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*Commentary: Food products. Addiction*

## Also in the mind



**Kelly Brownell**

Yale Rudd Center for Food Policy and Obesity

Yale University, New Haven, Connecticut, US

Email: [kelly.brownell@yale.edu](mailto:kelly.brownell@yale.edu)

**Mark Gold**

Department of Psychiatry, College of Medicine

University of Florida, Gainesville, US

Email: [msgold@ufl.edu](mailto:msgold@ufl.edu)

## Introduction

### Editor's note

This is an adapted version of the concluding chapter in *Food and Addiction: A Comprehensive Handbook*, whose editors are Kelly Brownell and Mark Gold. It was published on 31 August, the day before this issue of *WN* went on-line. The publisher is Oxford University Press. The editing, done with the authors' agreement, is designed to make the chapter self-contained and suitable for a relatively broad *WN* readership. We recommend the whole book. To purchase it, the link is [http://www.amazon.com/Food-Addiction-A-ComprehensiveHandbook/dp/0199738165/ref=sr\\_1\\_4?ie=UTF8&qid=1344867608&sr=8-4&keywords=kelly+brownell](http://www.amazon.com/Food-Addiction-A-ComprehensiveHandbook/dp/0199738165/ref=sr_1_4?ie=UTF8&qid=1344867608&sr=8-4&keywords=kelly+brownell)



*Everybody knows that some food products are intensely palatable, or habit-forming. It is only recently that their addictive nature is being recognised*

Is food and addiction a viable concept? We are sure that it is. The book that we have edited has brought together the world's top experts in nutrition, addiction, and the intersection of these fields. The whole work is impressive in quality and scope. It joins together studies using animal models with highly sophisticated human research, and converges on clear conclusions.

Here is our overall conclusion. Some types of food product can act on the brain as an addictive substance. Certain constituents of food products, added sugar in particular, may hijack the brain and override human will, judgement and personal responsibility, and in so doing create a public health menace. The products most likely to trigger an addictive process appear to be those marketed most aggressively by the food manufacturing industry, which formulates and manipulates its products to maximise palatability. Just like drugs of abuse, brain-rewarding effects or reinforcement from food products can lead to loss of control.

Vast numbers of people are likely to be affected, particularly those most vulnerable such as youth. The addictive impact of food products or their constituents may be a contributor to the global health crises created from obesity and diabetes, to the point where legislative and legal efforts might be informed by advances in this field, much as they were with tobacco.

We expect that the concept of food and addiction will enter the public and public policy limelight shortly. The evidence is compelling. The implications could be significant, in the way the public views nutrition and disease, in matters such as moral and legal culpability for health problems related to food, and in the way nations work to prevent diet-related epidemic diseases. Given the potential importance of this concept, it is essential that the work be robust, adequately funded, and communicated accurately and effectively.

## **The addict, or the food product?**

An important distinction here, is whether emphasis should be on individuals who are ‘food addicts’, or whether the food products themselves should be the focus and primary concern for the sake of the health of whole populations. Either the medical or the public health models can be applied. Each create different targets and potential outcomes. A traditional medical approach would focus on individuals with extreme eating patterns, in hopes of intervening to provide relief. Relatively small numbers of people might be identified as ‘food addicts’. In this case, intervention can be seen as helping people in need, but not as having a public health impact on whole populations.

A public health perspective changes the emphasis to food *and* addiction; which is to say, whether certain food products act on the brain as addictive substances with sufficient strength in a sufficient number of people in ways that affect global dietary patterns, and that therefore should affect policies and actions on global food systems and supplies. For instance, consumption of sugar-sweetened drinks is linked to risk of obesity and diabetes. Population consumption of these drinks has risen dramatically in recent decades. To the extent that high intake is driven by the addictive effects of added sugar, and of caffeination, is it reasonable to adopt the metaphor from drug addiction, and to say that food can hijack the brain? We think that yes, it is.

## What consumers say

In their chapter on the genetics of obesity, Wendy Chung and Rudolph Leibel state: 'The fact that apparently voluntary activities – eating and physical activity – strongly influence energy balance, has led to the notion, still prevalent in many quarters, that individuals become obese solely by acts of free will and choice. While there may be some perverse righteous satisfaction in this formulation, the biology does not suggest this'. Biological vulnerabilities, apparently shared by most humans given high rates of obesity, intersect with a toxic food and activity environment to produce disease. How important is the addictive effect of food?

