

RESEARCH ISSUES: THE FOOD ENVIRONMENT AND OBESITY

# Food Prices and Obesity: A Review<sup>1–4</sup>

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ABSTRACT

In response to rising rates of obesity in the United States due in part to excess food consumption, researchers and policy makers have argued that levying food taxes on obesity-promoting foods, perhaps combined with subsidies on healthier options, would be an effective tool to stem the obesity epidemic. The extent to which overall energy intake or weight outcomes will improve as a result of these policies is ultimately an empirical question. This review examines the link between food or beverage price changes and energy intake or weight outcomes among U.S. consumers. Current evidence indicates that, by themselves, targeted food taxes and subsidies as considered to date are unlikely to have a major effect on individual weight or obesity prevalence. While research suggests that the effects are modest, food taxes and subsidies may play an important role in a multifaceted approach to reducing obesity incidence. *Adv Nutr* 2014;5:818–821.

Introduction

The prevalence of overweight and obesity in the United States has reached astonishing rates. In 2007–2008, 68% of adults and 32% of children and adolescents were overweight (1,2). The medical costs of obesity were estimated to have reached \$147 billion in 2008, which equates to roughly 9% of all medical expenditures; approximately half of this total is financed by Medicare and Medicaid (3). As a result of the high health and medical costs of obesity, policymakers are considering many options for addressing the obesity epidemic.

Evidence strongly suggests that excess food consumption is a primary cause of rising rates of obesity (4–6). Moreover, this excess consumption is partly driven by the low cost of

highly processed energy-dense foods, which not only fuels higher rates of obesity and poor health but is also a likely contributor to socio-economic disparities in health (6). As a result, some researchers and policy makers have argued that levying food taxes on obesity promoting foods, perhaps combined with subsidies on healthier options, would be an effective tool to stem the obesity epidemic and reduce these disparities (7,8). The theoretical foundation for food taxes and subsidies stems from the economic principle known as the law of demand. This law states that, *ceteris paribus*, as the price of a good increases (decreases), the quantity demanded of that good will decrease (increase). Therefore, the theory suggests a tax on obesity-promoting foods will reduce their consumption, which may in turn improve weight outcomes.

Many liken these proposals to tobacco taxes, which were largely responsible for the 50% reduction in smoking rates seen over the past several decades (9–11). However, 1 major difference between food and tobacco is that tobacco has few substitutes. Therefore, it is difficult for consumers to get around the tax by switching to substitute products. With respect to food, this is not necessarily the case and it is even possible that a tax on 1 type of food, such as sugar-sweetened beverages (SSBs), could increase energy intake if consumers switch to more calorie-dense alternatives (12). Regardless, legislatures across the country have entertained the idea of using SSB taxes to reduce SSB consumption and address rising rates of obesity. As of May 2011, 15 states

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have filed legislation for additional soft drink taxes (13). At the federal level, the Senate Finance Committee included a proposal to tax 3 cents per 12-oz SSB in an early draft of a health care bill in 2009 to pay for health care reform. However, notwithstanding the enthusiasm of public health professionals and some lawmakers, no state or municipality has passed a proposal to impose large taxes on SSBs.

Aside from proposals to tax SSBs, other forms of economic incentives have been adopted or are currently being considered in efforts to encourage healthier food consumption. As of October 2009, Women, Infants, and Children program participants are being issued cash-value fruit and vegetable vouchers in efforts to increase their consumption. In the 2008 Farm Bill, Congress authorized the Healthy Incentive Pilot study to evaluate whether Supplemental Nutrition Assistance Program (formerly known as the food stamp program) participants could be incentivized to increase fruit and vegetable consumption through a 30% price discount.

Although theory suggests that these tax/subsidy options will influence purchases of the targeted products, given the potential to switch to other products as a result of the price changes, the extent to which overall energy intake or weight outcomes will improve is ultimately an empirical question. That is the focus of this review. We review empirical studies, including observational, simulation, and experimental, that examine the link between food or beverage price changes and energy intake or weight outcomes among U.S. consumers. Because our focus is on the impact of tax/price changes on overall diet quality and obesity, we ignore studies that focus on the effects of tax/price changes solely on purchasing behavior of a single product. A review of such studies has been conducted previously (14).

