FOOD ADDICTION: A BRAIN DISEASE?
Testing the hypothesis of food addiction

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“…comes to us with a great deal of knowledge to share but also an expressed interest in learning more about what is going on in the scientific world of addictions.”
OBESITY TRENDS AMONG U.S. ADULTS
("BMI > 30, or about 30 lbs overweight for 5'4" person)

1991

1993-1995 Combined Data

1998-2000 Combined Data

2008-2010 Combined Data

Legend:
- No Data
- <10%
- ≥10% and <15%
- ≥15% and <20%
- ≥20% and <25%
- ≥25% and <30%
- ≥30%
Prevalence of obesity*, ages 20+, age standardized
Both sexes, 2008

Prevalence of obesity (%)
- <10
- 10–19.9
- 20–29.9
- ≥30
- Data not available
- Not applicable

* BMI ≥30kg/m²

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization
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Fig. 7.1 Age-standardized prevalence of obesity in men aged 18 years and over (BMI ≥30 kg/m²), 2014

Prevalence of obesity (%)*

- <5
- 5–14.9
- 15–24.9
- Data not available
- Not applicable

* BMI ≥ 30 kg/m²
There has been a dramatic increase in unhealthy weights in Canada. Childhood overweight and obesity has been rising steadily in Canada in recent decades. Between 1978/1979 and 2004, the combined prevalence of overweight and obesity among those aged 2 to 17 years increased from 15% to 26%.

Increases were highest among youth, aged 12 to 17 years, with overweight and obesity more than doubling for this age group.

Eating behavior involving the overconsumption of specific foods in an addiction-like manner.
**Hooked on Food**

Our brains maintain healthy body weight by signaling when to eat and when to stop. Hormones regulate feeding circuits that control appetite and satiety (blue). But fatty, sugary foods can motivate some people to overeat (red). The more they have, the more they want, a sensation common in drug addiction.

**Overeating: Brain Chemicals Hijack the Controls**
Foods that are dense in fat and sugar prompt the striatum to make endorphins. “Feel good” chemicals that can trigger binge eating. The foods also spark dopamine release (red lines) by the striatum, which motivates feeding behavior, and into the prefrontal cortex, which influences decision making. In some people, the actions of endorphins, dopamine and other chemicals that regulate reward systems can overpower hormonal signals and conscious attempts to stop eating when full. A strong motivation to eat high-calorie foods prevails despite an individual’s knowledge about health consequences.

**Treatment Prospects**
Addictive drugs lead to dopamine release and feedback loops in the brain that can spur people to seek more and more—just as overeating high-calorie foods can do. Medications that could break this cycle could possibly ease not only drug addiction but obesity.

**Normal Eating: Hormones Signal Start and Stop**
Appetite-stimulating hormones from the gut (solid blue lines) alert feeding circuits in the hypothalamus. They also stimulate reward centers, such as the ventral tegmental area and the striatum, which increases the pleasure associated with eating. As the gut fills and blood nutrient levels rise, appetite-suppressing hormones such as leptin and insulin are released (dashed blue lines) in the hypothalamus and reward centers to suppress appetite and inhibit pleasure, making more food less appealing.
This survey asks about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:
- Sweets like ice cream, chocolate, doughnuts, cookies, cake, candy, ice cream
- Starches like white bread, rolls, pasta, and rice
- Salty snacks like chips, pretzels, and crackers
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza, and French fries
- Sugary drinks like soda pop

When the following questions ask about “CERTAIN FOODS” please think of ANY food similar to those listed in the food group or ANY OTHER foods you have had a problem with in the past year.

