39 Obesity and Socioeconomic Status

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Abstract

This chapter discusses the association between socioeconomic status (SES) and obesity, with a focus on explanations for the inverse association between SES and obesity in high-income countries. In addition to a review of the most common explanations, including that the relationship is spurious, due to underlying differences in human capital and/or due to SES group differences in the consumption of energy dense foods, we review the hypothesis and evidence thereof that the association is due, in part, to the direct effects of perceived scarcity on weight-related behaviors.

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Introduction

Socioeconomic status (SES), usually measured by indicators of education, income, or occupation, is associated with obesity (Sobal and Stunkard 1989; McLaren 2007; Cohen et al. 2013; Wu et al. 2015). In higher income countries, SES is negatively associated with obesity and, in a seminal review of the association between SES and obesity (McLaren 2007), low levels of education was the SES indicator most consistently associated with increased weight, a finding subsequently supported by a focused review of the education and obesity relationship (Cohen et al. 2013). Regarding educational differences in the prevalence of obesity, between 2013 and 2016, the estimated age-adjusted US adult prevalence of obesity among women with less than a college degree was 47.3%; among women with a college degree, the prevalence was 29.3%. Among men, the SES gradient was less stark and statistically insignificant: 36.2% of men with less than a high school degree had obesity versus 30.0% among college graduates (Hales et al. 2018). Nuances in the relationship between SES and obesity are important to recognize at the outset of any discussion purporting to explain the association. In contrast to the negative association found in higher income countries, SES is positively associated with obesity in lower income countries (Pampel et al. 2012). The shift in direction is more pronounced for women, as is the relationship between SES and obesity more generally (McLaren 2007; Dinsa et al. 2012).

Keeping the contextual nuances of the relationship between SES and obesity in mind, the focus of this chapter is on the association in higher income countries, where a sedentary lifestyle is normative and food is abundant (Evenson et al. 2015). Proposed explanations for between-country differences in the association between obesity and SES – though outside the scope of this chapter – include variations in the availability of food, levels of physical activity, and cultural values vis-à-vis body shapes (Monteiro et al. 2004). While many of the explanations for the association between obesity and SES are applicable in the context of either high- or low-income countries, most evidence review here comes from higher-income countries. Specifically, this chapter reviews several explanations for the association between obesity and SES, including the relationship between energy density, food cost, and obesity, given the Handbook's broader focus on eating and drinking. As we'll see, this explanation focuses on the higher financial costs of nutrient-rich, low energy density foods, making them less accessible to lower socioeconomic status individuals.

We also consider alternative explanations, including that the relationship is (1) spurious; (2) due to the differences in underlying knowledge, skills, and resources of individuals at varying socioeconomic strata; (3) differential exposure by SES to sociocultural values regarding weight and weight-related behaviors; and (4) direct effects of perceived scarcity on weight-related behaviors, an explanation receiving much recent attention. Each of these explanations is reviewed in turn, beginning with the role of nutrient-poor, high energy density foods. It's important to note that none are mutually exclusive from the others; indeed, it's likely that each of these factors contribute to the socioeconomic gradient in obesity.

The Role of Nutrient-Poor, High Energy Density Foods

The observation that lower SES individuals have poorer health due to diet is not new, though the health outcome of interest presumably affected by poor diet has shifted from nutritional deficiencies (now rare in higher-income countries) to cardiovascular risk factors (James et al. 1997). If micronutrient composition was responsible for past SES differences in nutritional deficiencies, what dietary characteristic explains why obesity is more prevalent in lower SES groups? While innumerable dietary constituents have been the focal point of health claims (and vociferous debates), including the relationship between sugar consumption and obesity (Bray and Popkin 2014), these claims are generally framed as explaining recent trends in cardiometabolic health and obesity prevalence more generally rather than explaining variation in obesity by SES. However, one dietary characteristic of research interest for its potential to explain variation in obesity by SES is *energy density*.

