



Review

ObesityTV: How television is influencing the obesity epidemic

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ABSTRACT

Obesity is a major public health concern in the United States. Over the last several decades, the prevalence of obesity among both adults and children has grown at an alarming rate and is now reaching epidemic proportions. The increase in obesity has been associated with rises in a host of other chronic conditions including cardiovascular disease, type 2 diabetes, and some cancers. While the causes of obesity are multifaceted, there is growing evidence that television viewing is a major contributor. Results of numerous studies indicate a direct association between time spent watching television and body weight. Possible explanations for this relationship include: 1) watching television acts as a sedentary replacement for physical activity; 2) food advertisements for nutrient-poor, high-calorie foods stimulate food intake; and 3) television viewing is associated with “mindless” eating. In addition to decreasing physical activity and increasing the consumption of highly palatable foods, television viewing can also promote weight gain in indirect ways, such as through the use of targeted product placements in television shows; by influencing social perceptions of body image; and airing programs that portray cooking, eating and losing weight as entertainment. This paper will provide an interdisciplinary review of the direct and indirect ways in which television influences the obesity epidemic, and conclude with ways in which the negative impact of television on obesity could be reduced.

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Contents

1. Introduction	147
2. Overview of television viewing in the United States	147
3. Television and obesity	147
4. Direct contributions of television to the obesity epidemic	147
4.1. Television viewing and physical activity	147
4.2. Food marketing and advertising on television	148
4.2.1. Children and adolescents	148
4.2.2. Ethnically-oriented food marketing and advertising	148
4.2.3. Effectiveness of food advertisements on television	148
4.3. Eating while watching television	149
5. Indirect contributions of television to the obesity epidemic	149
5.1. Product placement and foods consumed in television programs	149
5.2. Obesity stereotypes in television programs	149
5.3. The impact of weight loss-related reality television shows on obesity	150
5.4. Celebrity chef and food-related television shows	150
5.5. Reporting of obesity-related topics in news programs	150
6. Ways to reduce the negative impact of television on the obesity epidemic	151
6.1. Self-regulation by food companies	151
6.2. Government regulation of food companies	151

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7. Conclusion	151
Acknowledgments	151
References	152

1. Introduction

Obesity is a major public health concern in the United States. It is estimated that nearly 70% of adult Americans are overweight; of those individuals, 50% are obese [38]. The numbers are similarly alarming for children and adolescents. Over the past two decades, the prevalence of obesity has more than doubled for children aged 2–5 (5.0% to 12.4%) and 6–11 years (6.5% to 17.0%), and more than tripled for adolescents aged 12–19 years (5.0% to 17.6%) [20].

This rise in obesity has been accompanied by increases in a host of other chronic illnesses, including type 2 diabetes, cardiovascular disease, hypertension, and cancer. In addition, obese individuals are more likely than their leaner peers to experience negative stereotyping and social discrimination [61,100,101,104]. Because the physiological and psychological consequences of obesity can lead to increased morbidity and mortality, and decreased quality of life, researchers, clinicians and policymakers alike are concerned with discovering the psychosocial mechanisms through which this epidemic is spreading. While the bottom line with respect to becoming obese is seemingly simple – caloric consumption exceeds caloric expenditure – the factors that contribute to this positive energy balance are multidimensional and complex [3].

There is a growing body of literature that indicates a number of direct and indirect ways in which television could be contributing to the obesity epidemic. Direct influences include a culturally-accepted shift in the amount of time spent watching television; a rise in the prevalence, intensity and targeted use of televised advertisements for palatable foods; and a tendency toward “mindless” eating while watching television. Indirect ways in which television could promote obesity include the extensive and expansive use of product placements in television shows; the proliferation of programming that features food preparation, consumption, and weight loss as entertainment; and the portrayal of an idealized body image, which can lead to discrimination and stereotyping.

