Sugar Addiction—A Significant Concern in the United States

Sugar addiction is a growing problem in America. Currently Americans consume unprecedented amounts of sugar, and despite the advice of the World Health Organization that people intake less than ten percent of their daily calories as sugar, it is evident that many have far more. Sugar is ubiquitous in processed foods; one can even find it in foods such as salad dressing, bread, lunch meats, tomato sauce, and peanut butter, none of which resemble sweet treats (Frahm). Varying amounts of sugar in foods that Americans consume every day quickly add up. The USDA found that American sugar consumption equated to about 158 lbs of sugar per year, which is over 30% of a 2000-calorie diet. Even by the more conservative estimate of the Sugar Association, the average American still eats about sixty-four lbs of sugar per year, which is 16% of a 2000-calorie diet. High levels of sugar consumption pose a number of concerns. Many understand sugar to be “unhealthy” as it is a refined carbohydrate. Table sugar, known technically as sucrose, is composed of glucose and fructose, and causes tooth decay. Many scientists believe it also leads to maladies such as obesity, diabetes, and heart disease. Even though the public continually hears negative messages about sugar, it is curious that sugar consumption continues to grow. Sugar addiction is a relatively new area of scientific research that seeks to explain our growing sugar consumption and its implications.
In order to understand sugar addiction, it is first necessary to decide on a definition of the phrase. Most studies on the subject use the terms “addiction” and “dependence” synonymously, referring to compulsive and sometimes uncontrollable behaviors, which occur at the expense of other activities. This means that somebody who is addicted to sugar may disrupt their normal activities due to food cravings, or may continue to eat despite feeling full or knowing they are endangering their health. Furthermore, addictive behaviors typically intensify with repeated access to the substance. Research on the health effects of sugar is complex because there are numerous factors involved, producing a wide variety of results—often because, as Riccardo Baschetti states, researchers do not consider the form or manner in which people consume sugar (934). By trying to understand sugar addiction, it becomes easier to explain why the results of these studies differ. Furthermore, any discoveries have significant implications for the study of diets and obesity. Therefore, a more complete understanding of how sugar and sugar addiction affects our bodies may help many to avoid dangerous habits, and be useful to doctors and nutritionists so that they can better help their patients. It is also useful as it may help scientists perform more accurate dietary studies.

Current research has shown the existence of sugar addiction in animals, and that sugar consumption interferes with diet regulation. Scientists have also examined other types of palatable food addictions—in particular, fat addiction. Palatability is an important concept used in studies on sugar, and in this context it involves appetite-stimulating foods (Kessler, 12). Compared to other palatable foods, I believe sugar addiction differs in that it creates stronger dependence and has far more negative health effects. Therefore, I will attempt to identify sugar addiction as a unique and more significant problem than other types of food addiction by incorporating research on its effects on appetite regulation. It will become clear though an
examination of dietary adherence studies that the manner in which sugar addiction occurs in animals suggests that common ways that people try to reduce sugar consumption may be unsuccessful or problematic. Whether or not people become dependent on sugar depends largely on their eating patterns. One of the most significant conclusions that one can draw from this research is that most scientists have not yet considered the impact of these addictive effects in dietary studies on the way in which they collect data and analyze results. These conclusions will help to identify implications of sugar addiction in humans that are drastic and far-reaching.

Neurochemical Effects of Sugar Addiction in Animals Suggest Similar Effects in Humans

A key scientific study performed by a team of researchers at Princeton University in 2006 sought to determine if sugar had addictive properties. Incorporating the methods used to measure drug dependence in animals, Nicole Avena, Pedro Rada, and Bartley Hoebel tried to discover if rats exhibited drug-like addiction symptoms after consuming an excess of sugar.

