhoods have significantly more outdoor ads, retail establishments, and food and beverage price promotions near middle and high schools [63], and Latino students in low-income neighborhoods encounter more fast-food restaurants and inexpensive food outlets (e.g., bodegas) near their schools than non-Latino students [64]. Another study found significantly more food and beverage ads in New York City subway stations, including Spanish-language ads and ads directed at youth, in neighborhoods with a high Latino population [65]. Outdoor ads featuring junk food, especially fast food and sugary drinks, were more prevalent in Black and Latino communities with a high youth population in Los Angeles [66].

Marketing theories propose that greater exposure to marketing also leads to greater liking of ads, as well as the products advertised [10], and recent research suggests that Black youth may view food marketing more positively than White youth. Black adolescents and those in less-educated households were more likely to say they trust advertising messages and want to try the foods advertised compared to other

adolescents [21], and Black adolescents responded more positively to TV ads for youth-targeted junk food brands [67•]. Black and Hispanic adolescents also appear to engage more with online marketing. Hispanic youth were significantly more likely to visit food and beverage websites than non-Hispanic youth, including sites for fast food and sugary drinks, while Hispanic youth living in Spanish-speaking households were most likely to visit [68]. In another study, Black adolescents and Hispanic adolescents living in Spanish-speaking households were more likely to engage with junk food brands on social media, and Black youth were more likely to engage with five or more of these brands, compared to non-Hispanic White youth [39•].

Although relatively few studies have examined how targeted marketing affects youth of color relative to non-Hispanic White youth, focus groups with Black and Latino adolescents in one low-income community found that participants were highly aware of and engaged with targeted advertising by junk food brands [69•]. They also expressed strong liking of ads that appeared to target “people like them,” as indicated by the race/ethnicity of actors and cultural indicators (such as language or the types of food that their families eat). Some indicated that targeted marketing made them feel “special” and “more attached” to the product. However when probed, many were also aware that their neighborhoods had more junk food marketing than more affluent neighborhoods nearby, and some began to question the fairness. In the words of one Latino teen, “I feel kind of taken advantage of.”

In addition, companies have cited their use of targeted marketing images, including Black and Latino celebrities, to portray a “cool” image that appeals to “multicultural” youth [25]. In support of this effect, one study examined adolescents’ responses to TV ads for junk food brands, and found that both Black and White youth responded more positively to ads with Black actors than to comparable ads with White actors [67•]. Therefore, greater exposure to junk food marketing in the media and their communities may make it more difficult for Black and Latino youth to recognize and actively resist negative influence, while more positive attitudes about targeted food marketing may reduce their motivation to resist.

## Conclusions

Junk food companies view young people as potential lifelong loyal customers. Marketing to hook young people on their products represents a highly profitable investment, while potential regulation of food marketing to adolescents presents a significant business risk. In a strategic planning assessment of potential public policy risks (leaked to the press), Coca-Cola ranked a “Ban on advertising to children >12y” and restrictions on advertising sweet beverages and high-fat/sugar/sodium foods as having high negative business impact, but low

likelihood to materialize [70]. Nonetheless, they categorized these policies as threats to “prepare” for. As has been documented in industry responses to tobacco regulation and soda taxes, “preparation” for regulatory risks often involves questioning the research and implementing strategic communications campaigns to mislead consumers about public health issues [71, 72]. Given this likely industry response, academic researchers play a critical role in conducting unbiased research to help counter misperceptions that adolescents are capable of resisting the barrage of junk food marketing they encounter daily in support of expanding junk food marketing regulations to protect children over age 12.

Previous reviews of food marketing and adolescents have identified a number of gaps in the literature, including research on social media marketing and other youth-targeted techniques, intermediate outcomes that mediate long-term food marketing effects (e.g., recall, preferences and intentions), and research that specifically examines older adolescents (14+ years) [20, 73]. The present review highlights the need for additional research to better understand adolescents’ unique vulnerability in several key areas (Table 1): (a) how social media and other teen-targeted marketing techniques may unfairly impact adolescents, (b) how food advertising activates reward networks in the brain of teenagers, and (c) how junk food marketing disproportionately appeals to youth of color and contributes to health disparities affecting their communities.

In addition, research is needed to evaluate different policy solutions and other potential options to protect adolescents from the negative impact of junk food marketing. In addition to regulating advertising exposure, public health initiatives under discussion include alternative policy options (e.g., sugary drink and junk food taxes, regulating food marketing around schools); nutrition and media literacy education; and public health communications (e.g., a “truth” countermarketing campaign for junk food). Evaluations of sugary drink and other food taxes have shown that adolescents are more price sensitive, and thus more affected by taxing policies, compared to adults [75]. However, other proposed solutions have not been evaluated, and FMDM suggests that they may not address all four conditions necessary to effectively defend against persuasive attempts (i.e., conscious awareness, understanding how one is affected, cognitive ability and motivation to resist). Moreover, emerging evidence about the addictive properties of junk food and how products are designed to encourage overconsumption suggest further barriers to effectively resisting influence [76•]. For example, one study found that junk foods (e.g., pizza, chocolate, chips) were associated with greater loss of control, liking, pleasure, and craving based on participants’ self-report compared to healthier foods [77]. These findings raise new insights into why companies may choose to target marketing for these products to adolescents—and the long-term consequences of their decision on young people’s diets and health.

**Table 1** Future research needed to better understand adolescents' unique vulnerabilities to junk food marketing and potential

Topic area	Research questions
Effects of social media and other "disguised" marketing techniques	<ul style="list-style-type: none"> <li>• Do adolescents recognize the persuasive intent of social media marketing?</li> <li>• Do adolescents view engagement (e.g., creating/sharing branded food posts) as a form of marketing the brand?</li> <li>• Are disguised forms of marketing (e.g., via social media influencers, posts, product placement in online games) more effective than traditional easily recognizable marketing (e.g., TV)?</li> <li>• What motivates adolescents to engage with brands on social media? Do these brands represent their online identity?</li> </ul>
Activation of reward networks in adolescent brains	<ul style="list-style-type: none"> <li>• What components of food marketing are most effective at "getting under the skin" of adolescents?</li> <li>• How do reward networks interact with individual neural susceptibility factors and specific features of unhealthy food ads?</li> <li>• Do these interactions disproportionately affect food preferences, unhealthy diets, and obesity risk?</li> <li>• How do adolescents respond to food ads on social media? Does this form of advertising also engage reward regions and do individual differences predict food intake?</li> <li>• What are adolescents' neural responses to advertisements for healthier foods and brands that are primarily associated with healthier foods?</li> </ul>
Disproportionate effects on youth of color	<ul style="list-style-type: none"> <li>• Why do Black and Hispanic youth appear to respond more positively to junk food marketing?</li> <li>• What is the impact of greater exposure to junk food marketing messages?</li> <li>• How does targeted marketing affect their attitudes about and consumption of targeted brands and categories?</li> </ul>
Options to effectively counteract effects of junk food marketing	<ul style="list-style-type: none"> <li>• Would marketing of healthier food improve adolescents' eating behavior?</li> <li>• Do disclosures of digital advertising (such as the FTC requirements that online influencers disclose their relationships with brands) [74] reduce the effects of these ads?</li> <li>• Does media literacy education to recognize the persuasive intent of social media and other disguised forms of marketing reduce its influence?</li> <li>• Can countermarketing campaigns (such as "truth" for tobacco) change adolescents' attitudes about junk food marketing?</li> <li>• Will youth of color mobilize around targeted marketing of junk food as a social justice issue?</li> </ul>
Addictive properties of junk food	<ul style="list-style-type: none"> <li>• Which junk food attributes may be capable of triggering addictive-like eating in susceptible individuals?</li> <li>• Are adolescents particularly susceptible to the addictive attributes of junk food due to their still-developing reward pathways?</li> </ul>

In summary, existing research on how food marketing affects adolescents is limited, but the studies cited in this review indicate that junk food marketing negatively impacts adolescents' food preferences, diet, and long-term health. Moreover, adolescents may be even more vulnerable to harmful marketing influence than younger children. These findings support calls for policies to restrict junk food marketing for all children

up to age 17. However, additional research demonstrating how food marketing affects adolescents will be critical to increase the political will for such policies and counteract likely industry challenges. Research is also needed to evaluate the potential effectiveness of other proposed public health initiatives to protect adolescents from harmful influence. Given industry's substantial investments in marketing designed to

hook adolescents on junk food—together with the addictive properties of many of these products—protecting adolescents from exposure may be the only effective solution.

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## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Human and Animal Rights** This article does not contain any studies with human or animal subjects performed by any of the authors.

**Disclaimer** The views expressed here do not necessarily reflect the views of the Robert Wood Johnson Foundation.

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- Of major importance

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