This paper will provide an interdisciplinary portrayal of the interaction between television and obesity. To this end, the research literature reviewed in this paper comes from a variety of disciplines including nutrition, psychology, pediatrics, public health, sociology, marketing, media studies, and communication. Thus, while this type of review may not be typically found in *Physiology and Behavior*; it is critical for the scientific and policy-making community as well as the public to consider the multidimensional ways in which television could influence obesity.

2. Overview of television viewing in the United States

Television viewing has changed dramatically over the past 65 years. In 1945, fewer than 10,000 homes had a television set, there were only six stations, and broadcasting hours were limited [120]. Now, it is estimated that over 99% of American households have at least one television set, with an average of three television sets per household [65,95]; there are more than 800 stations [95], and shows are broadcast 24 hours/day, seven days/week. Accordingly, time spent watching television has increased; the average American adult watches 151 hours of television a month [123]. Younger members of our society also spend a considerable amount of time in front of the television. By three months of age, 40% of infants have been exposed to television; by 24 months of age, 90% are regularly watching it [135]. National surveys have found that 75% of infants,

toddlers and preschoolers watch television for more than one hour a day, while school-aged children watch an average of three hours a day [24,65]. This is not surprising given that more than 30% of children live in homes where the television is on most of the day, an additional 30% live in households where the set is on during meal times [107], and more than 60% of children have a television set in their bedroom [24,122]. Clearly, the television has become a ubiquitous part of daily life for both children and adults.

3. Television and obesity

This significant amount of screen time is cause for concern in light of several studies that have demonstrated associations between the time individuals spend watching television and their health. Seminal research published in 1985 by Dietz and Gortmaker demonstrated a significant, positive association between hours of television viewed and obesity in children and adolescents [29]. In the intervening 25 years, numerous studies have confirmed this relationship [14,27,29,63,64,81]. Additionally, the diets of children and adolescents who regularly watch large amounts of television may be less nutritionally sound than those of their peers who watch less television. For example, Coon and colleagues reported that children from families where the television was on during two or more meals/day had higher intakes of red and processed meat, and decreased consumption of chicken, fish, fruits, and vegetables [25]. The detrimental effects of television viewing on nutrient intake may be long lasting. Barr-Anderson and colleagues found that adolescents who as children watched television for more than 5 hours a day, ate fewer fruits and vegetables and consumed more sugar-sweetened beverages five years later than their peers who had watched fewer than five hours of television per day as children [9].

In light of research that suggests behaviors adopted in early in life can predict later habits [87], it is not surprising that more time spent watching television during youth is a strong predictor of compromised health later in life, including increased body weight, poor cardiovascular fitness, elevated cholesterol levels, and greater central adiposity [14,49,91]. For example, large prospective studies, such as the Health Professionals Follow-Up Study and the Nurses' Health Study found a direct associations between hours of television watched and increased risks of developing obesity and type 2 diabetes [59,60], as well as other negative metabolic consequences associated with obesity, such as hypertriglyceridemia and an elevated waist-hip ratio [23,30,44,55]. The evidence described above suggests that television-viewing habits can adversely influence both present and future dietary intake, body weight, and other related health outcomes.

4. Direct contributions of television to the obesity epidemic

The observed association between poor health and television viewing is multi-causal. Direct explanations include time spent watching television displaces time spent engaging in physical activity; the food industry's use of targeted advertisements for foods of low nutritional value; and “mindless” consumption of calorie-dense foods while watching television.

4.1. Television viewing and physical activity

One proposed explanation for the association between television viewing and obesity is that hours spent in front of the television

displace time spent in physical activity [31]. This decrease in physical activity leads to a positive energy balance, which results in weight gain and ultimately obesity. This hypothesis has been supported longitudinally, with data that found that children who spent more time watching television (greater than 120 minutes/day) at age six were less active and had higher body mass indices at ages eight and ten, than children who at age six watched less television [50]. However, even independent of physical activity, television viewing remains a risk factor for adiposity. In a population-based, cross-sectional study of children and adolescents, television viewing and physical activity were not associated ($r = 0.013$, $p = 0.58$); but eating meals while watching television was positively associated with adiposity ($p = 0.029$), even after adjusting for gender, age group, study location, and physical activity [32]. These findings indicate that watching television influences the development of obesity through mechanisms beyond simply decreases in physical activity.