Figure 1 shows the criteria the researchers used to design their research and analyze their results. The researchers found that when they fed rats sugar intermittently, after a while, the rats would binge on sugar as soon as it was available, and exhibit opiate-like withdrawal symptoms when deprived of it (25). They also found that rats craved sugar, as those deprived of sugar for two weeks would consume significantly more after this period compared to those with regular access to sugar. In addition, they noticed that rats became “cross-sensitized”—that is, after exposure to amphetamines, they became hyperactive when
consuming sugar (27). The paper also recalls a previous study in which sugar had a “gateway effect,” as rats fed sugar intermittently and then deprived of sugar would intake more alcohol than those that initially had continuous access to sugar (27). Both of these results imply that sugar and drugs stimulate rats’ brains similarly. Along with these behavioral changes, the researchers observed neurochemical changes in the rats’ brains. These changes occurred when rats fed sugar on an intermittent schedule exhibited dopamine releases similar to those of addictive drugs, and showed “morphine-like neurochemical imbalance in [dopamine / acetylcholine] during withdrawal” (30). Rats with sugar available constantly did not show the same signs of dependency as those that the researchers provided sugar to intermittently. In combination, the results of this study present plausible evidence of sugar addiction in animals, which is applicable to humans because rats and humans share similar neurological systems. Previous research has shown that rats react quite similarly to humans when consuming addictive drugs, so the results from this study would likely be similar in humans given the same controlled conditions. Besides the conclusion that sugar can be addictive in rats, one can gleam from this study that eating patterns are essential to determining whether one can become addicted to sugar.

A later analysis by the same researchers in 2009 tried to find the specific conditions under which sugar induces dependence. They found that the intermittent feeding schedule appears crucial to the development of sugar addiction, as rats that have continuous sugar access “develop a blunted [dopamine] response that is typical of a food that loses its novelty” (34). The sporadic schedule, however, is more similar to eating patterns in humans. Most people do not have free access to sugary foods throughout the day—they eat them usually during meals. In rats, this infrequent consumption led to binge eating, and possible adaptations in the rats’ brains mimicking those of drugs (38). This combination of symptoms closely follows that of addictive
drugs and presents plausible evidence that humans can develop a sugar dependency if they intermittently consume a diet high in sugar. The researchers also noted that only the sweet taste of sucrose rather than actual digestion was necessary to trigger certain symptoms of addiction, suggesting that high-fructose corn syrup and artificial sweeteners could have similar properties (36).

Sugar Addiction Differs from Other Food Addictions

Compared to other food addictions, sugar addiction induces more drug-like symptoms and is more difficult to combat. In particular, the intermittent feeding behavior required for sugar to be addictive in animals may make it more difficult for humans to modify their diets. This result stands out through an examination of the common perception of sugar and the little effect this perception has on the behavior of Americans. Most popular media sources portray high sugar consumption as unhealthy. Even the Sugar Association, composed of companies in the U.S. sugar industry, tells readers of their website to consume sugar in moderation. The problem is that many interpret moderation to mean infrequent consumption. It is reasonable that many people will try to limit their sugar intake and then consume delicious treats on occasion. Unfortunately, this manner of eating sugary foods infrequently in large amounts is exactly what researchers have found to be most addictive in animals. David Benton debates the validity of sugar addiction when people are influenced by culture and environment in a way that rats in a controlled study are not (2). However, this environment may reflect a similar eating pattern to the one the lab rats followed. It is more likely that people try moderate their sugar intake consuming it less often instead of reducing consumption evenly. For example, if one was to reduce one’s soda consumption, it is more plausible that one would drink a carbonated beverage half as often, rather than drink half a can of soda each time. Intermittent sugar eating makes it
more difficult for people to track how much they actually consume, making it less effective, encouraging addiction.

An analysis of the difficulties in adhering to weight loss regimens by Laura E. Shay found one of the common difficulties to be relapse. The study states that “success for most individuals comes after several relapses” and that “91% of participants in the National Weight Control Registry report previous unsuccessful attempts to lose weight” (45). Sugar addiction may be one of the causes of this relapse, because it produces cravings and withdrawal symptoms in animal studies. People also report time and scheduling problems to be an issue in following diets (Shay, 45). Some claim that their lives are too busy or that they unable to dedicate enough time to change their habits. Instead of more evenly regulating their food intake, some people may instead snack intermittently or eat less often, similar to the eating patterns in rat studies.