If we listen to what people actually say, the addiction concept seems plausible. It is common for people to use addiction-like terms to describe aspects of the ways they eat and drink. Cravings for specific food products are often described. People speak of withdrawal when they stop using products containing caffeine and added sugar. There is clear evidence that eating can map on to the diagnostic criteria for substance abuse – as an obvious example, consumption of food beyond the point where harm occurs. It is informative to examine such observations and then to see if these are supported by available science.

Food manufacturers themselves use colloquial addiction terms. They commonly advertise products as satisfying cravings, and may even refer to concepts like 'chocoholism'. Recent examples are an advertising campaign run by Dunkin Donuts for its products using the line 'Craving, Meet Your Maker', and a McDonald's campaign for the Angus Third Pounder Deluxe which said 'Crafted For Your Craving'. This may be no more than marketing ingenuity, but it would be extremely interesting to obtain and inspect internal industry documents, to see how often the language of addiction is used in consideration of product formulation and of advertising and marketing.

Several chapters in our book are written by professionals who direct food addiction programmes. One is written by a person who sees herself as a food addict, sought help, and changed her life as a consequence. We consider these chapters to be dispatches from the field. They provide clues based on observation and personal experience that hint at underlying biology and that suggest clusters of symptoms that may have clinical meaning, and might form the basis for treatment programmes testable in clinical trials.

These chapters tell stories and provide observations of peoples whose lives have been governed by their relationship with food. These stories read like those of people addicted to classic recognised substances of abuse, with similar helplessness, similar problems controlling use, and similar impacts on family, friends, work, and more

## A brain disease

It is now understood that drugs of abuse hijack the brain, and that addiction is a disease of the brain (1). One of us (Mark Gold) has with colleagues since the 1970s worked on heroin and the *locus coeruleus*, and cocaine and dopamine, and on addictions in general. During this work, it became clear that drugs of abuse cause changes in eating and weight, and that withdrawal causes opposite changes (2). Comparably, food is compulsively appealing to a person in early withdrawal.

While we first posited the food addiction hypothesis (3), we had few data (4,5). Clinical results from pre-bariatric surgery cases confirmed that drugs and alcohol interfered with appetite, and that withdrawal caused increased appetite, compulsive eating, and weight gain. Bart Hoebel and Nicole Avena showed that animals will avidly self-administer glucose, and that naloxone administration caused opiate withdrawal-like symptoms in these glucose-bingeing rats (6). So for these animals self-administration indicates that glucose is a drug and addiction is possible (7). Also, withdrawal is provoked by opiate blockade. It was a remarkable series of studies by this Princeton group, demonstrating self-administration, withdrawal, bingeing, and cross-tolerance to other drugs of abuse. (8-11).

Major advances followed Nora Volkow's and Brookhaven National Laboratory's building of a positron emission tomography (PET) facility capable of scanning obese and morbidly obese patients. First, they showed that these people had down-regulation of the D2 dopamine receptor, as do alcoholics and other addicts (12). They also showed brain-stomach connections (13), as well as changes in the somatosensory cortex in obesity and after bariatric surgery. The work of Gene-Jack Wang and Nora Volkow led to the conclusion that that overeating and obesity changed the brain, as if any practically any food consumed was a drug (14).

## Which substances may be addictive?

Which substances in food are most likely to be addictive, and why? Thus far research has focused primarily on added sugar. This is justified based on biological plausibility, and also because added sugar is an important reason why calories are over-consumed. Intake of added sugar in US adolescents, for instance, is two to three times higher than recommended. The evidence suggests that such added sugar acts on the brain in ways similar to substances of abuse, strengthening the case for making foods high in added sugar a high priority for public policy.

Indeed, added sugar is already targeted as a policy priority. A great many organisations have called for reductions in sugar or sugared drink consumption,

including the American Heart Association, the American Medical Association, the American Academy of Pediatrics, and the World Health Organization. Cities including New York, Los Angeles, Boston, Seattle, Philadelphia, and Cleveland, have launched aggressive anti-sugared soft drink campaigns or have moved to ban the sales of such drinks in municipal facilities.

We believe that emphasis on added sugar is justified, but food products contain much more than sugar. Added fat, because it is so highly palatable and energy-dense, would be a logical constituent to examine, but has been the focus of relatively little work thus far. Individuals who direct food addiction programmes mention refined flour as a problem, but again, relatively little research has been done on this.