<table>
<thead>
<tr>
<th>IN THE PAST 12 MONTHS:</th>
<th>Never</th>
<th>Once a month</th>
<th>2-4 times a month</th>
<th>2-3 times a week</th>
<th>4 or more times daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I find that when I start eating certain foods, I end up eating much more than planned</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I find myself continuing to consume certain foods even though I am no longer hungry</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I eat to the point where I feel physically ill</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. Not eating certain types of food or cutting down on certain types of food is something I worry about</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I spend a lot of time feeling sluggish or fatigued from overeating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. I find myself constantly eating certain foods throughout the day</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase certain foods even though I have other options available to me at home.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. There have been times when I consumed certain foods so often or in such large quantities that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. There have been times when I consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. There have been times when I avoided professional or social situations where certain foods were available, because I was afraid I would overeat.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. There have been times when I avoided professional or social situations because I was not able to consume certain foods there.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods. (Please do NOT include withdrawal symptoms caused by cutting down on caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13. I have consumed certain foods to prevent feelings of anxiety, agitation, or other physical symptoms that were developing. (Please do NOT include consumption of caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14. I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15. My behavior with respect to food and eating causes significant distress.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16. I experience significant problems in my ability to function effectively (daily routine, job/school, social activities, family activities, health difficulties) because of food and eating.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
IN THE PAST 12 MONTHS:

<table>
<thead>
<tr>
<th></th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. My food consumption has caused significant psychological problems such as depression, anxiety, self-loathing, or guilt.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>18. My food consumption has caused significant physical problems or made a physical problem worse.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>19. I kept consuming the same types of food or the same amount of food even though I was having emotional and/or physical problems.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>20. Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions or increased pleasure.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>21. I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>22. I want to cut down or stop eating certain kinds of food.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>23. I have tried to cut down or stop eating certain kinds of food.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>24. I have been successful at cutting down or not eating these kinds of food</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

25. How many times in the past year did you try to cut down or stop eating certain foods altogether?

<table>
<thead>
<tr>
<th></th>
<th>1 time</th>
<th>2 times</th>
<th>3 times</th>
<th>4 times</th>
<th>5 or more times</th>
</tr>
</thead>
</table>

26. Please circle ALL of the following foods you have problems with:

<table>
<thead>
<tr>
<th>Ice cream</th>
<th>Chocolate</th>
<th>Apples</th>
<th>Doughnuts</th>
<th>Broccoli</th>
<th>Cookies</th>
<th>Cake</th>
<th>Candy</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Bread</td>
<td>Rolls</td>
<td>Lettuce</td>
<td>Pasta</td>
<td>Strawberries</td>
<td>Rice</td>
<td>Crackers</td>
<td>Chips</td>
</tr>
<tr>
<td>Pretzels</td>
<td>French Fries</td>
<td>Carrots</td>
<td>Steak</td>
<td>Bananas</td>
<td>Bacon</td>
<td>Hamburgers</td>
<td>Cheeseburgers</td>
</tr>
<tr>
<td>Pizza</td>
<td>Soda Pop</td>
<td>None of the above</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

27. Please list any other foods that you have problems with that were not previously listed:
## Diagnostic and Statistical Manual of Mental Disorders (DSM-5)

<table>
<thead>
<tr>
<th>Substance use (<em>food</em>) disorder criteria</th>
<th>Empirical evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance (<em>food</em>) often taken in larger amounts or over a longer period than was intended</td>
<td>Present</td>
</tr>
<tr>
<td>Persistent desire or unsuccessful efforts to cut down or control substance use (<em>food intake</em>)</td>
<td>Present</td>
</tr>
<tr>
<td>Great deal of time is spent in activities necessary to obtain or use (<em>overeat</em>) the substance (<em>food</em>) or recover from its effects</td>
<td>Plausible</td>
</tr>
<tr>
<td>Craving, or a strong desire or urge to use the substance (<em>eat specific food</em>)</td>
<td>Present</td>
</tr>
<tr>
<td>Recurrent substance use (<em>overeating</em>) resulting in a failure to fulfill major role obligations at work, school, or home</td>
<td>Plausible</td>
</tr>
<tr>
<td>Continued use (<em>overeating</em>) despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance (<em>specific foods</em>)</td>
<td>Plausible</td>
</tr>
</tbody>
</table>