### Study Selection Criteria

We searched PubMed, Medline, and Google Scholar for original research articles examining food and/or nonalcoholic beverage purchases as a function of price changes. Searches that included various combinations of “health,” “obesity,” “BMI,” “weight,” “tax,” “subsidy,” and “price elasticity” were used to identify relevant journal articles. Any peer-reviewed articles published in English between January 1980 and June 2011 that fit the criteria based on title and abstract were reviewed for relevance. Studies that did not examine the price of food or nonalcoholic beverages, overall diet or weight outcomes, and commentaries, essays, and editorials were excluded. A total of 13 articles met the inclusion criteria. The articles are organized according to 1) studies that examine the relationship between market prices and diet/weight outcomes and 2) studies that specifically focus on the effects of taxes and/or subsidies.

### The Relationship between Market Prices and Diet/Weight Outcomes

Several studies have examined the relationship between prices and obesity in the United States. In 2009 Powell and

Chaloupka (15) conducted a review of 9 empirical studies that estimated the relationship between food prices and BMI or obesity in the United States. The studies included prices for fast food, restaurant food, and food at home, and looked at a variety of different products, including fruits, vegetables, sugar, potatoes, whole milk, and soft drinks. The review concluded “when statistically significant effects were found between food and restaurant prices and weight outcomes, the effects were generally small in magnitude” (p. 229). Most recently, Han and Powell (16) examine the extent to which fast food prices are associated with obesity status among young adults. Although their initial estimates suggest that 10% higher fast food prices are associated with a 13.2% lower probability of obesity, this effect was not statistically significant once individual fixed effects were controlled for in the estimation. In other words, the results are more likely driven by individual’s propensity for fast food consumption than by actual price variation across markets. Several additional studies specifically examine associations between food prices and childhood obesity. Findings suggest that higher fast food prices are associated with higher children’s weights and lower fruit/vegetable prices are associated with lower weights (15–17). Combined, these results suggest that targeted tax/subsidy policy may have a greater positive effect on children’s dietary/weight outcomes than adults.

### Taxes and Subsidies

**Observational studies.** Observational studies on the effect of taxes or subsidies on diet/weight outcomes have been hampered by a lack of large tax variation across states or time. Unlike for tobacco, where excise taxes vary considerably from state to state and on average account for about 27% of the retail price of cigarettes (19), current state sales taxes are imposed primarily on soft drinks, candy, and snacks only, and are small, with a mean of roughly 4% and a maximum of 8% (20). As a result, these taxes are trivial components of retail prices paid by consumers. Moreover, unlike for excise taxes on cigarettes, the prices that consumers see in the aisles do not include these taxes, as they are only incorporated at the register, thus further reducing any effect they may have on consumption.

Results from SSB studies are consistent with the hypothesis that current SSB taxes are too small to significantly influence dietary/weight outcomes. Three observational studies that examined the effect of SSB taxes on children and/or adolescent BMI found no effect (21–23). One study focusing on adults found that a 10% increase in prices leads to a 0.03% reduction in BMI and a 0.1% reduction in the prevalence of overweight and obesity (24). This effect is too small to be clinically meaningful.

**Simulation studies.** In addition to lack of large tax/price variation, many observational studies are limited due to lack of a true comparison group, simultaneity bias where price changes may be the result of both supply and demand

shocks, or an inability to control for all sources of potential confounding. To avoid these pitfalls, several authors have attempted to simulate the likely effects of specific tax policies on dietary/weight outcomes using the best available sources of data. In a simulation study on SSB tax increases and a tax on food eaten away from home, Schroeter and colleagues (12) estimate that a 10% tax on SSBs would translate into a very small 0.09 kg weight reduction in men, and 0.045 kg reduction in women. Interestingly, they found that a 10% tax on food eaten away from home would lead to an increase in weight because it would encourage increased consumption of food eaten at home, which they claim, on net would result in greater energy intake.

Wendt and Todd (25) simulated the effect of healthy food subsidies on BMI of children and adolescents. The researchers found that a 10% subsidy on low fat milk would lead to a 0.07 decrease in BMI for children 8–9 y old, a 10% subsidy on dark green vegetables (e.g., spinach and broccoli) would lead to a 0.28 reduction, and a 10% tax on sweet snack prices would lead to a 0.27 decrease in BMI.

**Experimental studies.** The studies cited above are based on actual transactions data. As noted above, these data have significant limitations due to lack of variation of prices and/or taxes across regions and over time and because it is difficult to distinguish whether any effects are due to changes in consumer demand or to changes in supply. Another source of information on the effects of tax/subsidy policy comes from experimental studies that test the relationship between food price changes and outcomes in a controlled setting. These studies allow for the most control and thus the best chance to determine causal relationships between food prices and consumption, although that may be at the expense of external validity. Several experimental studies have tested the relationship between large taxes and/or subsidies and changes in diet quality/weight outcomes.