Currently most scientists have reached a consensus that consumption of sugar regularly, in excess, can cause weight gain and induce diseases such as type 2 diabetes. However, it is debatable whether reduced consumption is as dangerous. Studies that vindicate sugar as a problem, such as a review produced by the National Academy of Sciences that the Sugar Association refers to, did not account for patterns of food intake. Since it is difficult for one to completely eliminate sugar from one’s diet, people engage in eating habits conducive to sugar addiction. As many may see this as still acceptable, people may discover that they are addicted to sugar regardless of their attempts to consume less.

Through an analysis of a variety of human and animal studies, and research about the food industry, David Kessler tries to show how Americans are addicted to palatable food. Kessler identifies “hyperpalatable” food as addictive and as the primary cause of overeating, classifying foods containing a combination of sugar, fat, and salt as the culprit (14). Based on
animal research studies, Kessler notes that an obesity-resistant rat fed a diet high in sugar will “grow just as fat as an obesity-prone rat on a high-calorie diet,” eating many more calories than it normally does (15). He cites another study in which “animals will work for foods that are high in sugar and fat even if they are not hungry” (30). Additionally, he mentions a discovery that rats will readily cross an open field to obtain sugary food when they would not otherwise (15). In order to connect these animal studies to humans, he draws upon the fact that people, when provided with an unlimited amount of food, will eat significantly more if the food is highly palatable (17). Kessler argues that a diet high in sugar alters one’s natural appetite and energy balance regulation, causing one to consume more than one would ordinarily. As evidence of this, he refers to another study that showed that dopamine levels in animals did not habituate to highly palatable foods as they would with other foods, a result that helps to explain Avena et al.’s discovery that dopamine levels can induce withdrawal (51). This means that repetitive exposure to sugary foods did not decrease their desire. Kessler’s examination of other studies is further evidence for sugar addiction in humans. However, in order to better understand food addiction, it is important to go beyond Kessler’s analysis of palatable foods and examine the differences between sugar addiction and addiction to other palatable macronutrients—in particular, fat.

While many studies that Kessler examines show palatability alone to be a significant part of the stimulus for addiction, it is not the only requirement. Even though sugar and fats evoke similar responses due to taste, upon absorption, they have distinctive effects. Sugar addiction, according to a 2009 review by Avena et al., differs notably in its addictive effects from fat. The researchers found “no significant evidence of opiate-like withdrawal” in rats provided fat-rich diets, even though they did find these symptoms caused by sugar (626). When deprived of food
for over a day, the rats fed diets high in fat did not show the same “signs of anxiety and somatic indications of distress” that the sugar-fed rats did (626). In order to explain this difference, the researchers suppose that fat intake stimulates a neuropeptide (protein-like molecule used for communication in the brain) called galanin, inhibiting the opioid withdrawal symptoms (627). These withdrawal symptoms involve opioid receptors that are so named because they are triggered similarly by opiates. So while the taste of sugar and other palatable foods may be addictive in itself, the actual intake of sugar has even more significant effects. Hoebel et al. suppose that glucose, a component of sugar, differs from other nutrients in that “it has its own receptor system in the tongue, the intestines, the liver, pancreas, and brain” (36), suggesting that sugar addiction in rats is aided by excessive stimulation of these receptors. Sugar stands out as fulfilling more properties of addictive drugs, which usually cause some sort of withdrawal symptoms. Consequently, sugar addiction differs significantly from other food addictions because it creates stronger dependence, increasing consumption more than other substances do. Increased consumption, combined with the other negative risks that will be discussed later such as greater mortality rates, indicate sugar addiction as a significant problem for Americans with far-reaching consequences.

**Sugar’s Ability to Control Appetite Can Cause Sugar Addiction**

In addition to causing addictive responses via neurotransmitters in the brain, sugar has been shown to interfere with appetite regulation, increasing sugar’s addictive potential. A group of researchers at Lund University in Sweden tried to analyze the effect that sugar consumption has on appetite-controlling hormones—specifically ghrelin, which has been “reported to initiate feeding;” leptin, which suppresses eating; and peptide YY (PYY), which also suppresses eating (26). Similar to Avena et al., they performed their carefully controlled study on rats. The team
provided the groups with sugar solution and chow, and the control group with water instead of
sugar. After two weeks, test groups ate less chow, but enough sugar to have consumed far more

Figure 2. (A) Rats fed sugar consumed less chow. (B) Rats fed sugar solution drank more than rats fed
water instead. (C) Rats fed sugars consumed more total calories. (D) Rats fed sugar gained more
weight over time.

calories than the other group, leading to “increased body weight” (28). In other words, the
presence of sugar modified the rats’ appetites. One can see the results of their study in Figure 2.
To find the cause of this overeating, the researchers recorded the fasting levels of ghrelin and
leptin in the rats after two weeks. They discovered that fructose, but not sucrose or glucose
increased ghrelin levels by 40%, and that all of the three sugars increased the rats’ leptin levels
(28). Both glucose and sucrose decreased PYY levels in the rats (28). Additionally, they found
changes in other appetite-controlling proteins. The researchers concluded that these changes
“may suggest that the rats are receiving signals to continue eating” (31). Furthermore, they looked at CB1 mRNA, a type of RNA that regulates appetite, and found that sucrose and fructose “seem to activate reward systems in the hypothalamus” (31). They believe that fructose is likely the cause of this “up-regulation of CB1 mRNA,” encouraging the consumption of more sugar (31). This study on appetite regulation corroborates Avena et al.’s study on sugar addiction. Sugar appears not only addictive because it causes binging and withdrawal, but also because it interferes with normal appetite regulatory mechanisms. Effectively, rats do not feel full when they consume sugar instead of chow, so they eat more than is necessary to maintain their weight. This effect fits in with the definition of sugar addiction, which includes uncontrollable behaviors. Most people who experience this effect will realize not that sugar controls their food consumption, rather than normal mechanisms. As people have similar processes of appetite regulation as rats, this overeating effect is significant because it may be one of the causes of obesity in humans.

Health Implications of Sugar Addiction

The implications of sugar addiction can be severe. A review by Johnson et al. published in the American Journal of Clinical Nutrition in 2007 compared the current trends in sugar consumption and obesity, and found a distinct pattern, which can be seen in Figure 3. The authors suppose that this relationship is more than merely a correlation, referencing evidence that even after many people switched low-fat diets, obesity rates continued to increase along with sugar consumption. Other studies have shown greater weight loss when people followed a diet low in carbohydrates and sugar (Gardner et al), and that one high in sugar can induce weight gain (Johnson et al). Researchers found that fructose, which comprises half of sugar and high-fructose corn syrup, is unable to adequately “stimulate insulin and leptin and to inhibit ghrelin,”
factors that influence satiety (Johnson et al), as the researchers from Lund University also found in rats. In addition to encouraging weight gain, high sugar consumption increases mortality, because it increases glucose tolerance. Connecting research that shows that sugar increases glucose tolerance with reports that elevated glucose tolerance increases mortality illuminates the danger of sugar addiction. Several studies have found evidence that consumption of sugar consumption causes increases glucose tolerance. T. Kawasaki et al. showed that “long-term sucrose drinking causes increased body weight and glucose intolerance in an ordinary strain of rats” (617). Similarly, a study by Kimber Stanhope et al., found that fructose, a component of sugar, decreased glucose tolerance (1736S). Many believe glucose intolerance to be a risk factor for diseases such as diabetes and coronary artery disease. The Whitehall Study, which began in 1967, examined a group of 17,896 male civil servants aged between forty and six-four over a period of about thirty-five years in order to examine the link between high sugar intake and mortality. In 2006, the researchers published the results of this significant study. As one would expect, they found that people considered diabetic or pre-diabetic had increased mortality levels because of their glucose tolerance (28). More importantly, they also discovered that people with even slightly elevated glucose tolerance levels (above 83mg/dl) had increased chances of dying due to coronary heart disease (29). The researchers found a relationship between glucose tolerance and mortality over a period of thirty-five years. As tolerance levels increased above the baseline of
83mg/dl, they found that mortality increased linearly (28). Keep in mind that the patients studied were not overweight and did not have other visible risk factors that may have been the cause of increased mortality. Along with a greater chance of death, glucose intolerance, according to Ten and Maclaren, leaves sufferers “prone to other complications, such as early atherosclerosis, progression of obesity … and increased cancer rate” (2532). Compared to the immediate results of sugar addiction, such as bingeing, the results of these studies are evidence of the far-reaching and potentially dangerous impacts of sugar addiction over an extended time period.