4.2. Food marketing and advertising on television

The association between television viewing and caloric intake may be explained in part by research suggesting that television-based food advertising influences what, when and how people eat [40]. Behavioral studies have found the more food advertisements people see, the more primed they are to want to eat – and to want the foods advertised, which are typically highly palatable and calorically-dense [54]. Moreover, experimental and epidemiological studies reveal that watching television is positively associated with an overall increase in food intake [11,12,63,119], particularly pizza, soda [12], high-calorie snacks, and fast food [23]; and is inversely associated with intakes of fruits and vegetables [16,25,37,73]. Food companies' strong preference for marketing on television [43] is reinforced by this apparent success at increasing product consumption, specifically among children, adolescents, and ethnic and income-sensitive minorities.

4.2.1. Children and adolescents

Children and adolescents represent an important demographic for the food industry for several reasons: 1) they can directly purchase food, which makes them a “primary market”; 2) they can manipulate family purchasing decisions, so they are an “influence market”; and 3) they will mature into adult consumers, so they represent a “future market” [80]. Thus, it is not surprising that annual expenditures related to food advertising to children and adolescents are \$870 million and more than \$1 billion, respectively [35]. The vast majority of this money is spent on advertisements for foods that young people should consume in limited quantities, yet are highly preferred, such as sweetened cereals, confectionery products, snacks, fast foods, and sugar-sweetened beverages [54,86,98,99,122].

These food advertisements are often part of an integrated marketing strategy that includes cross-promotions with popular television and movie characters, celebrity endorsements, targeted product placement, and special sales promotions [35,52,84,118,122]. Accordingly, food marketing is particularly prevalent on children's networks and during programming aimed at young audiences [10]. During Saturday morning cartoons, for example, children are exposed to one food commercial every five minutes [134], most often for fast food restaurants [22]. Another recent study found that foods high in calories and fats were almost twice as likely to receive airtime than healthy ones during Public Broadcasting System (PBS) programs targeting children [105]. If children were to follow a diet consisting only of the foods endorsed on television, then they would be consuming 25 times the daily recommended amount of added sugar and 20 times the daily recommended amount of fat, but less than half the recommended servings for fruits, vegetables and dairy [82].

Adolescents are another target population for food manufacturers as they are more likely than younger children to have their own money to spend, and they have greater autonomy from parental decisions about

food purchases. Moreover, given the maturation process of adolescents, conforming with their peers is important; this may lead to the development of an “image,” which can increase brand consciousness and make adolescents more susceptible to advertisements than other age groups [92]. Approximately 25% of television advertisements viewed by adolescents are for food; with fast food being the most commonly advertised subcategory, followed by sweets and beverages [98]. In addition to encouraging the consumption of foods with a less than optimal nutritional profile, television advertisements also promote frequent consumption (e.g., at irregular meal times, such as while driving), as enjoyable and equated with popularity [52,97]. Aggregated, these factors interact to promote food intake and discourage physical activity among young populations, thus encouraging a positive energy balance early in life.

4.2.2. Ethnically-oriented food marketing and advertising

Among children and adolescents, minority youth, in particular, are disproportionately exposed to food marketing on television. Black and Hispanic children between the ages of 8 to 18 spend more time watching television than their Caucasian peers [28,72,114], which means these children see a greater number of advertisements. Furthermore, compared with general audiences, food advertisements appear more often during programs aimed at Black and Hispanic populations, and are more likely to be for high-calorie fast foods, candy and sweetened soft drinks, than for more nutritious foods such as fruits, vegetables and grains [56,99,125]. Further evidence of targeted ethnic marketing comes from studies demonstrating that while Spanish- and English-language programs are equally likely to include food commercials, advertisements for fast food restaurants are more common on Spanish-language than English-language channels [10].

These observations are especially important given that, according to national epidemiologic data, racial and ethnic minorities are at increased risk for being overweight and obese compared with their Caucasian peers; this is true across the lifespan from childhood through adulthood. More specifically, among youth, Hispanic boys (ages 2–19) have an overweight and obesity prevalence rate of 40%; for African American boys it is 33% and 30% for Caucasians [90]. Among adults, 78% of non-Hispanic African American women and 76% of Hispanic women are overweight or obese (compared with 61% of non-Hispanic White women); Hispanic men have the highest prevalence (79%) compared with both non-Hispanic White men (73%) and non-Hispanic African American men (69%) [89].

4.2.3. Effectiveness of food advertisements on television

The efficacy of food commercials to directly influence dietary intake is supported by multiple studies that demonstrate a positive association between exposure to television advertising and choices of energy-dense, nutrient-poor foods and adiposity in children, adolescents and adults [62,74,111,112]. Obese children, in particular, appear to be highly susceptible to food advertisements. For example, while both lean and obese children consumed significantly more calories and energy dense foods when watching television shows containing food advertisements than when watching similar shows without advertisements, obese children increased caloric intake to a greater degree than lean children [34,47].

Several studies have also found that when exposed to food advertisements, preschoolers, children and adults are more likely to want the advertised food/beverage post-screening, than controls who saw the same show without the advertised item [15,48,52,71]. This translates into actual buying behavior, as research indicates that the frequency with which children request foods at the grocery store is directly related to the amount of television they watch. Requests are most often made for cereals, snacks, and sweetened drinks, and frequently result in a successful purchase [4,21,122]. Aggregated, this research highlights the significant effect that advertised food has on consumption preferences. While most of these studies looked at

post-viewing preferences, others have looked at food intake while watching television.

4.3. Eating while watching television

It is common to eat while watching television. In fact, a considerable portion of Americans' calories are consumed while watching television [77]; this appears to be especially true in minority populations, such as Black youth [76]. Such a distraction can lead to "mindless eating," or a lack of attention paid to consumption due to external cues in the environment [128]. Laboratory studies have found that children consumed significantly more food when watching a continuous, ongoing television program than when either watching a repeated segment of a television program or when they weren't watching television [121]. Similarly, young adults consumed more calories from energy-dense foods when watching television than when listening to classical music [12].

Further evidence of the effects of television on food intake comes from epidemiological studies demonstrating that children who watched television during a meal consumed fewer fruits and vegetables, drank more soft drinks, and took in a higher percentage of calories from snack foods than children who did not watch television. It should also be noted that among these children, watching television while eating was positively associated with being overweight [73]. The effects of eating while watching television may impact not only concurrent eating, but also later food intake. More specifically, young women who ate snack-food while watching television ate a greater amount of food during a television-free lunch (and had poor recall of their earlier food consumption) than young women who had consumed the same amount of snack-food but not previously watched television [83].

It is hypothesized that the allocation of attention to tasks such as watching television may disrupt the ability of individuals to adequately respond to normal internal hunger and satiety cues, and instead lead to a greater reliance on external cues, such as the end of a television show, to signal the completion of a meal [128]. In support of this hypothesis, individuals who were asked to view a novel television show while consuming a meal were less accurate in estimating the amount of food they had consumed than individuals who consumed the meal while not watching television [85].