Using an analog to a grocery store, Epstein and colleagues (26) showed that taxes on less healthy foods (based on calorie for nutrient scores) resulted in a net reduction in calories and dietary fat purchased and an increase in protein purchased. Interestingly, subsidies on healthier foods resulted in a net increase in calories because consumers used the savings to increase purchases of less healthy foods. In an experimental study focusing on lunch purchases, Giesen and colleagues (27) found almost no effect on calories purchased when 0%, 25%, and 50% taxes were implemented alongside posted caloric information. Lowe and colleagues (28) examined the effect of 15% to 25% subsidies on low energy–dense foods. Despite finding increases in healthy food purchases, they did not find improvements in health or weight outcomes.

### Implication and Areas for Future Research

Public policy efforts to influence market prices will largely work through changes in current tax/subsidy policy. Although research is hampered by a lack of large price/tax variation on specific foods, the current evidence indicates that

small food taxes/subsidies or those that target a specific food or food category are unlikely to have a major effect on overall diet quality or weight outcomes. However, this is likely true for just about every obesity intervention. That is why the NIH and the Institute of Medicine have called for a systems-oriented approach for obesity prevention and treatment (29–31). A systems approach emphasizes the linkage between individual behavior change strategies and social and physical environmental change. Although research is lacking, tax and/or subsidy policy aimed at reducing barriers to healthy food consumption is likely to be a necessary, although insufficient, component of a successful obesity prevention policy. Moreover, the revenue generated from these taxes could be used to finance other obesity prevention efforts, although in the current funding environment it may be difficult to earmark tax revenue for specific causes.

These studies also suggest that the changes in food prices required to encourage improved diet and weight outcomes will likely need to be large and not limited to 1 or a few food categories. This is because, as shown with the SSB studies, narrowly applied taxes are too easily avoided by switching to substitute products and/or because the taxed products do not make up a large enough percentage of energy intake to significantly influence weight.

The study by Epstein et al. (26) further suggests that subsidies alone may have unintended negative effects. Their study focused on taxes (subsidies) on high (low) calorie-for-nutrient foods. Although their results suggest this may be an effective policy, other strategies may be equally or more effective. For example, it may be possible to tax/subsidize foods based on overall nutritional characteristics or relative to other foods within the same product category. Taxes/subsidies could also be based on overall calories per serving, calories per dollar, or many other criteria. Each is likely to have different effects. For example, whereas taxing high-calorie foods may have intuitive appeal, taxing foods that are high in calories per dollar (as opposed to calories per serving) may have a better effect on weight because consumers not wishing to increase costs will be forced to purchase foods lower in calories. Clearly more research is needed to identify an optimal tax/subsidy policy if the goal is to most efficiently improve diet quality and/or weight outcomes of consumers.

Although improving health is a primary objective of public health agencies and advocates, there are several valid objections to doing so through targeted food taxes. A primary concern is that food taxes large enough to improve health outcomes will further strain consumer budgets and more so for low-income households. A worst case scenario is that these taxes increase food insecurity. As such, any broad-based and large tax strategy should be associated with a correspondingly large subsidy to ensure that consumers' access to low-cost foods is not diminished.

Several economists, including some of the authors of this analysis, have further argued that a targeted food tax is inappropriate unless one can justify market failures that need to

be corrected (32). One possible justification is the costs that obesity imposes on public sector health plans. As noted in the introduction, these costs total roughly half of the annual costs of obesity and amount to many billions of dollars per year. Without empirical data tying specific foods to obesity it is difficult to make a case for which foods to tax/subsidize. However, that link has recently been made, thus providing a potential roadmap for an economically justified tax/subsidy policy on select foods (33). Future efforts could be made to identify the extent to which specific foods increase obesity-related costs and then to develop and test strategies aimed at recovering those costs through tax policy. These tests could be conducted via small scale real-world studies targeting specific population subsets or through experimental studies by the use of web-based grocery stores or other methods. It is important to note, however, that if one's sole goal is to recover the external costs of obesity to government, then such a tax strategy could be effective even if there is no reduction in caloric intake or weight. From a public health perspective, that outcome will be unsatisfactory.

Finally, even with limited evidence, several jurisdictions are implementing their own tax/subsidy policies aimed at improving food intake/obesity outcomes. For example, Denmark is now taxing foods containing >2.3% saturated fat (34). It will be important to quantify the effects of this and other tax/subsidy strategies in efforts to identify which are most successful in improving health outcomes.

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