Energy density is the amount of metabolizable energy available in food per a given unit of weight. Foods with a high ratio of calories per gram (kcal/g) are said to be energy dense. The least energy dense foods contain 0 kcal/g, while the densest foods contain 9 kcal/g – the amount of energy per gram of fat. As water contains zero calories, the primary drivers of energy density are moisture and fat content, with low moisture, high fat foods such as butter, chocolate, and cheese, being the most dense (Rolls 2009). Indeed, whether energy density of meals and diets is calculated with or without beverages is an important methodologic decision, as the inclusion of beverages can significantly reduce the calculated energy density of meals (e.g., Hall et al. (2019) included a beverage with a dissolved fiber supplement in their calculation of the energy density of an "ultra-processed" diet presented to subjects, reducing the calculated energy density of ultra-processed meals, ordinarily energy dense, such that their density was similar to that of unprocessed meals. When beverages were excluded from the calculation, the energy density of the ultra-processed meals was 54% higher than the unprocessed meals).

One basic outline of the argument for the role of energy density in the socioeconomic gradient in health is as follows. First, research suggests that energy dense foods promote increased energy intake, especially in short-term, laboratory settings (Stubbs et al. 2000). Second, energy dense foods may be more affordable and convenient, making them more attractive to individuals with less financial resources and time to devote to food and its preparation (Darmon and Drewnowski 2015). Thus, lower SES individuals may be more likely to choose and consume energy dense foods, predisposing them to weight gain due to uncompensated increased energy intake. The two basic premises of this argument are reviewed below, beginning with the claim that higher energy density leads to greater energy intake.

Energy dense foods may promote increased intake due to their relatively high palatability (Drewnowski and Greenwood 1983) and reduced satiating effects, with palatability defined as, "the momentary subjective orosensory pleasantness of food" (Stubbs and Whybrow 2004). If the consumption of energy dense foods promotes increased long-term energy intake without a corresponding compensation in energy expenditure, one would expect an association between energy density and body weight, with those consuming more energy dense diets weighing more, on average, than those consuming less energy dense diets (Rolls 2009). Consistent with the hypothesis that higher energy density is associated with increased dietary intake and body weight, Ledikwe et al. (2006) found that free-living US adults who self-reported consuming a low energy density diet had a lower prevalence of obesity relative to those consuming an energy dense diet.

However, the association between energy density and body weight is inconsistent. de Castro (2004) found that free-living adults who self-reported consuming energy dense diets reported greater energy intake but did not find a corresponding association with body weight or BMI. Indeed, this result was noted as surprising, "given the rather salient apparent effect of dietary energy density on meal and daily intake," suggesting that individuals may compensate for acute increases in energy intake associated with energy dense meals and that dietary energy density does not affect body size in the natural environment (de Castro 2004). A 2016 meta-analysis of observational studies on the association between dietary energy density (calculated from self-reported measured of food intake) and weight found a complex mix of associations: dietary energy density was not significantly associated with the risk of elevated BMI or abdominal obesity; however, higher energy density was significantly associated with excess adiposity and weight gain over time (Rouhani et al. 2016).

Taken together, evidence consistently suggests that consuming foods with a high energy density is associated with acute increases in energy intake, while evidence that energy density is associated with long-term increases in energy intake and risk of obesity is less consistent (Karl and Roberts 2014). Herein lies the relevance of the premise that energy dense foods are more affordable and convenient, making them more attractive to lower SES individuals. If the long-term effects of the energy density of food intake on weight are, on average, de minimis due to compensatory behaviors (i.e., reduced energy consumption following acute energy density associated increases in energy intake), financial factors which discourage compensation for increased energy intake – such as an inability to afford or prepare less energy dense foods and other means by which individuals might reduce their energy intake – may induce an association between energy density and obesity among lower SES individuals. It's thus important to consider the association between food cost and energy density and whether variations in the availability of energy dense foods are associated with obesity (Darmon and Drewnowski 2015). Indeed, energy density is inversely associated with the cost of food such that energy-dense foods cost less, on average, than less energy-dense foods (Drewnowski 2010). High energy density foods such as oil, margarine, and sugar have a per-energy unit cost much less than that of low energy density foods such as lettuce, strawberries, and frozen fish (Drewnowski and Specter 2004). Individuals facing economic constraints may thus preferentially select lower-cost, higher energy density foods in order to meet their energy needs. Economic modeling suggests that the introduction of a progressively stronger cost constraint pushes rational consumers to meet a higher proportion of their energy needs from energy-dense sweets and added fats and less from fruits and vegetables, recapitulating a dietary pattern commonly found in lower SES groups likely facing similar constraints in their selection of foods (Darmon et al. 2002).

Another analysis comparing the cost of a "healthy" diet versus an "unhealthy" diet using data from the UK Women's cohort study found, on average, that women consuming the healthiest diet spent $1,285 (2018 USD) more per year on food than those consuming the least healthy diet (Cade et al. 1999). Further, those consuming the healthiest diet spent approximately $4.45/day on foods with low energy density, such as fruits and vegetables, which was three times the money spent on such items by women consuming the least healthy diet (remarkably, the same study found that women consuming the healthiest diets also self-reported consuming about 1,000 kcal more per day than those consuming the least healthy diets while also maintaining the lowest BMI, etc.). Finally, a 2015 systematic review on the effects of food costs on diet quality concluded that studies of dietary costs in multiple countries were "unanimous" that "the global hierarchy of food prices is such that energy-dense foods composed of refined grains, added sugars, or fats are cheaper per calorie than are the recommended nutrient-dense foods" (Darmon and Drewnowski 2015).

The increased cost of low energy density diets may encourage individuals to preferentially select energy-dense foods, potentially counteracting compensatory behaviors that would ordinarily prevent long-term changes in energy balance. The financial resources individuals have at their disposal to spend on food vary substantially, and cumulative differences in financial resources by education level are especially striking: median lifetime earnings of an individual in the United States with less than a high school education is $973,000 (in 2009 dollars), compared to the estimated $2,268,000 lifetime earnings of a college graduate (Carnevale et al. 2011). Higher wages are associated with a decreased risk of obesity (Kim and Leigh 2010), as is living in a neighborhood with a higher percentage of adults with incomes over $75,000 and home valuations in the upper quartile (Grafova et al. 2008). Of course, differences in individual financial resources are not the only SES-related factor affecting diet. Indeed, differential access to healthful foods has been argued to be a causal factor in the rapid increase in obesity prevalence in the United States (Drewnowski et al. 2012). Neighborhoods in the United States have grown increasingly segregated by SES, and individuals with greater educational attainment increasingly live in more isolated and affluent neighborhoods (Massey et al. 2009; Robert and Reither 2004). As individuals reside in increasingly economically segregated neighborhoods, the characteristics of the food environments they are exposed to will continue to diverge, with lower income neighborhoods having food environments believed to promote unhealthy eating (Hilmers et al. 2012; Larson et al. 2009).

Given the above discussion of energy density, obesity, and socioeconomic status, one might expect that exogenous increase in income would reduce obesity, presumably because individuals would have more money to devote to (more costly, less energy dense) foods. Yet some studies suggest the opposite – that the provision of short-term financial resources may, in fact, exacerbate trends in obesity prevalence. For example, results from *Programa de Apoyo Alimentario* (PAL), a program implemented by Mexico to improve the health and nutritional status of families, found that families receiving a monthly cash transfer for 23 months had a 53% increase in weight gain relative to a control group not receiving a monthly cash transfer (Leroy et al. 2013). One explanation for this finding and others like it (Forde et al. 2012), as described elsewhere (Maner et al. 2017), is that "increased energy intake and other behaviors that promote adipose accretion may result from physiological and psychological responses to uncertainty about the future availability of food" (Pavela et al. 2019) as a means to build energy reserves to "buffer" against future food scarcity (Kaiser et al. 2012). Short-term exogenous cash infusions may thus be sufficient to improve access to food but insufficient to reduce perceptions of food scarcity, an explanation revisited shortly. Longer-term studies of the effect of direct financial aid on obesity and other weight-related behaviors are needed, as newfound financial support might be expected to lead to an acute increase in spending on food, leading to weight gain, before settling into a longer-term dietary pattern. Similarly, in the United States, participation in the Food Stamp Program is associated with higher adult BMI; however, participation in the program is associated with a lower BMI *among those participating 6 months or more* (Webb et al. 2008).