Marketing of sugary products to children early in life further encourages sugar addiction, as Ten and Maclaren found (2536). Children are bombarded with advertisements that influence what they eat, and as they are particularly vulnerable to drug addictions due to their age, they may also be more vulnerable to sugar addiction. During childhood, poor eating habits may determine one’s future obesity potential (2536). It seems ideal for adults to recognize symptoms of glucose intolerance and obesity in children in order to prevent their progression, which is easier to reverse the earlier they attempt to do so. This message implies that in general, it is useful to recognize when others have addictive eating problems that may be interfering with their health, since it is sometimes difficult for them to realize the issues themselves until the results are difficult to reverse. The two researchers found that in younger people, the presence of high blood glucose levels (hyperinsulinemia), which high sugar consumption may cause, presages glucose intolerance in the future. As Ten and Maclaren suggest that “family-based behavior interventions for obese children are considered safe and useful treatments” (2536), parental attempts to modify behavior conducive to sugar addiction may prove to be a helpful solution—given that the manner in which people consume sugar is important in producing its negative health effects, as Riccardo Baschetti hypothesizes (935). Specifically, Baschetti states that
consuming sugar in higher concentrations and more dense forms leads to a different manner of gastric emptying that affects how the sugar is absorbed (935). Eating behaviors resulting from sugar addiction, like bingeing, are likely to involve higher concentrations of sugar than normal, falling under Baschetti’s category of behaviors humans were not originally designed to handle. Taken together, the advice of these researchers suggests that treatment of undesirable eating behaviors in children, such as bingeing and high sugar consumption may be helpful in preventing addiction, as children are the ones most vulnerable to addictive behaviors and advertisements.

**Broader Implications of Sugar Addiction**

The existence of sugar addiction, and the neurochemical effects it causes call into question the validity of many previous dietary studies. As sugar addiction is a relatively new field of study, scientists have not fully explored how different manners of sugar consumption result in different neurochemical effects and effects on appetite regulation. As seen in the study by Avena et al., sugar, when consumed intermittently in binges, causes markedly different effects in rats than when rats have it at regular intervals in smaller quantities. Most dietary studies divide people into groups that follow different diets composed of specific quantities of certain foods or macronutrients, primarily fats, carbohydrates, proteins. However, many of these studies only focus on average food consumption levels. For example, a study by Gardner et al., assessed the number of calories and types of foods the patients consumed through “telephone-administered, 3-day, unannounced, 24-hour dietary recalls” (970), instead of more directly accounting for the exact times of day that people ate different types of foods. Even if the researchers collected this data, they did not report on it. Without examining the patients’ eating patterns, it may be difficult for researchers to get consistent results. This may explain why different studies focusing on the same goals often achieve different results, as these studies may
have had the patients consume similar diets but regulated consumption patterns in different ways. Widely differing results and conclusions from dietary studies can be confusing to many. By examining the extra variable of behavior, it may be possible for researchers to make new dietary discoveries that fit in with the current research on sugar addiction and the idea that the form of sugar consumed is as important as the amount one consumes. At the very least, looking at this additional data may help scientists to find previously unseen differences between diets that may explain why some are more effective than others.

The implications of sugar addiction extend beyond health impacts on Americans. Most importantly, as sugar addiction encourages more sugar consumption, demand for sugar and its similar counterpart, high-fructose corn syrup (HFCS), rises. The economic effects of HFCS are heavily discussed and provide an example of the broader effects of sugar addiction. Daniel Engber says that high-fructose corn syrup accounts for about “half of all the added sugars in the U.S. diet” (1), and is chemically similar to sucrose: the most common formulation of it contains 55% percent fructose and 42% glucose. Sucrose, the most common form of sugar, contains equal parts of glucose and fructose. Steadily increasing high-fructose corn syrup consumption poses a number of economic and environmental issues. A Washington Post article by Eviana Hartman recalls Michael Pollan saying that “‘the environmental footprint of HFCS is deep and wide’” causing dead zones due to “‘fertilizer runoff’” (1) from corn farms. Pollan also mentions how herbicides used in corn production for HFCS find their way into water supplies and have been shown to “‘turn male frogs into hermaphrodites’” (1). The article also points out how energy-intensive HFCS production is. The reason companies use it in such large quantities is primarily due to federal subsidies that keep prices of corn artificially low. Higher demand is not met with higher prices, and low costs enable HFCS to find its way into a significant number of
processed foods. As Kessler argues in his book, the easy availability of sweeteners for manufacturers of processed foods encourages excessive use, which is intensified by the addictive effect these foods have on many. The growing demand for sugar, encouraged by sugar addiction, will likely lead to more severe economic and environmental effects in the future.

With the rapidly growing sugar intakes of many Americans, it has become increasingly important for consumers, doctors, and scientists to examine sugar addiction and its implications. Hopefully, as an awareness of the effects of sugar addiction grows, people will reduce their sugar consumption to safer levels, helping to curb increasing obesity and mortality rates in the United States. Current governmental attempts to reduce sugar consumption are a step in the right direction. The Obama Administration recently devised a plan to ban sweetened beverages from schools, as Mark Bittman from the New York Times reports. Others believe that a sugar tax is worth considering. The article says that some public health advocates are “urging that soda be treated like tobacco,” which seems an appropriate reaction because sugar and drug addictions are similar. While these actions may not be the most effective means of addressing the problem of sugar addiction, they are an important step toward doing so. Since it is difficult for people to curb their sugar intake by themselves, government and other types of intervention may prove to be successful means of reducing sugar intake and addiction in America.
Works Cited


Images Cited


In political science, the study of rhetoric may be presented as an alternative to established perspectives on political beliefs and decision-making. In social and political psychology, interest in rhetoric arose as part of the "turn to language," a movement that involved a rejection of cognitivism, and a commitment to approaching talk and text as strategic communicative action rather than as expressions of inner psychological processes, states, or traits (e.g., Burman & Parker, 1993; Edwards, 1997; Harré & Gillett, 1994; Potter, 2000; Potter & Wetherell, 1987; Shotter, 1993). Consequently, rhetoric remains associated with its political origins. However, even the original instructors of Western speech—the Sophists—disputed this limited view of rhetoric. However, the enthymeme based upon logic (especially, based upon the syllogism) was viewed as the basis of rhetoric. However, since the time of Aristotle, logic has changed. Aristotle, writing several years after Isocrates, supported many of his arguments and continued to make arguments for rhetoric as a civic art. In the words of Aristotle, in the Rhetoric, rhetoric is "the faculty of observing in any given case the available means of persuasion". According to Aristotle, this art of persuasion could be used in public settings in three different ways. Rhetoric is the art of speech and persuasion, the study of argument and, in Classical times, an essential component in the education of the citizen. For rhetoricians, politics is a skill to be performed and not merely observed. Only a grasp of the techniques of rhetoric and an understanding of how they manifest themselves in contemporary politics, argues the author, can guide us in answering these perennial questions. Politics and Rhetoric draws together in a comprehensive and highly accessible way relevant ideas from discourse analysis, classical rhetoric updated to a modern setting, relevant issues in contemporary political theory, and numerous carefully chosen examples and issues from current politics. Rhetoric and politics or rhetoric in/of politics constitute a heterogeneous area of research. The long history of both rhetoric and politics gives anything but a straightforward answer concerning their interrelations. The common problem for the rhetoricians, discourse analysts and linguists who explore this area of research is therefore defining the object of analysis. What does qualify a language/discourse/rhetoric as political? The volume reflects latent ambiguity of rhetoric creativity—both liberating and potentially manipulative—based on the assumption than "things might be otherwise." Indeed, it illustrates a broad spectrum of nuanced realizations, from positive to negative ones. 172 Introduction to political science Chapter 12: Protecting the environment. 205 Aims of the chapter. 172 On 17 December 2010, a young man in Tunisia called Mohamed Bouazizi set himself on fire. Chapter 1 looks at what political science is. We answer this by discussing some of the main questions that political science tries to answer and by beginning to think about why politics is different in various countries and regions around the world. Next we introduce two different theoretical approaches to political science: those that emphasise the behaviour of individuals and those that emphasise the role of institutions.