Processed foods contain a great many ingredients with entirely unknown effects on the brain. For example, here below is the ingredient list for a popular line, a 'Frosted Chocolate Fudge Pop Tart', which shows a stunning array of chemicals involved in the manufacture of such products:

*Enriched flour (wheat flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid), sugar, dextrose, soybean and palm oil (with TBHQ for freshness), corn syrup, whey, cracker meal, high fructose corn syrup; contains 2 per cent or less of cornstarch, cocoa, cocoa (processed with alkali), salt, calcium carbonate, modified corn starch, leavening (baking soda, sodium acid pyrophosphate, monocalcium phosphate), mono- and diglycerides, sodium stearoyl lactylate, gelatine, egg whites, datem, xanthan gum, partially hydrogenated soybean oil, caramel color, soy lethicin, color added, vanilla extract, vitamin A palmitate, niacinamide, tricalcium phosphate, reduced iron, pyridoxine hydrochloride, riboflavin, thiamine hydrochloride, folic acid.*

Industry's aim is to maximise sales by enhancing the reinforcing properties of its products. A great many colourings, preservatives, fragrances, and 'flavour enhancers' (including caffeine, said by industry to enhance flavour) are added to food products. Manufacturers are not required to test their products for addictive effects on the brain or on the extent to which constituents of its products provoke overeating. The US Food and Drug Administration requires that food additives be GRAS (Generally Regarded As Safe), but addictive effects on the brain have not been considered relevant to considerations of safety. We think this may change.

## Evolutionary drives

There could well be reasons related to human evolution, to explain why some foods or food products are addictive. With food needed to survive, the foods with greatest survival value, which is to say those that are most energy-dense, are the most desirable and would be consumed in large amounts when the environment provided them. Because such foods would be abundant only occasionally, mechanisms to

protect against overuse would not be necessary, and eating beyond the satisfaction of short-term hunger would be adaptive, in order to maximise energy stores.

Innate drives to consume energy-dense foods are now no longer adaptive but destructive. Industrial processing by manufacturers has created products that do not appear in nature and that are stripped of constituents that slow their reinforcing properties. Much as the only mildly reinforcing coca leaves are processed into highly and immediately reinforcing cocaine, foods are made to be as immediately reinforcing as possible, creating a biological drive for more, followed by withdrawal, and so on and on, and chaos with the body's ability to regulate eating and weight.

Who is most vulnerable? Certain segments of the population might be especially sensitive to the addictive properties of various food products. Exposure early in life to drugs of abuse is an especially serious problem. By analogy, the age at which children first consume foods products with addictive potential might be an important consideration. This would be especially important if exposure to such products alters the brain, perhaps permanently, such that tolerance and cross-sensitisation occur. Policies to protect youth from such products may be justified.

Other demographic variables may make certain groups more vulnerable, for whom the marketing of unhealthy products will be highly problematic. The chapters by Shiriki Kumanyika and Jennifer Harris show that some demographic groups are at particularly high risk for obesity and related diseases such as diabetes, and that these groups have greatest exposure to the marketing of unhealthy foods.

## **The need for regulation**

What is to be done? Government certainly has a duty to regulate access to and the price and marketing of products known to have addictive properties. There are strict rules and regulations about sales of legal but addictive products. Their taxes are high, there are restrictions on marketing, and government compels disclosure, such that manufacturers are required by law to make declarations contrary to their commercial interest, like adding warning labels to packages..

It might now seem far-fetched to think of warning labels on some food products, or restrictions on sales of these products to minors, but such policies and actions once seemed far-fetched with tobacco and alcohol. The political power of the food manufacturing and allied industries might seem a daunting obstacle to policy change, but the tobacco industry was once considered invincible. There are now a substantial number of indications that the US and many other countries view policy change, in some cases directly confronting the interests of the manufacturers, as the hallmark of an obesity prevention strategy.

We believe that there will soon be common public awareness of the concept of food product addiction, and that attention to the issue by policy-makers will generate a number of new legislative and regulatory debates and then statutory measures. It is therefore instructive to examine the policies that have been developed in areas such as tobacco, alcohol, and drugs.

## **Tobacco, alcohol, drugs**

A great deal is known about public policy on addictive substances, learned from decades of lessons with tobacco, alcohol, and drugs. Thus in his chapter on tobacco, Kenneth Warner states, of countries like the US: 'The rise and fall of smoking during the 20th century may well prove to be one of the most significant, and fascinating, stories in the history of public health'.

It is instructive to see what promotes addictive substances. In their chapter in alcohol policy, Ian Gilmore and Karishma Chandaria note, 'The consumption data indicate that there has been increased access to alcohol across three dimensions: real price, availability, and the social acceptability of drinking'. The widespread access to, and the low cost of unhealthy food products is characteristic of the modern industrialised food environment.

There has already been work on limiting access to unhealthy food products, particularly among youth. School policies have changed dramatically, at local, state, and federal levels. The restriction of products that compete with school meals, and banning sugared drinks and snacks in canteens and vending machines, is quite common. In these cases schools have become a safer nutrition environment (15). The mayors of Cleveland and Boston have proposed ordinances banning the sale of sugared drinks in municipal buildings. We expect that more such initiatives will come.

In chapters on tobacco, alcohol, and drugs respectively, the importance of price is emphasised. Robert DuPont states 'Real demand reduction involves not only limiting the supply of drugs but also raising their prices'. Ian Gilmore and Karishma Chandaria point out that when Finland reduced alcohol taxes by 33 per cent in 2004, there was a 10 per cent increase in consumption and 16 and 31 per cent increases in alcohol-related mortality for men and women, respectively. Kenneth Warner, an economist who has done pioneering work on tobacco taxes, sees a direct relationship between increasing taxes and lower consumption.

Due in part to agriculture subsidies and trade policies, there is a divide between the costs of healthy foods and unhealthy food products. Government agriculture policy

surely should align with health and nutrition policy, such that economic influences on food systems favour healthy foods. The reverse is true now.

It is likely that attention to food taxes will increase. There has been considerable discussion in the US on taxes on sugared drinks (16,17). Drinks manufacturers have launched massive campaigns to fight such taxes. Denmark has a comprehensive tax programme designed to raise prices on food products with added sugar and saturated fat. Hungary has taxes designed to affect consumption patterns. A number of other countries are considering such approaches.

An issue related to both price and access, is whether government food assistance programmes should pay for or provide foods linked to risk for diseases such as obesity and diabetes, that tax-payers largely pay for through programmes like Medicare and Medicaid (18). Whether certain food products are addictive or have addictive potential may have a strong influence on this debate.

## Pushing the products

There is a large literature on food product marketing, which is powerful, pervasive and pernicious (19). The well-known report on children's food marketing published by the US Institute of Medicine begins by stating: 'Marketing works' (20). Ian Gilmore and Karishma Chandaria note that the same is true for alcohol: 'In 2003 the World Health Organization review concluded that: "The promotion of alcohol is an enormously well-funded, ingenious and pervasive aspect of modern life . . . Exposure to repeated high-level alcohol promotion initiates pro-drinking attitudes and increases the likelihood of heavier drinking".' Further: 'Robust external governance of alcohol advertising is needed to tackle both the volume as well as the nature of advertising'.

In her chapter on food marketing, Jennifer Harris shows how much marketing there is, how it circumvents cognitive defences and parental authority, how sophisticated it has become, and how many forms of media deliver it, now including social media such as Facebook. In the US there is much debate about the role of federal regulatory bodies such as the Federal Trade Commission and the Food and Drug Administration in addressing this problem. There is also some authority at the state level, particularly through state Attorneys General (21).

The science on food products and addiction may well have an important role to play in decisions about how far government might move to restrict marketing. Knowledge that food products can be injurious to health is the current impetus for marketing restrictions. If that is amplified joined by concerns with the effects of food products on the brain, more aggressive restrictions might be possible.

## Legal actions

If some food products or some of their constituents affect the brain to the extent that judgment and responsibility are impaired or overridden, are the manufacturers legally liable? This issue is likely take years to clarify and would involve public attitudes, scientific input, court actions being mounted, and interpretation of the law by the courts. The chapter in our book by Stephen Teret and Lainie Rutkow says that there is a basis in legal theory for addressing this issue.

If corporations are accused of liability, an important issue is: who knew how, where and when culpability began? This is yet another example of an action, litigation perhaps, that might seem far-fetched at the moment. But at one point it seemed far-fetched to hold tobacco corporations responsible for addiction and health damage. As recently as 1994, top executives of seven leading tobacco corporations swore under oath before the US Congress that nicotine is not addictive. Internal industry documents later showed that the industries knew full well about nicotine and addiction, with some of the studies being done by their own scientists. When the public and legislators discovered that these industries were intentionally manipulating nicotine levels, outrage was the result.

There is general widespread concern about negative impacts of food on health. In the US it is why schools are kicking out junk foods, why the Food and Drug Administration is beginning to crack down on health claims, and why the Federal Trade Commission is looking seriously into food marketing directed at children. There may be different culpability timetables for the health consequences of food and the addictive nature of food products. If outrage builds about manufacturers manipulating ingredients such as sugar, and a solid case is made about substances in food products hijacking the brain, corporations may have an entire new level of legal exposure to confront.

## What will the manufacturers do?

Food manufacturers and their allies have not yet begun a vigorous effort to address the issue of food products and addiction. We think it is just a matter of time until they do. Once the science becomes more public and is discussed in policy circles, manufacturers will be put on the defensive and are likely to act in predictable ways. The behaviour of the tobacco industry, and also the response of food manufacturers to damaging evidence thus far on other fronts (for example, links of sugared drink consumption with ill-health and disease) suggest a likely script, as follows:

- Ignore the issue until it begins to enter public discourse.
- Dismiss the idea and lampoon any suggestions of its validity.
- Hire public relations firms to characterise available studies as ‘junk science’.
- Attack scientists, sometimes personally, claiming they are biased against industry.
- Pay scientists to undertake studies that plant doubt.
- Call in favours from community groups and professional associations it has supported to discount the concept.
- Begin a public relations campaign to counter the concept.
- Make self-regulatory pledges to care for the public good and issue promises to change business practices such as marketing certain products to children.
- Spend massive amounts to lobby against policy changes that would alter its ability to continue business as usual.
- Work to have industry figures or supportive political figures installed in key regulatory agencies in order to stall, subvert or weaken regulatory action.

So far food manufacturers have reacted much like the tobacco industry, as evidence has emerged about the damaging impact of some food products (22,23). In the case of tobacco, industry misbehaviour delayed and even prevented public policy actions that could have saved millions of lives. This history must not be repeated with food.

## **Unhealthy environments**

A number of chapters in our book make clear that bad food environments are driving unhealthy food supplies and dietary patterns. All over the world, food environments are increasing access to, promotion of, and low costs for, food products that are energy-dense, and fatty, sugary or salty. Conditions such as poverty leave some segments of the population especially high vulnerable.

When unhealthy conditions are normal (26) ill-health is normal. Further attempts to portray obesity and diet-related diseases as personal failings and individual irresponsibility will, we believe, fail. These will become no more successful than attempts by the tobacco industry to make the same sort of claims about diseases caused by smoking and exposure to tobacco smoke. Knowledge that food products can impact the brain in ways similar to classic drugs of addiction, and that these very products are those that are most heavily promoted, most of all to children, could become a key impetus for changes in social norms and attitudes to food manufacturers and could catalyse bold policies and actions.

As mentioned earlier, there is no better example than schools. As Gary Schwartz points out, it is the children in schools with worse food policies who eat worse.

When policies improve, children's diets improve. Opponents argue against improving foods in schools with statements like 'Kids will then just eat more of these foods after school', as if children have a 'junkostat' that keeps consumption of unhealthy foods constant. Research shows the opposite. When children's diets improve as schools clean up and clear out the junk food, they do *not* react by eating more of these foods outside school.

This concept of improving health by changing its environment is an elementary principle of public health. It is also used by addiction experts. In his chapter on drug policy, Robert DuPont says: 'Because brain biology cannot be changed and because the drugs of abuse are not going to go away, the major public health opportunity is to focus on efforts in the environment in which decisions are made to use or not to use drugs of abuse'.

Ian Gilmore and Karishma Chandaria, speaking of alcohol policy, take this concept a step further. They emphasise the role of government: 'The acknowledgement of the role of wider determinants of health on individual choices in alcohol and food consumption are encapsulated in the "stewardship" model that implies that the state has a duty to look after important needs of people individually and collectively. It emphasises the role of the state in fostering conditions that allow individuals to make healthy choices and, in particular, to ameliorate health inequalities. The stewardship-guided state sees the health of the nation is an asset and higher levels of health corresponding to greater well-being and productivity'.

We agree that government has a role, indeed a duty, to exert stewardship over environments that foster good health. When the environment becomes toxic in ways that predict and create high levels of disease, government has the opportunity to act for the collective benefit of its citizens, and must sometimes have courage to resist corporate interests determined to protect the *status quo*.

## Conclusion

We believe it is critically important to connect science with public policy, such that science is communicated effectively with policy-makers and scientists can respond rapidly to the need for studies that can inform policy. There are many positive signs that this is occurring. More can be done.

Discourse about food and addiction may well play a pivotal role in determining how government will now deal with diet, nutrition, and problems such as obesity. The public now believes that foods can act in addictive ways, and this is without widespread knowledge of the available science. It is a short jump to then become angry with industry for manufacturing such foods and promoting them so

aggressively. This can mobilise groups like parents, health professionals, and public interest non-government organisations to work together with government officials for change. Elected leaders, aware of public sentiment and concerned with high rates of obesity and diabetes, may be less likely to yield to industry pressures and may create policies to foster a better food environment.

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