Obesity and Socioeconomic Status: Additional Explanations

As indicated at the outset, in addition to the role of energy density and food costs in the association of SES and obesity, additional explanations include the possibility that the relationship is spurious, due to the differences in human capital (Mirowsky and Ross 1998), differential exposure by SES to social norms regarding dietary intake, physical activity, and body size (Sobal and Stunkard 1989) and possible direct effects of perceived scarcity and social inequality on weight and weight-related behaviors. These explanations are briefly reviewed herein, with a focus on the relationship between education and obesity, as education is commonly used as an indicator of SES, along with income (Pavela et al. 2016).

First, the association between SES and weight may be spurious – that is, due to factors other than a causal effect of SES on weight, including reverse causation and omitted variables affecting both education and weight (Devaux et al. 2011; Boardman et al. 2015; Haas 2006). For example, obesity is associated with lower academic performance (Caird et al. 2013), with some evidence to suggest teacher and peer prejudice contribute to lower grades (MacCann and Roberts 2013). Students with obesity are more likely to report school absences, school problems, and low engagement (Carey et al. 2015). Obesity is also associated with a wage penalty, such that among white males, a 1 kg increase in body fat is associated with a 1.8% decrease in wages and, among white females, a 1 kg increase body fat is associated with a 1.9% decrease in wages (Wada and Tekin 2007). Other studies have found a similar wage penalty for both sexes and multiple racial ethnic groups in the United States, with white women with obesity earning 11.9% less than their peers with normal weight, African-Americans with obesity earning 6% less than peers with normal weight, and Hispanic females with obesity earning 8% less than peers with normal weight. The possibility that obesity affects educational attainment and income raises the general problem of reverse causation, especially in cross-sectional studies. If individuals who are obese are selected into a lower SES, it suggests that at least part of the association between obesity and SES is not due to the causal effects of SES on weight.

Second, the association between SES and obesity may be due to differences in human capital. Human capital is the embodiment of knowledge and skills in humans (Becker 1994). Originally developed by economists conceptualizing human capital as a form of investment in the self in the pursuit of increased productivity, the concept of human capital has since been applied to the analysis of health outcomes (Mirowsky and Ross 1998; Grossman 1972). From this perspective, greater educational attainment and resulting increases in human capital improve the productive and allocative efficiencies of individuals who demand good health, with productive efficiencies being those which directly improve returns on investments in health, such as an improved ability to understand the advice of a medical doctor, and allocative efficiencies being those that improve the selection of health inputs for a desired health goal, implying that greater educational attainment increases the likelihood that individuals will select effective health-producing behaviors (Grossman 2008).

When a particular weight is the desired health outcome, the human capital perspective posits that a more highly educated individual will, on average, select activities better suited to achieve weight goals and derive greater benefit from those activities given their greater skills and knowledge. Evidence of a causal relation between education and weight are consistent with the human capital perspective (as well as sociocultural explanations – see below). In the absence of randomized controlled trials to test the causal effects of education on weight, multiple non-RCT Extended Association Tests (EATs) have been used (Richardson et al. 2017). These methods go beyond what have been called "Ordinary Association Tests," (OATS) for "which the sole or primary means of controlling for potential confounding factors is inclusion of measures of some potential confounding factors as covariates in statistical models (or stratifying by measures of such factors)" (Richardson et al. 2017). Although not all EATS find a causal relation (e.g., Petter 2008; Kenkel et al. 2006; Clark and Royer 2010), many have found causal evidence utilizing changes in mandatory school laws (Kemptner et al. 2011; Grabner 2009; Brunello et al. 2013), sibling fixed-effects (Fletcher and Frisvold 2012), and timing of school entry (Zhang and Zhang 2011). For example, Grabner (2009) utilized US state-level variation in compulsory schooling requirements, finding that an additional year of education is associated with a 2–4 percentage point reduction in the probability of being obese, an effect that is stronger in females. This analysis and others like it which utilize variation in *compulsory* school attendance requirements are valuable as they substantially reduce the risk that the association between education and obesity is due to selection (i.e., individuals *choosing* to stay in school longer). Sibling fixed-effects models utilize variation in educational attainment (or other independent variable of interest) *within* sibling pairs in an effort to reduce the risk of confounding in the relationship between education and obesity due to unobserved family characteristics or genetics (when using identical twins). Research using variation in education among Australian twins found that education was inversely associated with the probability of being obese among men but not women (Webbink et al. 2010).