5. Indirect contributions of television to the obesity epidemic

In addition to the direct influences of television on obesity, indirect factors related to television viewing could promote excess weight gain. For example, food companies often use discreet, yet targeted, placement strategies to advertise their products to consumers. Such strategies may manipulate viewers' preferences for unhealthy foods or subconsciously influence their desire to eat when they are not hungry. In addition, television plays an important role in shaping social norms and personal beliefs about physical appearance, appropriate eating behavior, and self-concept. More specifically, the way in which overweight and obese individuals are portrayed on television programs can influence real-world social interactions, perceptions of body image, and cultural stereotypes [116]. For example, reality television shows targeting obese people (e.g., "The Biggest Loser"), portray weight loss as a game or competition, and undermine the complexity and scope of the problem, and its associated health consequences. Cooking shows, such as those found on the Food Network, present food preparation as a spectacle rather than as an important life skill that impacts diet quality. Finally, news media can influence society's understanding of the obesity epidemic by overemphasizing the role of the individual, and oversimplifying environmental and social causes.

5.1. Product placement and foods consumed in television programs

Research presented earlier in this paper demonstrated that when viewers see a given food advertised on television, it increases their likelihood of choosing that product. However, foods do not need to be directly advertised to get the attention of the television viewer. More passive references to food and eating behavior are common on television. Indeed, it has been estimated that food references occur approximately five times in a typical 30-minute primetime television program [117]. These references may not be related to a particular product; however, in many cases, the placement of foods and the use of brand-name items are intentional. Indeed, in 2008, food, beverage and restaurant brands appeared an estimated total of 35,000 times during primetime television [115].

The intentional use of (or reference to) certain items in television shows is a form of promotion in which advertisers methodically place brand-name products into programs and pay a contracted fee [33]. There are three basic forms of product placement: 1) visual: a specific product, logo, or sign is prominently shown; 2) auditory: the product is specifically mentioned; or 3) a product is part of the background, but attention is not drawn to the product during a program [17]. Television is a particularly good venue for this form of marketing since the effectiveness of product placement lies in its concealed nature. Viewers do not recognize it as advertising [133], which prevents critical thinking, and instead invites passive processing. Over the past three decades, the amount of money spent on all types of product placement has increased from less than \$200 million to more than \$4 billion [17]. The use of product placements in television shows, instead of in traditional commercials, is also effective because the promotional life is lengthened given the likelihood for re-runs and videotaping, and serves as a way to counter new technologies, such as digital video recorders and remote controls, which allow viewers to avoid watching traditional advertisements [17].

Companies can also subtly focus marketing efforts on different populations through the placement of certain products on certain television shows [7], and through the careful manipulation of popular characters with particular demographic traits to market foods [8]. Repeated exposure to a specific name-brand product may also produce feelings of familiarity with, and even a preference for it [6]; this has been found true both when a given product is used in line with a show's plot [109], and when it is superficially presented [6]. This form of marketing may be especially cogent for individuals who regularly watch a given program that uses product placement; as viewers become emotionally attached to the show's characters, the on-screen, repeated use of a particular product or brand can become an implicit endorsement for it [7]. Due to its success, this strategy is being increasingly employed to market high-calorie, nutrient-poor foods to children [17]; this further underscores its relative contribution to the role of television viewing in the obesity epidemic.

5.2. Obesity stereotypes in television programs

As previously illustrated, on-screen interactions can play an important role in influencing real world attitudes and behaviors. This is also true with respect to the shaping of social norms and beliefs about body image and weight [58]. More specifically, on television, overweight and obese individuals are frequently stigmatized through stereotyping, unequal treatment, and discrimination in social and professional settings [5]. They are also more likely to face negative social consequences, such as teasing and romantic rejection [58]; are more likely to be older, unmarried, unemployed, and members of ethnic minority groups; and are seen eating more often than their non-obese peers [46]. This negative stereotyping of obesity is not limited to programs with real actors; even in animated cartoons, heavier characters face stigmatization and are more likely to be presented as unattractive than thinner characters [70]. In fact, cartoons typically

convey the message that being overweight is bad and being underweight is good [69]. Considering that most cartoons target very young audiences, the “thin ideal” concept has the potential to be internalized at a very young age [108].

Aside from negative portrayals, obese persons are under-represented in television programs, whereas thin persons are over-represented. Only 14% percent of female and 24% of male television characters are overweight or obese, which is less than half their percentages in the general population [41,42,58,69]. While, overall, obese characters are under-represented relative to real world percentages, this is not true for racial minorities; the percentage of overweight Black characters on children's television is nearly 10% greater than real figures. Moreover, Black characters, particularly young women, tend to be cast as heavier than average for their age group [108]. These significant disparities in characterizations of obesity in television programming have the potential to translate into social norms, influencing people's beliefs about cultural and behavioral differences.

While the full extent to which stereotypes seen on television can translate into real world behavior is largely unknown, one study found that exposure to a television comedy with thin, physically attractive characters adversely influenced women's satisfaction with their own appearance, and increased their food intake. These findings suggest that low self-esteem and poor body image negatively affect cognitive control of food intake; this can then lead to overeating and weight gain [129] – even if the trigger was seeing thinner people. Another study found that the tendency for boys to attribute negative stereotypes to overweight females increased with the amount of television they watched [53]. Compared with other forms of media, such as print and radio, it is likely that television shows differentially impact audiences' perception of the ideal body because viewers can identify with the actors; they are not models on a page or voices on the air – they are supposed to represent real people [2]. These characterizations have the potential to adversely influence individual's self-perception; this, in addition to negative treatment, can lead to body dissatisfaction and psychological distress, both of which have been associated with unhealthy weight control behaviors, such as binge eating [88,102,132].

5.3. *The impact of weight loss-related reality television shows on obesity*

Perhaps even more than fictional dramas, reality shows about weight loss have mainstreamed issues related to body weight and obesity into the popular culture. The most watched weight loss show is, “The Biggest Loser,” in which contestants compete with one another to lose the most weight and win money. Proponents argue these shows provide inspiration and remind viewers that lifestyle changes can result in successful weight loss. However, most well-designed weight loss programs yield a weight reduction of 10% [131]; this is often less than individuals want, and even that modest amount of weight loss can be hard to maintain [39,94]. Thus, reality shows where contestants lose significant weight in a short amount of time present an unrealistic picture of weight reduction [13]; this can be discouraging viewers who are trying to lose weight.

These improbable weight loss goals have drawn the attention and concern of practitioners in the obesity prevention and treatment field. In 2007, the editor in chief of the journal, *Obesity Management*, published an editorial about the potentially negative repercussions of weight loss reality shows [57]. He questioned the shows for trivializing the complex genetic and environmental components of obesity, humiliating contestants, not providing accurate information on some of the extreme measures individuals use to lose weight, and for their failure to investigate the ability of contestants to maintain long-term weight loss.

In addition, a team of Australian researchers conducted an in-depth, qualitative study with 76 obese people, exploring their perceptions of, “The Biggest Loser,” and what, if any, impact it had on their

personal lives [124]. The vast majority of study participants felt the show's concept was negative; it made weight loss seem like a “circus sideshow,” and oversimplified the complex nature of obesity by narrowing the focus to binge eating and lack of exercise. While participants believed the basic tenants of healthy eating and exercise were good, they also felt the show's approach was unrealistic, unaffordable, and unsustainable. The participants also felt the show sent the message that obese people could be bullied or shamed into changing, and reinforced a culture of blame toward people who are overweight and obese [124].

