

CORPORATE LEANWASHING AND CONSUMER BELIEFS ABOUT OBESITY

Aneel Karnani
Brent McFerran
Anirban Mukhopadhyay

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Aneel Karnani, PhD, is Professor of Strategy, Stephen M. Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI 48109, USA.

Brent McFerran, PhD, is W. J. VanDusen Associate Professor of Marketing, Beedie School of Business, Simon Fraser University, 500 Granville Street, Vancouver, B.C., Canada V6C 1W6.

Anirban Mukhopadhyay, PhD, is Professor of Marketing and Associate Dean, School of Business and Management, Hong Kong University of Science and Technology, Clear water Bay, Kowloon, Hong Kong. E-mail: Anirban.Mukhopadhyay@ust.hk.

Order of authorship is alphabetical and all authors contributed equally.

Abstract

Purpose of review. Caloric overconsumption, rather than lack of exercise, is the primary driver of overweight and obesity. We review people's beliefs about the causes of obesity, and the origins and consequences of these beliefs, and suggest possible mechanisms for corrective action.

Recent findings. In multiple samples across the world, approximately half the population mistakenly believes that lack of exercise is the primary cause of obesity. These misbeliefs have consequences: people who underestimate the importance of one's diet are more likely to be overweight or obese than people who correctly believe that diet is the primary cause of obesity. Next, we discuss the systematic misrepresentation of these factors -- which we call 'leanwashing' -- by the food and beverage industry. Corporate messaging and actions are likely contributing factors to these mistaken beliefs being so widespread, and corrective actions are required. These include regulation and taxation.

Summary. People's beliefs have important medical consequences, and the origins of these beliefs and misbeliefs need to be monitored and regulated.

Introduction

Over 300 million people worldwide are obese [1], and obesity is responsible for around 5% of all global deaths. The prevalence of obesity and overweight combined crosses 50% in many countries worldwide (e.g., Egypt, Morocco, Turkey, Russia, Ukraine, Mexico, much of the Caribbean, and most countries in South America; [1]), several of which are highly populous. Moreover, the growth rates are alarming almost everywhere. The number of overweight and obese individuals worldwide increased from 857 million in 1980 to 2.1 billion in 2013 [1]. Indeed, a recent McKinsey report estimated the global economic impact from obesity at US\$2.0 trillion, or 2.8% of global GDP, an amount roughly equivalent to the global impact from smoking, or armed violence, war, and terrorism combined [2].

The starting point for any solution must be a diagnosis of the problem. While obesity is influenced by many factors, such as poor diet, lack of exercise, genetics, and their interactions, overnutrition is the single most important factor [3, 4, 5]. Overnutrition involves both the quantity of food consumed and the quality of the diet [6]. The situation is well-summarized by a 2012 editorial in the *Journal of the American Medical Association*, which concluded that, "Obesity results from overnutrition and the primary therapeutic target is preventing or reversing overeating.... Exercise is associated with weight loss but its duration or intensity has minor effects on weight loss relative to diet" [7]. Essentially, people gain weight if they eat too much, and if they over-consume "empty calories" in food that has low nutritional value. Exercise, of course, is beneficial for one's health, but is relatively less instrumental for weight loss [8, 9]. As the prevalence of and cost of obesity grow ever faster every year and as people correspondingly succumb to weight-related afflictions, the problem of understanding how people make food-related decisions grows in importance and urgency [10, 11].

In this review, we provide an overview of research examining what laypeople (i.e., ordinary consumers) believe about the cause of obesity and how best to combat it. Our primary research shows that, in spite of the medical evidence, only about half of laypeople believe that bad diet is the primary cause of obesity. We then highlight how these misbeliefs have consequences, as our empirical research demonstrates people who mistakenly underestimate the importance of bad diet are in fact more overweight than people who correctly believe that bad diet is the primary cause of obesity. Next, we examine possible sources of the gap in knowledge between scientists and laypeople, which we deem a consequence of market failure. We highlight how the marketing, public relations, and so-called corporate social responsibility campaigns of food and beverage companies consistently overemphasize the role of exercise as the cause of obesity, and almost never mention diet. We call this systematic misrepresentation of the causes of obesity 'leanwashing', and argue that it is one of the hidden factors leading to obesity. Finally, we conclude with implications for public health policy, with particular focus on sugar taxes. We review the recent surge in the political popularity of sugar taxes in the US and other countries.