Third, and in contrast to the human capital perspective, a sociocultural perspective emphasizes the role of education as a socializing institution that reinforces weight-related norms and influences individual attitudes toward body shape (Neighbors and Sobal 2007). In their original review, Sobal and Stunkard (1989) recognized the likely role of societal attitudes toward obesity as an explanation for the consistent relationship observed between SES and obesity among females, a relationship less consistently observed among males. Indeed, evidence suggests that beginning in the 1960s, the ideal feminine body became thinner (Garner et al. 1980). The pressure to stay thin begins early in life, with some evidence indicating that girls as young as 3 years old have internalized the thin ideal (Harriger et al. 2010). Educational institutions may thus act to reinforce social values, including the value of thinness. Among college students, women believe that men have a thinner feminine ideal than men actually report liking, potentially leading to greater body image dissatisfaction and weight control behaviors among women (Fallon and Rozin 1985). Certain educational environments may also more strongly reinforce the thin ideal; compared to freshman at all female colleges, female freshman at mixed colleges may be more likely to endorse thinner ideals once they become seniors (Spencer et al. 2013).

Finally, in addition to the explanatory roles of financial resources and human capital, a more recent line of research examines the hypothesis, sometimes called the Insurance Hypothesis (Nettle et al. 2017), that *perceptions* of food scarcity directly promote weight-related behaviors that encourage a positive energy balance, perhaps as a means to buffer against future food scarcity (Kaiser et al. 2012). Thus, insofar as low socioeconomic status begets perceptions of food scarcity, the association between SES and obesity may be due, in part, to the effects of perceived food scarcity. Emblematic of this line of research is (Cardel et al. 2016), which experimentally manipulated social status to observe its effects on energy intake, finding that participants randomized to a lower social status position consumed a significantly higher proportion of their daily calorie needs compared to participants randomized to the higher social status position. However, not all studies in this vein have found a significant effect of social status on energy intake (e.g., Pavela et al. 2017).

Perceptions of food scarcity may also promote adipose accretion via reductions in energy expenditure rather than increases in energy intake. Energy expenditure can be broken into three primary categories: resting metabolic rate, thermic effect of food, and physical activity energy expenditure. Lee and Cardel (2018) expanded on the Insurance Hypothesis to include energy expenditure, theorizing that individuals in subordinate positions (e.g., of lower social status) may have lower resting metabolic rates and lower physical activity energy expenditure as a means to preserve energy during times of insecurity or scarcity (Lee and Cardel 2018; Dhurandhar 2016). This protective mechanism could lead toward a state of energy imbalance that promotes excess adiposity and obesity development due to both the immediate effects of reduced energy expenditure as well as the potential effects on the regulation of energy intake. Hill et al. (2012) hypothesize that "human physiology developed under circumstances that conferred [an] advantage for achieving energy balance at a relatively high (compared to resting metabolic rate) level of energy expenditure – a high energy throughput – or high energy flux," which suggests that humans today are better able to match energy intake and expenditure (achieve energy balance) at higher levels of energy expenditure; thus factors which tend to reduce energy expenditure, including perceptions of food scarcity, may make it more difficult to achieve energy balance and promote weight gain.