5.4. *Celebrity chef and food-related television shows*

Cooking shows have come under fire in the popular media [96] as a potential contributor to obesity since they treat food preparation as a form of entertainment rather than a practical skill. In the sociological literature, food shows have been compared to pornography, using the terms, “food porn” and “gastroporn” [78]. This occurs “when we imagine cooking and eating while watching other people actually doing it” [106]. While watching these shows, viewers imagine they are capable of creating the same meal, while simultaneously knowing it is unlikely they will. For purposes of entertainment, the act of cooking seems effortless [106,127], and unlike at home, cooking on television builds up to an infinite succession of physical ecstasies, but never a pile of dirty dishes [66]. These shows are spectacles, “where the point is no longer replication within a domestic kitchen but the show itself, from the exotic ingredients and cuisine of *Iron Chef* to the ‘Bam!’ and ‘kicking it up a notch’ of *Emeril Live*” [106]. People watch not to learn and practice in their own home, but to be amused.

While we found no quantitative data showing an association between watching food-preparation television shows and weight status, media studies research has analyzed the growing popularity of the Food Network, and some have argued its very existence may reflect widespread ambivalence about health, excess consumption, and the ideal body [1]. It has been claimed the Food Network promotes unattainable, expensive and irresponsible consumer bliss, and ignores the environmental, social and personal health consequences associated with excess consumption [79]. More specifically, a content and thematic analysis of Food Network programs found the majority of shows, especially those aired during primetime, used filming and acting techniques to create a sense of adventure, excitement and sensuality; rather than accurately displaying actual food preparation and responsible consumption.

New standards for entertaining are also increasingly visible in lifestyle-oriented television programs, such as those aired on the Food Network. These shows give viewers vision and advice on how to gain pleasure through consuming [67], and have augmented the popularity of the celebrity chef and other reality food television. This, in turn, has expanded the consumer base that purchases products to create a lifestyle instead of a meal [51]. A study in Great Britain, for example, which used both survey data and focus groups, found that food television viewers considered the shows to be entertaining, but did not feel the programs were reliable sources of cooking or health instruction. However, viewers were affected by the aesthetics of the shows, and considered them to be a window into a wider social and cultural world [18]. Thus, modern cooking shows appear to have little to do with actual food preparation; instead, they have morphed into an opportunity to market products and celebrity status, and serve as a passive form of entertainment for viewers.

5.5. *Reporting of obesity-related topics in news programs*

It is clear television has a significant impact on society's perception of obesity; this is also true for news reports. In fact, the way in which the obesity epidemic is framed in the news can influence the

public's views about potential causes and solutions. Based on the Social Ecological Model [45], the causes of obesity are multidimensional, including influences from community, culture, environment, and policy. Despite these aggregated macro-level factors, the majority of news programs highlight only the role of the individual. A 2007 study by Kim and Willis analyzed newspaper and television coverage of the obesity epidemic, looking for ways in which causes and solutions were framed. Personal causes of obesity were nearly three times more likely to appear in the news than societal ones [68], and individual solutions to addressing obesity were four times more likely to be described. While individual accountability is important, this narrow scope contributes to a misunderstanding about other causes and potential solutions, and augments the potential for society to “blame the victim,” and further weight bias and fat stigmatization [103].

6. Ways to reduce the negative impact of television on the obesity epidemic

The simplest way to minimize the impact of television on the obesity epidemic is to watch less of it. In fact, an Expert Panel on Children, Television and Weight Status was convened in 2006 by the Centers for Disease Control and Prevention and, after reviewing the literature, found the following several strategies promising: 1) eliminate television from children's bedrooms; 2) turn off television while eating; and 3) provide healthcare professionals with ways in which to help patients reduce television use [65]. While these seem reasonable, television has become a ubiquitous part of life in the twenty-first century, and such behavioral shifts will be difficult. Therefore, it is important to consider other macro-level changes that can alter the direction of influence, such as more socially responsible industry practices, and stricter government regulations with respect to food advertising.