Laypeople's beliefs about obesity

The medical field has converged on the view that an unhealthy diet is the primary cause of obesity, but what is the public understanding of the science? In other words, what do laypeople believe? Across a series of surveys conducted in five countries (Hong Kong, South

Korea, the US, Canada and France), we found that about half of laypeople named poor diet as the primary cause of obesity and the other half named lack of exercise; other factors were barely mentioned [12]. Does it matter that about half the people are misinformed about the real cause of obesity? Unfortunately, it does.

These beliefs are associated with unfavorable consequences. We found that people who believed obesity is caused primarily by lack of exercise had significantly higher body mass index (BMI) -- a common measure of how heavy someone is relative to an accepted standard -- than those who attributed it to poor diet. In South Korea, for instance, the “diet theorists” had a mean BMI of 21.55 versus 23.10 for “exercise theorists” – a difference corresponding to ten pounds in weight for a South Korean of average height. The patterns were the same everywhere, even after accounting for other factors known to affect body mass, such as medical conditions, sleep deprivation, education, residential location, and stress. The evidence is cross-sectional, but we observed similar differences in several countries.

What explains this difference? Much research in psychology shows that people’s beliefs guide their actions [13, 14, 15]. In the context of weight loss, people who believe overeating primarily causes obesity should monitor the quality and quantity of their eating more so than people who believe exercise causes obesity. While the question of how the specific quality and composition of one’s diet is shaped by lay theories is open and needs further research (indeed, it is something we are currently investigating), we find causal, experimental evidence that those who believe diet causes obesity tend to eat smaller quantities. In contrast, people who blame insufficient exercise should try to increase their physical activity. But, as mentioned, it is harder to control weight using exercise rather than diet. Moreover, people generally overestimate how many calories they burn while exercising, and underestimate how many calories they eat [10, 16]. What is worse, we reward ourselves for exercise with an indulgent treat, and may end up consuming more calories than we had burned [17, 18]. Exercise has many health benefits, of course. But when it comes to weight control, people who just eat less simply tend to put on less weight.

Leanwashing

Why are so many people, roughly half the population, misinformed about bad diet being the primary cause of obesity? Our answer is: at least in part because of ‘leanwashing’ by the food and beverage industry. ‘Greenwashing’ is a term derisively used to describe the public relations and marketing activities of a firm to deceptively promote the perception that the firm’s strategies and actions are environmentally friendly. In a parallel manner, we use the term leanwashing to describe the public relations and marketing activities of a firm that promote the perception that the firm is helping to solve the obesity problem and to deflect attention from the fact that it might well be contributing to the obesity crisis.

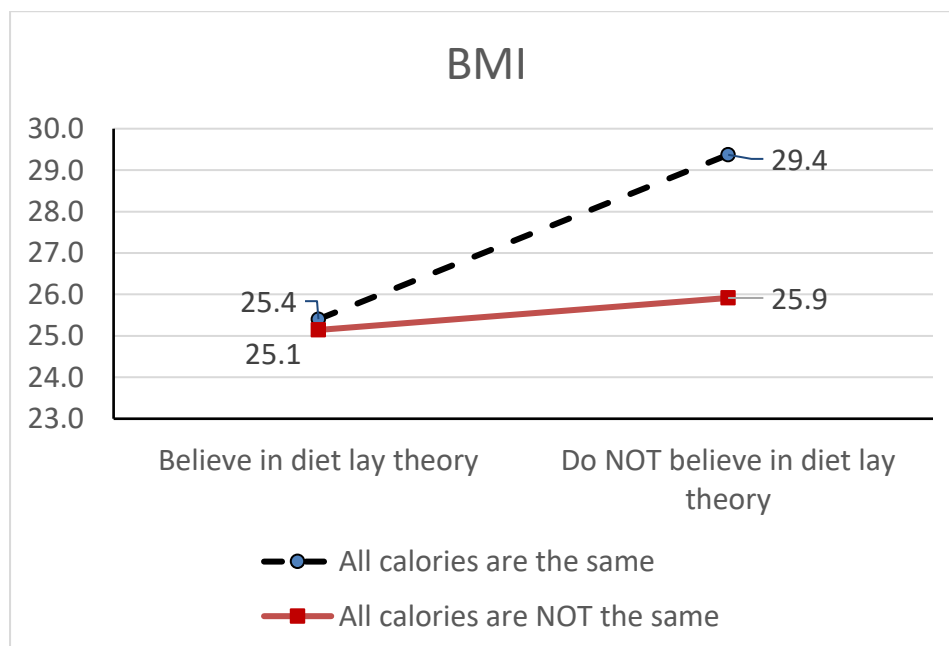
We analyzed corporate messaging of four types -- public statements, lobbying, philanthropy, and sponsorships of sports teams and events -- avenues whereby food companies disseminate messages not directly advertising a specific product [19]. The industry’s messaging has been consistently and overwhelmingly focused on either exercise or a “balanced” lifestyle, but almost never mentions poor diet as the cause of obesity. For example, a sampling of the websites of the following corporations revealed the extent of the unanimity — ‘active balanced lifestyle’: Coca Cola; ‘balanced active lifestyle’: McDonald’s; ‘balanced and

healthy lifestyle’: General Mills; ‘balanced diet and lifestyle’: Unilever; ‘well-balanced lifestyle’: Mars; ‘a balanced lifestyle’: Nestle, PepsiCo.

This unanimity is well supported by a concerted lobbying effort. The Center for Consumer Freedom (CCF), a nonprofit “lobbying front for the restaurant, food, beverage, and alcohol industries” states, in a paper titled “An Epidemic of Obesity Myths” that “A hefty number of studies has shown that the trend of rising obesity rates can be attributed not to increased intake of food in general (or any particular food) or to the influence of restaurants, but rather to less physical activity compounded by a variety of other factors that are constantly being explored” [20]. This same paper also states that “A calorie is a calorie” – a keystone of the “balance” philosophy that is also at odds with much (but not all) medical research.

To investigate the effect of slanted (and sometimes outright inaccurate) corporate messaging further, we investigated the possible joint effect of these two sets of beliefs – the extent of agreement with the idea that diet is the primary cause of obesity (in line with the medical consensus and opposite to the industry messaging) and the idea that a calorie is a calorie. In unpublished data, we asked 253 Americans (56% male, ages between 18 and 70, mean age 34) to indicate the strength of their belief that poor diet is the primary cause of obesity, and the strength of their agreement with the statement that a calorie is a calorie. Multiple regression revealed three interesting insights. First, consistent with our earlier research, belief in the diet theory was negatively associated with BMI ($p < .004$). Second, belief in the industry position that a calorie is a calorie was positively associated with BMI ($p < .03$). Critically, there was a significant interaction between the two beliefs ($p < .006$). Figure 1 plots the estimated BMI at 1 standard deviation above and below the mean of each predictor variable. As may be evident, the people who are likely to have significantly higher BMI than the others are those who believe both the food industry’s messages – diet is *not* the most important factor and a calorie *is* just a calorie.

FIGURE 1: THE JOINT RELATIONSHIP BETWEEN DIET LAY THEORY AND THE BELIEF THAT “A CALORIE IS A CALORIE” ON BMI



We analyzed several other ways in which the food industry misdirects consumer beliefs [19]. Every major sports competition, be it the Olympics, the National Football League (NFL), or the Indian Premier League in cricket, has a major food company as sponsor. Food companies help build and renovate neighborhood parks, playgrounds, and fitness centres, and launch initiatives called “Get In Step” and “Get The Ball Rolling”. First Lady Michelle Obama’s ‘Let’s Move’ campaign to address childhood obesity pivoted soon after launch from criticizing the food industry to promoting exercise, allegedly due to lobbying efforts [21].