Current evidence for the hypothesis that perceptions of food scarcity are associated with reduced energy expenditure primarily exist in animal models. For example, mice in a subordinate position have significantly lower total energy expenditure compared to mice in dominant positions after experiences of psychosocial stress (Moles et al. 2006; Sanghez et al. 2013). Though experimental studies in humans exist to study social status and energy intake, there has yet to be experimental work focused on social status and energy expenditure. Thus, in humans there is minimal experimental evidence available to assess the strength of this hypothesis. Observational studies of the association between socioeconomic status and physical activity (a contributor to energy expenditure) are at least consistent with the Insurance Hypothesis, as physical activity (PA) is inversely associated with SES in higher income countries. In the United States, the proportion of adults meeting physical activity guidelines significantly increases as education level increases and adults on private insurance (a common proxy for higher income level) were 93.1% more likely to meet guidelines than those with public insurance (U.S. Department of Health and Human Services 2019). An umbrella review of systematic reviews also found convincing evidence that SES is significantly associated with overall PA, occupational-based PA, and leisure-based PA in adults (O'Donoghue et al. 2018). Infrastructure accessibility and quality can differ between high- and low-SES neighborhoods. Access to sidewalks, paths, parks, and recreational facilities have all been found to facilitate physical activity, but may not be present in lower SES neighborhoods (Salvo et al. 2018; Smith et al. 2017). When such facilitators of physical activity are present, perceived access and safety concerns can impact use and behavior. A study between high- and low-income neighborhoods in Australia found that, even though the number of recreational facilities in neighborhoods were equitable, low-SES residents perceived that they did not have access to recreational facilities (Giles-Corti and Donovan 2002). Individuals in high crime areas have 28% reduced odds of achieving sufficient levels of PA; however, perceived safety can increase the odds of achieving higher activity levels by 27% (Rees-Punia et al. 2018).

Though minimally studied, similar relationships are observed between objectively measured socioeconomic status and PA as when assessed using subjective measures of social rank or subjective social status (SSS). In adolescents, a study conducted in Finland found that low SSS was positively correlated with moderate to vigorous PA and negatively correlated with sedentary time (Rajala et al. 2019).

In adults, an analysis of data collected from China, Taiwan, South Korea, and Japan found that SSS was significantly associated with odds of weekly or daily PA except in South Korean and Japanese females (Frerichs et al. 2014). There is a need to replicate these findings in countries with different income and education classes, as well as diversity of racial ethnic identities, as these factors could affect the perception of social status in countries of greater inequality.

Research on the relationship between perceptions of food scarcity and weight-related behaviors may also add insight into the perhaps counterintuitive association between food insecurity and obesity. Food insecurity occurs when there is a lack of reliable access to safe and nutritious foods to support an active and healthy lifestyle. Individuals that have low food security experience reduced diet quality or variety due to inadequate resources and are at subsequent risk of poor nutrition and health outcomes. In more severe instances of very-low food security, individuals also experience disrupted eating patterns and an overall reduction in food intake due to their inability to consistently access food in a safe, socially appropriate manner. Those living with very-low food security are known to experience the sensation of hunger without the means of relieving this physical discomfort (USDA 2018). Though not causal, the prevalence of food insecurity in the United States is closely related to poverty rates. Food insecurity is three times more likely among households below the federal poverty line, yet households above this federal poverty line may experience food insecurity due to nonmonetary causes, such as instances of family illness, emergency, or other unforeseen life circumstances (Holben and Marshall 2017; Coleman-Jensen et al. 2019).

Access to nutritious foods is essential in the promotion of healthy food choices, eating patterns, and positive health outcomes (ODPHP 2019). Limited access to healthy foods has been shown to contribute to either extreme of malnutrition – both undernutrition, a by-product of food insecurity, and obesity (SOFI 2019; World Health Organization 2019). The United Nations' Food and Agriculture Organization estimates that 10.9% of the global population experiences undernutrition, and 13.2% of adults have obesity (SOFI 2019). Estimates exclusive to the United States are even graver: 12.5% of Americans experience food insecurity and 39.8% of adults have obesity, and these statistics are not mutually exclusive (What Is Food Insecurity in America? 2019; Centers for Disease Control and Prevention 2019). The prevalence of obesity is greater among lower SES women in affluent countries such as the United States, yet there is no known association among men (McLaren 2007; Nettle et al. 2017). Food insecure, lower SES women are at a 50% greater risk of obesity than food secure women (Nettle et al. 2017).

The association between food insecurity and obesity may occur for a multitude of reasons. For instance, the limited availability of financial and other resources among food insecure individuals makes selecting healthy food choices even more challenging for this population. Food insecure individuals are also prone to consuming calorically heavy food items, given the inverse relationship between calorie density and cost of foods (Dhurandhar 2016; Seligman et al. 2007). As a means of coping with their circumstance, food insecure individuals may seek calorically dense food for the sensation of satiety (Holben and Marshall 2017). Understandably, these choices often occur without consideration for nutritional adequacies to support an active, healthy lifestyle or for potential long-term health outcomes. Each of these actions may exacerbate the risk of obesity by contributing to limited fresh fruit and vegetable intake or consumption of dietary variety, and, when ample food is available, promote overeating (Dhurandhar 2016; SOFI 2019). Given that low SES households are more likely to experience food insecurity, *taste* differences by class may serve to reinforce (or counteract) tendencies to devote limited financial resources to energy dense foods. As the authors have noted elsewhere, "*taste* may be embodied in the working class through their attention to the strength of the male body while the professions prefer non-fattening options due to their greater focus on body shape," an observation stemming from the sociologist Pierre Bourdieu (Pavela et al. 2017), whose concept of cultural capital is increasingly applied to differences in health and health behaviors by SES, including SES differences in food preferences (Kamphuis et al. 2015). Promoting healthy food choices among food insecure adults could help to prevent against and reduce the prevalence and severity of obesity in this population (Rees-Punia et al. 2018). Supporting the intake of nutritionally adequate foods among those who are food insecure should be addressed through holistic methods such as innovative community-based initiatives that incorporate nutrition education (ODPHP 2019). More emphasis is needed on training for community-based initiatives and programming that is based upon research and consistent program evaluation (Holben and Marshall 2017).

Conclusions

Socioeconomic status is associated with obesity, an association that is context-specific and varies in strength by sex, food insecurity, and race-ethnicity. This chapter has reviewed several of the standard explanations for the inverse association between SES and obesity in higher-income countries, as well as a more recent explanation – the Insurance Hypothesis – which posits that social-psychological mechanisms in response to perceived food scarcity may promote weight gain. However, there are other important social-psychological factors that influence food intake and may, ultimately, increase the risk of obesity. Thus, rather than close with a brief summary of the chapter, a few especially important determinants of food intake not necessarily linked to SES, including modeling, social facilitation, and impression management, are reviewed here (see ▶ Chap. 14, "Social Influences on Eating" by Higgs in this volume for additional detail). These factors may operate synergetically with some of the factors contributing to the excess risk of obesity in lower SES individuals, for example, the social modeling of the consumption of energy dense foods.

Research on the effects of social modeling on food intake stems from the external/internal food cues distinction developed by Schachter (1971). Social cues are just one type of external cue among many, including sensory inputs that indicate the palatability of food. Although Schachter (1971) originally believed that obese individuals were more sensitive to external cues than nonobese individuals, including social cues, Nisbett and Storms (1974) found little evidence that an individual's weight moderated the relationship between social modeling and food intake behavior among males, a finding supported by later research using both male and female subjects (Conger et al. 1980). A recent systematic review of research on the effects of social modeling on food intake and selection found that the majority of research found a statistically significant effect of social modeling (Cruwys et al. 2015). While most research on modeling effects has used palatable, energy dense foods, some research has found a modeling effect for nutrient-dense foods such as vegetables among college-age females and adolescents (Hermans et al. 2009; Salvy et al. 2008), and the effect appears to be less pronounced with nutrient-dense foods than with energy dense foods (Cruwys et al. 2015).

A second important influence on energy intake is social facilitation. de Castro, who has done much of the research on social facilitation, has called it "the most important and all-pervasive influence on eating yet identified" (de Castro et al. 1990). Indeed, a large amount of research indicates that people eat more in groups than they eat alone and that meal size appears to increase as the number of people increase – each additional person at a meal is associated with an increase in meal size, likely due to increasing length of the meal (Bell and Pliner 2003; Pliner et al. 2006; Feunekes et al. 1995).

Finally, impression management may influence the type and amount of foods consumed, as the kinds of food we eat convey to others (and ourselves) information about the kind of person we are. Insofar as we associate different foods with different traits that an individual might possess, such as high social status, masculinity, femininity, or healthfulness, individuals may select certain foods to manipulate the perceptions of others (and their self-perceptions) – a process of impression management (Leary 1995). Several studies have suggested that types of food and amount eaten are associated with gender. Rozin et al. (2012) found that subjects were quicker to make the association between "meat" and "male" than other associations (suggesting the two concepts are linked in thought), and, among college students, males expressed a greater preference for meat than females (along with beef and orange juice), while females expressed a greater preference for salad and vegetables.

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