6.1. Self-regulation by food companies

The food industry is in the early stages of self-regulating television advertisements. In 2006, the Council of Better Business Bureaus (BBB), in conjunction with several leading food and beverage companies, including McDonald's USA, Burger King Corp., Campbell Soup Company, General Mills, Inc., Kraft Foods Global, Inc, The Coca-Cola Company, and PepsiCo, Inc. launched the Children's Food and Beverage Advertising Initiative (CFBAI). The goal of the Initiative is to shift food advertising content aimed at children to encourage healthier dietary choices and lifestyles. Industry participants in the CFBAI pledge to commit at least 50% of their child-directed advertising toward “better-for-you” products, reduce third-party licensed characters in advertisements that do not promote healthy dietary choices or healthy lifestyles, and refrain from product placements in editorial and entertainment content aimed at children under the age of 12 [93]. Since initiating the program, there has been a decrease in the amount of sugar and an increase in the amount of whole grains in cereals advertised to children. Additionally, in 2011, the CFBAI participants proposed to place limits on calories, saturated fat, *trans* fat, sodium, and sugars in ten product categories including juices, dairy products, soups and meal sauces and nut butters and spreads [26].

Although the CFBAI represents a good beginning for industry self-regulation, it is still far from perfect. The CFBAI's impact is limited because it lacks independently-established definitions of terms such as, “advertising directed primarily toward children,” “healthier food,” and “healthier lifestyle.” Also, while many major food companies are participating in the Initiative, other powerful manufacturers have chosen not to join; those that are participating are not subject to mandatory public reporting or objective means of evaluating compliance and impact [110,113,130].

6.2. Government regulation of food companies

Stricter government regulation of food companies' advertising campaigns could also help curb obesity. Indeed, a number of countries including the United Kingdom, Brazil, Thailand, and Chile have established, or are proposing, restrictions on food marketing. The success of these endeavors is yet to be quantified; however, previous work indicates that countries with stricter regulations on child-oriented food advertising have a lower prevalence of obesity than those with less stringent standards [19]. Research supports the potential efficacy of bans on television advertisements for energy-dense foods/beverages, with a projected decline of 2.5–6.5% in unhealthy weight gain among children between ages 5 and 14 [126], and an 18% reduction in overweight youth between the ages of 3–11 years [22].

To that end, a federal interagency working group was established in 2009 to develop recommended standards for foods marketed to children under the age of 18. Three tentative food standards have been proposed: foods in Standard One are considered to be part of a healthful diet and may be marketed freely; these include 100% whole grains, 100% fruit and fruit juices, 100% non-fat and low-fat milk and yogurt, and 100% vegetable and vegetable juices. Marketed foods that are not listed in Standard One must make a meaningful contribution to a healthful diet and contain significant amounts of fruits, vegetables, whole grains, low-fat dairy, and/or lean sources of protein. Any food marketed to children cannot contain more than pre-determined amounts of saturated fat (1 g and not more than 15% of calories), *trans* fat (0 g), sugar (<13 g of added sugar) or sodium (<140 mg) [36].

While it is not yet clear if advertising regulations such as this will be helpful in reducing obesity, research suggests that fewer advertisements for energy-dense, nutrient-poor foods may lead to reduced intakes of these foods; thus, it stands to reason that advertising healthier foods may be protective against excess increases in body weight [74]. In support of this, studies have shown that seeing popular characters, such as those on Sesame Street, consume vegetables and fruits, can lead to an increased preference for those foods by young children [75]. This may open the door for alternate consumption patterns influenced by product placement and character endorsements on popular television shows.

7. Conclusion

Television's role in influencing the obesity epidemic is significant, and may be explained by both direct and indirect pathways. These, in aggregate, work to alter individuals' energy balance, with a tendency towards increases in caloric intake and decreases in caloric expenditure. However, the causes of obesity are multidimensional, and include changes in biological, psychological, social, political, and environmental norms. Thus, while decreasing time spent watching television and altering programming content are certainly beneficial contributions, television modifications are not a panacea, and other causal pathways need to be considered. From the point of view of research, experimental designs that would further and directly address a cause-and-effect relationship between television and obesity, particularly through interventional studies, are still necessary in order to precisely decipher and analyze the extent of television's effects on the obesity epidemic.

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