We are not alone in reaching the conclusion about the role companies play in obfuscating the primary cause of obesity to the public. *The New York Times* recently ran a major article revealing that Coca-Cola paid researchers to shift blame for obesity away from bad diets to lack of exercise [22]. Barry Popkin, a professor of global nutrition at the University of North Carolina at Chapel Hill, said Coke’s support of prominent health researchers was reminiscent of tactics used by the tobacco industry. A few days later, Muhtar Kent, CEO of Coca-Cola wrote “the company, taking to heart criticism of how it deals with scientific research and childhood obesity, vows to improve transparency” [23]. The research and forceful advocacy of Robert Lustig, a paediatric endocrinologist, and author of *Fat Chance* has also gained much public attention. Other popular books also have focused on obesity, its causes and the role of food companies -- such as *Salt Sugar Fat* [24].

But to us, the most apt summary of the role of this industry comes from Indra Nooyi, the CEO of Pepsico, who responded to a question about her firm’s role in the obesity crisis by saying that children nowadays play on computers instead of outdoors – “lifestyles have changed” [25]. “If all consumers exercised, did what they have to do, the obesity crisis wouldn’t exist,” she said [26]. In other words, in response to public concerns about obesity, the food and beverage industry almost always argues in terms of personal choice and responsibility, even if science points to more systemic causes.

The Obesity Crisis as Market Failure

As the next step in this research stream, we broadened the scope of our investigation from food industry messaging to the effect of the industry as a whole. We analyzed the obesity crisis as a case of market failure in the food industry [27]. Our research and others shows that consumers are misinformed about food in various ways. Children clearly are not capable of making rational farsighted decisions about food. Even adults do not have full information or understanding about the foods they eat or about the causes of obesity (due to leanwashing among other reasons), and some foods have addictive properties. Economists refer to such gaps in knowledge between producers and consumers as asymmetric information, a significant cause of market failure. Another cause of market failure is the fact that the costs of obesity are not proportionately borne by either the relevant firms or the consumers, and instead are imposed on the taxpayers (in the case of government financed health care) or other people in the health insurance pool -- this is called an externality.

Research documents four potential mechanism to correct market failure: industry self-regulation, corporate social responsibility (CSR), consumer social activism, and government regulation [28]. Our analysis shows that each of CSR, industry self-regulation, or social activism are probably not sufficient to correct the market failure in the food and beverage market [27]. Thus, government intervention will be required for a meaningful reduction in the

prevalence of obesity. Others have reached this conclusion as well, for this industry [29] and more generally [30].

We analyze several possibly policy approaches that governments could take [27]. Of course, obesity is a complex problem that will require a multi-faceted approach to slow the growth in its prevalence, let alone reduce it. In short, increased education can be part of such a solution, as consumers do respond to certain well-designed educational interventions. Restrictions on marketing actions, such as regulating advertisements, banning certain products, or restricting their access are likely to be more effective but would be hard to implement politically. Actions aimed at children, such as restricting marketing of unhealthy foods, have empirical support and should be part of policy actions. Taxation is another class of actions that is gaining support of late.

Taxation

A straightforward way to correct a market failure due to an externality is to impose a Pigouvian tax on the behavior causing the externality. Many “sin” activities, such as alcohol are taxed heavily. Since refined carbohydrates are a factor in weight gain [31], a possibility is to impose a tax on sugar itself, or on products containing sugar; the most common example in practice has been a tax on sugary drinks. The focus on soft drinks is justified since per capita soft-drink consumption has increased by almost 500% over the past 50 years, and currently soft drinks constitute the leading source of added sugars in the diet and approach or exceed the daily limits for total added sugar consumption recommended by the US Department of Agriculture [31, 32]. Moreover, there is considerable evidence that the consumption of sugary drinks has adverse consequences on health, specifically, increased risk of cardiovascular disease, Type 2 diabetes, and weight gain leading to obesity [33, 34, 35]. Consequently, several jurisdictions have implemented such taxes, including Hungary (salt, sugar, and high caffeine), France (soft drink tax), (soft drink tax), Mexico (soda tax), and Denmark (fat tax). Norway and several Polynesian countries also have import and/or excise taxes on sugared beverages. In 2015, Berkeley, California, became the first American city to institute a tax on high-calorie sugary drinks. Historically there has been much political opposition to such taxes, especially in the U.S., but 2016 marked a turning point for sugar taxes.

In November 2016, voters in San Francisco, Oakland and Albany, all in California, as well as Boulder, Colorado, approved ballot measures imposing soda taxes. Cook County, Illinois, which includes the city of Chicago, passed a soft drink tax a few days later. Portugal, Spain, Estonia, UK, and Ireland are expected to introduce sugar taxes in 2017 or 2018 [36]. There is active political debate in other countries including New Zealand, Australia, Brazil, Colombia, Philippines, Indonesia, and India. "There's a momentum with these taxes that will be hard for the industry to stop," says Kelly D. Brownell, Dean of the Sanford School of Public Policy at Duke University, and an early proponent of a 'sin tax' on junk food [37].

This shift in favour of sugar taxes is due to a swing in both scientific and public opinion. A major event was the publication of a World Health Organization study urging all countries to tax sugary drinks [38]. The study concluded "there is a reasonable and increasing evidence that appropriately designed taxes on sugar-sweetened beverages would result in proportional reductions in consumption, especially if aimed at raising the retail price by 20% or more."

Research on the effectiveness of such taxes in practice is arriving soon after implementation. Falbe and colleagues found that in Berkeley, the soda tax led to a drop in consumption of sugar-sweetened beverages by 21%, while consumption increased by 4% in comparison cities [39]. This effect was more pronounced in low-income neighbourhoods. Water consumption increased significantly more in Berkeley than in comparison cities. Colchero and colleagues found that the tax on sugar-sweetened beverages in Mexico was associated with reductions in purchases of taxed beverages [40]. Relative to 2014, purchases of taxed beverages decreased by an average of 6%; this effect was most pronounced for households of low socioeconomic status.

Historically Coca-Cola, Pepsi and other beverage companies have used their significant resources to fight against any efforts to tax sugary soft drinks. The American Beverage Association, an industry trade group, spent \$38 million opposing the ballot measures in Fall 2016 -- but it lost every one [37]. The industry now faces a more sophisticated and well-financed opposition. Billionaire Michael Bloomberg, the former mayor of New York City, poured nearly \$20 million into the Bay Area, California, soda tax campaigns, hiring political consultants and media experts. John Arnold, a hedge fund billionaire also supported heavily the soda tax campaigns in Philadelphia and California. Both Mr. Arnold and Mr. Bloomberg said they hoped the recent election successes would make soda taxes a more popular idea, and "we certainly aren't going to walk away from this" [36].

Conclusions

Even if we accept that individuals are largely responsible for their own diet and lifestyle choices, "doing what they have to do" as the industry would have it, these same individuals are making these choices under misguided beliefs. And in today's environment, corporate messaging is one of the most prominent, and consequential, drivers of peoples' beliefs. Food and beverage companies should be held responsible for how they influence these beliefs.

Given our conclusion that market failures in the food industry cannot be corrected without government intervention, we contend the area where research is most needed is on government policies to address the obesity crisis. Specifically, how would consumers respond to steep food taxes? How can such taxes be presented (and sold) to constituents to make them more palatable? What about outright bans on products, ingredients, or advertising to certain groups? What is the content and structure of laypeople's belief systems: how do their beliefs about obesity interact with other related beliefs, about, for example, nutrients, supply chain (e.g., monocultures, organic farming), consumption norms, and taste? How can corrective messaging be designed to combat the 'junk science', 'fake news', and corporate misinformation that consumers are facing more frequently than ever before? These are some of the questions that form an agenda for research in this area going forward.

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Compliance with Ethics Guidelines

Conflict of Interest

A. Karnani, B. McFerran and A. Mukhopadhyay declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent

All reported studies/experiments with human or animal subjects performed by the authors have been previously published, with one exception. All reported studies/experiments complied with all applicable ethical standards (including the Helsinki declaration and its amendments, institutional/national research committee standards, and international/national/institutional guidelines).

References

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2014;384(9945):766-781.
2. *Dobbs R, Sawers C, Thompson F, Manyika J, Woetzel J, Child P, McKenna S, Spatharou A. Overcoming obesity: An initial economic analysis. McKinsey Global Institute, discussion paper. 2014; November. *This paper assesses the global economic impact of obesity*.
3. Blair SN, Brodney S. Effects of physical inactivity and obesity on morbidity and mortality: current evidence and research issues. *Medicine and Science in Sports and Exercise*. 1999;31(Suppl. 11):S646-S662.
4. Jakicic JM, Marcus BH, Gallagher KI, Napolitano M, Lang W. Effect of exercise duration and intensity on weight loss in overweight, sedentary women: a randomized trial. *Journal of American Medical Association*. 2003;290(10):1323-1330.
5. Ledikwe JH, Ello-Martin JA, Rolls BJ. Portion sizes and the obesity epidemic. *Journal of Nutrition*. 2005;135(4):905-909.
6. Ludwig DS, Friedman MI. Increasing Adiposity: Consequence or Cause of Overeating? *Journal of American Medical Association*. 2014;311(21):2167-2168.
7. Livingston E, Zylke JW. JAMA obesity theme issue: Call for papers. *Journal of American Medical Association*. 2012;307(9):970-971.
8. Malhotra A. Take off that Fitbit. Exercise alone won't make you lose weight. *Washington Post*. 2015;May 15.
https://www.washingtonpost.com/posteverything/wp/2015/05/15/take-off-that-fitbit-exercise-alone-wont-make-you-lose-weight/?utm_term=.45dd448c3a93
9. Malhotra A, Noakes T, Phinney S. It is time to bust the myth of physical inactivity and obesity: you cannot outrun a bad diet. *British Journal of Sports Medicine*. 2015;49(15):967-968.
10. Wansink B. *Mindless eating: why we eat more than we think*. New York: Bantam - Dell; 2006
11. *Wansink B, Chandon P. Slim by design: Redirecting the accidental drivers of mindless overeating. *Journal of Consumer Psychology*. 2014;24(3):413-431. *This paper reviews environmental drivers of food consumption quantity*.
12. **McFerran B, Mukhopadhyay A. Lay theories of obesity predict actual body mass. *Psychological Science*. 2013;24(8):1428-1436. *This paper demonstrates the existence and impact of laypeople's beliefs about the primary cause of obesity*.
13. Dweck CS. *Self-theories: their role in motivation, personality, and development*. Philadelphia, PA: Taylor and Francis; 2000.
14. Wyer RS Jr. *Social comprehension and judgment: the role of situation models, narratives, and implicit theories*. Mahwah, NJ: Erlbaum; 2004.
15. Mukhopadhyay A. An Ounce of Prevention, An Apple a Day: Effects of Consumers' Lay Theories on Health-Related Behaviors. In *Leveraging Consumer Psychology for Effective Health Communications: The Obesity Challenge*. Ed. Batra R, Keller PA, Strecher VA. M. E. Sharpe: Armonk, NY, 2011:87-103
16. Lichtman SW, Pisarska K, Berman ER, Pestone M, Dowling H, Offenbacher E, Weisel H, Heshka S, Matthews DE, Heymsfield SB. Discrepancy between self-reported and actual caloric intake and exercise in obese subjects. *New England Journal of Medicine*. 1992;327(27):1893-1898.
17. Church TS, Martin CK, Thompson AM, Earnest CP, Mikus CR, Blair SN. Changes in

- weight, waist circumference and compensatory responses with different doses of exercise among sedentary, overweight postmenopausal women. *PLoS One*. 2009;4(2):e4515.
18. *Werle COC, Wansink B, Payne CR. Is it fun or exercise? The framing of physical activity biases subsequent snacking. *Marketing Letters*. 2015;26(4):691-702. doi:10.1007/s11002-014-9301-6. *This paper demonstrates that if exercise is labeled as 'fun' versus 'exercise', people subsequently eat less unhealthy food.*
 19. **Karnani A, McFerran B, Mukhopadhyay A. Leanwashing: a hidden factor in the obesity crisis. *California Management Review*. 2014;56(4):5-30. *This paper reviews food marketers' communications on the topic of obesity.*
 20. *Lustig RH. *Fat chance: beating the odds against sugar, processed food, obesity, and disease*. New York: Hudson Street Press; 2013. *This book reviews possible links between processed foods and obesity.*
 21. Huber B. Michelle Obama's moves. 2012. www.thenation.com/article/170485/michelles-moves#
 22. O'Connor A. Coca-Cola funds scientists who shift blame for obesity away from bad diets. *The New York Times*. 2015;August 9.
 23. Kent M. Coca-Cola: we'll do better. *The Wall Street Journal*. 2015;August 19.
 24. *Moss M. *Salt sugar fat: how the food giants hooked us*. New York: Random House; 2013. *This book reviews the marketing practices of food companies.*
 25. Zakaria F. Interview with Indra Nooyi. In: *The Global Public Square*. CNN.com. 2011. <http://transcripts.cnn.com/TRANSCRIPTS/1104/17/fzgps.01.html>. Accessed 16 Feb 2017.
 26. Mangalindan JP. PepsiCo CEO: if all consumers exercised...obesity wouldn't exist. In: *Fortune 500*. 2010. http://archive.fortune.com/2010/04/27/news/companies/indra_nooyi_pepsico.fortune/index.htm. Accessed 16 Feb 2017.
 27. **Karnani A, McFerran B, Mukhopadhyay A. The obesity crisis as market failure: an analysis of systemic causes and corrective mechanisms. *Journal of the Association for Consumer Research*. 2016;1(3):445-470. *This paper reviews imperfections in the market for food and assesses mechanisms to address the problem of obesity.*
 28. Karnani A. Doing well by doing good--case study: 'Fair & Lovely' whitening cream. *Strategic Management Journal*. 2007;28(13):1351-1357.
 29. Nestle M, Jacobson, MF Halting the obesity epidemic: A public health policy approach. *Public Health Reports*. 2000;115:12-24.
 30. *Soman D. *The last mile: Creating economic and social value from behavioural insights*. Toronto: University of Toronto Press; 2015. *This book reviews the principles of behavioral economics and provides a framework for understanding how public policy can be guided by psychological principles.*
 31. Ludwig DS, Peterson, KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: A prospective, observational analysis. *The Lancet*. 2001; 357(9255):505-508.
 32. Brownell, KD, Farley T, Willett WC, Popkin BM, Chaloupka FJ, Thompson JW, Ludwig DS. The Public Health and Economic Benefits of Taxing Sugar-Sweetened Beverages. *New England Journal of Medicine*. 2009; 361:1599-1605.
 33. Ebbeling CB, Feldman HA, Chomitz VR, Antonelli TA, Gortmaker SL, Osganian SK, Ludwig DS. A Randomized Trial of Sugar-Sweetened Beverages and Adolescent Body Weight. *New England Journal of Medicine*. 2012;367:1407-1416.
 34. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. *American Journal of Clinical Nutrition*. 2006; 84(2):274-288.

35. Schulze MB, Manson JE, Ludwig DS, Colditz GA, Stampfer MJ, Willett WC, Hu FB. Sugar-Sweetened Beverages, Weight Gain, and Incidence of Type 2 Diabetes in Young and Middle-Aged Women. *Journal of the American Medical Association*. 2004; 292(8):927-934.
36. Whitehead R, Watson E, Chu W, Michail N, Gore L. 2016: The year of the sugar tax. *Beverage daily.com*. 2016;December 15. <http://www.beveragedaily.com/Trends/Soda-taxes-regulation/2016-The-year-of-the-sugar-tax>. Accessed 16 Feb 2017.
37. O'Connor A, Sanger-Katz M. As soda taxes gain wider acceptance, your bottle may be next. *The New York Times*. 2016;November 26.
38. *World Health Organization. Fiscal policies for diet and prevention of noncommunicable diseases. Geneva; 2016. *This paper suggests that taxation at appreciable levels can motivate reduced consumption of unhealthy nutrients.*
39. *Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA. Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *American Journal of Public Health*. 2016;106(10):1865-1871. *This paper assesses the initial impact of the 2015 soda tax in Berkeley, CA.*
40. *Colchero MA, Popkin BM, Rivera JA, Ng SW. Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. *British Medical Journal*. 2016;352:h6704. *This paper assesses the initial impact of the soda tax in Mexico.*