## Substance use (food) disorder criteria

<table>
<thead>
<tr>
<th>Important social, occupational, or recreational activities are given up or reduced because of substance use (<em>overeating on foods</em>)</th>
<th>Plausible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent substance use (<em>overeating</em>) in situations in which it is physically hazardous</td>
<td>Plausible in the context of health conditions</td>
</tr>
<tr>
<td>Substance use (<em>overeating</em>) is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (<em>overeating on foods</em>)</td>
<td>Present</td>
</tr>
</tbody>
</table>

### Tolerance
- need for markedly increased amounts of the substance (*food*) to achieve intoxication or desired effect
- markedly diminished effect with continued use of the same amount of the substance (*food*)

### Withdrawal
- withdrawal syndrome (differs by substance)
- substance (*specific foods*) is taken (*eaten*) to relieve or avoid withdrawal symptoms

<table>
<thead>
<tr>
<th>Empirical evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
</tr>
<tr>
<td>Plausible</td>
</tr>
<tr>
<td>Plausible, but difficult to distinguish from energy deficit</td>
</tr>
</tbody>
</table>

The hedonic appeal of chocolate (fat, sugar, texture, and aroma) is likely to be a predominant factor in cravings.

Chocolate may be used by some as a form of self-medication for dietary deficiencies or to balance low levels of neurotransmitters involved in the regulation of mood, food intake, and compulsive behaviors.

Chocolate contains several biologically active constituents (biogenic amines and cannabinoid-like fatty acids), all of which potentially cause abnormal behaviors and psychological sensations that parallel those of other addictive substances.

- carrot craving

- nervousness, craving, insomnia, waterbrash and irritability are associated with withdrawal from excessive carrot eating


- Experiment in animals provide evidence supporting food addiction, but human studies are lacking to support some of the results found in those studies

- Only one study has examined the new DSM-5 criteria in relation to eating behavior, but its validity is questionable because it was based on the semistructured interviews and sample size was small

- The notion that food addiction may be responsible for the high prevalence rates of obesity and that obesity by itself represents an addictive behavior is outdated

- Although there are similarities in brain responses to food and drugs, substantial differences have also been noted
• The food addiction model involves the danger of possibly creating a new stigma or to move attention away from the individual’s responsibility in weight regulation such as engaging in physical activity.


GUIDELINES FOR MEAL PLAN
Abstinence is a Commitment to Recovery

Definition of Abstinence

We ask for help from our Higher Power to abstain from those substances we find ourselves craving, ever mindful of our addiction to sugar, flour and wheat. Feeding our bodies with a plan of sound nutrition will allow us freedom from the insanity of this disease. With honesty, an open mind, and willingness to share our experience, strength and hope, we can recover from this disease—ONE DAY AT A TIME.
• Weigh or measure all food as specified
• Look for hidden ingredients and read all labels
• Fresh is best
• Never use cornstarch or other thickeners • Limit red meat

Food addiction as an hypothesis

“If food is addictive, it must contain some unique component that drives the addiction - the nicotine of junk food, if you will.”
Obesity and high fructose corn syrup

Daily calories of HFCS

Percentage of obese adults

Years


200 150 100 50 0

Obesity HFCS

250 ml APPROX.
A rat repeatedly receives a drug in one of two distinctive compartments. Then, on the test, the tendency of the rat, now drug-free, to prefer the drug compartment is assessed.
“Food addiction” is an hypothesis

There are significant behavioral and neurobiological differences between different “sweet” substances

High fructose corn syrup self-administration is associated with neurobiological alterations also observed after exposure to drugs of abuse. But, if HFCS dependence exists, it is not like heroin dependence!

Undergraduate students

Graduate Students: AnneMarie Levy and Stephen Daniels
• Collaborator: Dr. Linda Parker, Dr. David Mutch & Dr. Yan Zhou (Rockefeller University, NY)

• Funding: