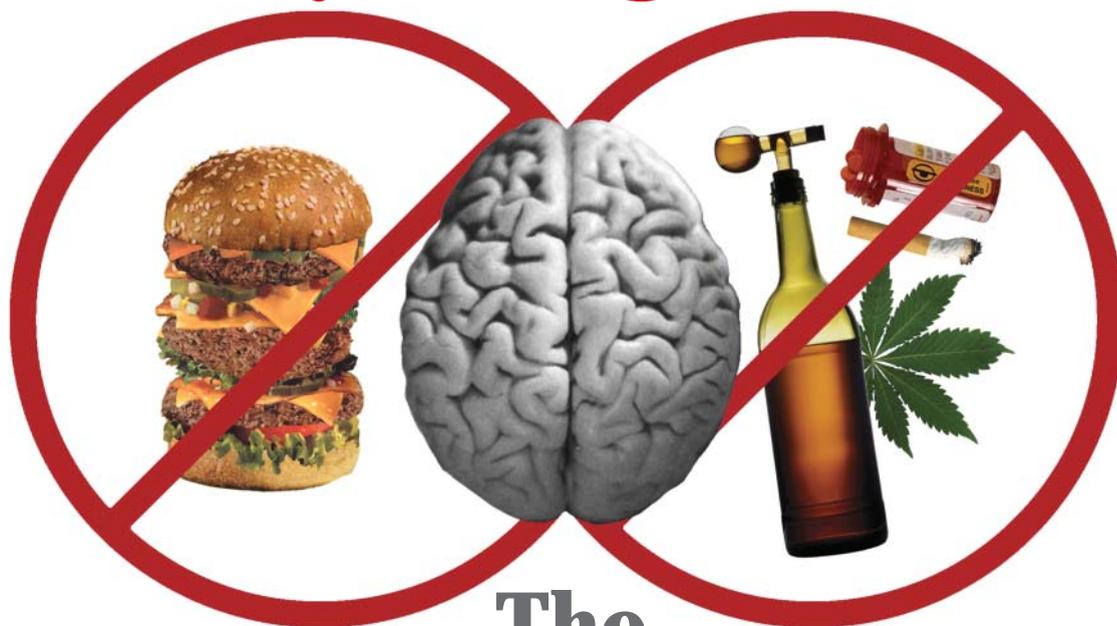


Two Teen Health Dangers: Obesity & Drug Addiction



The Brain Link

Researchers have discovered an amazing connection between how the brain is involved in obesity and drug addiction.

Ask experts to name the biggest health threats for teens today, and these two answers will rise to the top: obesity and drug addiction.

Are you surprised by the first answer? You shouldn't be.

More and more teens weigh far too much, and the problem is growing. It's no joke. Check out these numbers: 16 percent of young people between the ages of 12 and 19 are overweight,

according to a 1999–2002 federal study by the Centers for Disease Control and Prevention. That's more than triple what the rate was between 1976 and 1980. The same study revealed that an additional 15 percent of teens are at risk of becoming overweight.

What's so bad about being overweight or obese? For starters, it can cause diabetes, a life-shortening disease in which the body loses its ability to

metabolize sugar. It can also lead to asthma and can cause heart disease. Most obese people just aren't healthy, overall.

HEADS UP: A WILD CONNECTION

What do you think? Could the health threats of drug addiction and obesity be connected? If you're like most people, you probably think, "No way." Well, you—and most people—are wrong!

Think about it. People addicted to drugs and those who suffer from obesity have at least one thing in common. It can be extremely hard for them to stop doing things that they know are harming them. For the drug abuser, it's taking drugs. For the obese person, it's usually excessive eating (although there are other factors as well, as we'll learn). NIDA researchers decided to find out if and how the two disorders could be related. Their amazing new findings indicate that there is a link. If you think back to what you've learned from earlier articles in this series, you can probably guess what the link is. Got it? It's dopamine and the brain.

Researchers are discovering that obesity (like drug addiction) is, at least in part, a brain disease.

HEADS UP: SEE SCIENCE IN ACTION!

How did researchers find the obesity-addiction link? They started by reviewing what they already knew: Dopamine is a brain chemical that stimulates pleasurable feelings. When dopamine binds to special structures in your brain—called D2 receptors—it activates the brain's reward circuits. The end result? You feel good.

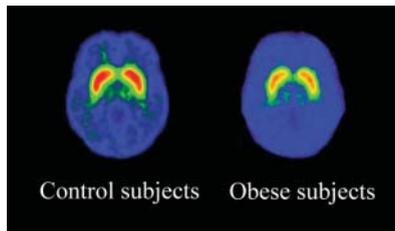
For some time now, researchers have known that people who are addicted to alcohol, cocaine, and other drugs tend to have a lower-than-average number of D2 receptors in their brains. That makes sense when you think about it. If you have a shortage of D2 receptors, it's harder for you to feel good. It's harder for dopamine to find a D2 receptor to bind to, so it

takes more dopamine for you to feel pleasure. As it happens, most drugs of abuse cause a flood of dopamine in the brain. Taking drugs makes people feel better—in the immediate short term.

Researchers also knew that eating can stimulate the production of dopamine in the brain. Could it be that obese people suffer from a shortage of D2 receptors? They might need to overeat to get feelings of pleasure from food.

Using PET scanners to look inside the brains of obese and non-obese people, researchers Nora Volkow, M.D., who is now the director of NIDA, and Gene-Jack Wang, M.D., found that obese people do have lowered numbers of D2 receptors. In fact, Drs. Volkow and Wang's research at Brookhaven National Laboratory in New York showed that the more obese the person, the lower the number of D2 receptors. "The low number of receptors in obese people might be causing them to overeat," says Dr. Wang. "They might be doing it to compensate for reduced stimulation in their brain's reward circuits."

Dr. Volkow adds, "An individual who has low sensitivity to normal



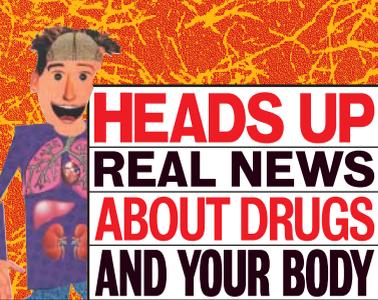
These composite brain-scan images show that obese individuals have significantly fewer dopamine receptors than control subjects. Dopamine receptors transmit pleasurable feelings from basic activities such as eating. Low levels of these receptors have also been found in people addicted to drugs of abuse. The reduced reward experienced by people with this deficiency may make them more likely to engage in addictive behaviors.



By using their knowledge of addiction and how the brain works, Dr. Volkow and her colleagues had an idea: Maybe obese people have low numbers of D2 dopamine receptors in their brains—just like drug addicts. How did the researchers test their theory? They used the scientific method. The scientific method—which scientists in all disciplines have followed for hundreds of years—has four steps.

- 1. OBSERVE** Researchers observed that D2 receptor levels are lower than normal in many drug abusers.
- 2. QUESTION** Researchers raised the question of whether obese people, whose behavior can be described as "addictive," might also have low D2 levels.
- 3. PREDICT** Researchers came up with a hypothesis: People suffering from obesity will have lower D2 levels than people whose weight is normal.
- 4. TEST** Researchers took PET scans of obese adults to see how many D2 receptors they had.

The researchers validated the experiment by testing a control group—a similarly made up group of non-obese people. Accurate results from the obese group are only obtainable by looking at the results from the control group. The researchers also made sure the experiment was quantitative. In other words, they made exact measurements. (It wouldn't have been enough to say, "There were oodles of D2 receptors in that thin woman's brain.") Finally, the experiment was valid because it was set up in a way that was replicable—it could be repeated and tested by other scientists.



HEADS UP REAL NEWS ABOUT DRUGS AND YOUR BODY

stimuli learns behaviors, such as abusing drugs or overeating, that will activate them.”

HEADS UP: ADDICTION MAY CAUSE THE DAMAGE

Just because obese people and drug addicts share a shortage of D2 receptors, does that mean their disorders are caused by the lack of receptors? Not necessarily. It’s a classic “chicken-and-egg” question. In other words, which comes first—the addictive behavior or the D2 shortage? Maybe the addictive behavior causes the shortage. Or . . . maybe the shortage causes the behavior?

Dr. Wang says an experiment with animals indicates that “having plenty of D2 receptors does protect against drug abuse and obesity.” So, that’s some evidence that the D2 shortage causes the behavior. The experiment Dr. Wang is talking about worked like this: Panayotis K. Thanos, a Brookhaven National Laboratory researcher, trained rats to regularly take alcohol, then introduced additional D2 receptors into their brains. As soon as the receptors took hold, the rats’ consumption of alcohol decreased. Dr. Wang says researchers have had similar findings involving cocaine and food.

Case closed? Not exactly. Scientists also know that the flood of dopamine in the brain that drug abuse causes can overstimulate the reward pathways—and cause a reduction in D2 receptors in abusers’

brains. “In the end, people who become addicted could be much worse off biologically than when they started,” says Joseph Frascella, Ph.D., of NIDA’s Division of Treatment Research and Development.

HEADS UP: CHECK OUT THE DIFFERENCES

Of course, there are major differences between drug addiction and obesity. For one, according to Dr. Wang, obesity is not all about the brain. “You have to consider a person’s metabolism and other genetic issues,” he says. “The brain chemistry is just part of the picture.” Dr. Wang adds that it’s not accurate to describe an obese person as a “food addict.” Rather, one should say that overeating is an “addictive behavior.”

Also, drug addiction seems to

Wake-Up Call How Much Is Too Much?

What’s the difference between being overweight and “just a bit chunky”? The Centers for Disease Control and Prevention has very strict definitions of weight-related terms. They’re not based on how a person looks in jeans, they’re calculated using height, weight, and—for people under 21—age and gender.

If you’re worried that you have a weight problem, you should talk to a health professional. He or she will likely determine your body mass index (BMI) using this formula:

$$\text{BMI} = \frac{(\text{Weight in Pounds})}{((\text{Height in Inches}) \times (\text{Height in Inches}))} \times 703$$

With your BMI and a specially made chart, the health professional can determine what percentile your BMI falls into. The percentile shows how your BMI compares with that of other teens of the same gender and age.

- BMI value at or above the 95th percentile is considered overweight.
- BMI value between the 85th and 95th percentiles is considered at risk for becoming overweight.
- BMI value between the 6th and 84th percentiles is considered healthy.
- BMI value below the 6th percentile is considered underweight.

As you may have noticed, there is no “obese” category for teens. That’s because, unlike adults, young people’s bodies are growing and changing. Once you reach adulthood, your body levels off. But teens who are overweight not only face health problems, they are also at higher risk for becoming obese as adults.



As BMI increases in adults, so does risk of the following:

- premature death
- diabetes
- cardiovascular disease
- high blood pressure
- arthritis
- certain cancers

If it turns out that you do have a weight problem, you and your parents can talk with your health professional about what actions you can take to improve your health.

cause more wide-ranging brain damage than obesity. For example, in people who are addicted to drugs, the drop in D2 receptors is often accompanied by a loss in functioning of the prefrontal cortex—the part of the brain responsible for judgment and impulse control. “In obesity, we didn’t see any problems in the prefrontal cortex,” says Dr. Wang. This probably explains why obese people, though compulsive when it comes to eating, have more control over their behavior than drug abusers.



“Yes!” says Dr. Wang. “Exercise has been found to increase dopamine release and to raise the number of dopamine receptors,” he says. “This suggests that obese people might be

able to lose weight.” He feels that exercise can be helpful for recovering addicts, as well.

Dr. Wang also notes that animal studies have revealed that group interactions can increase D2 receptor levels.

So, exercising and spending time with family and friends can help you keep your mind and body healthy—and help you avoid developing addictive behaviors.

That’s all good to know. But according to Dr. Wang, perhaps the most important way the research can help is by giving people an understanding of their own behavior. It helps remove the mystery and stigma that surround addictive behaviors. “When you know the reason why,” says Dr. Wang, “it makes everything much easier.”

able to boost their dopamine response through exercise instead of eating—which is just one more reason to exercise if you are trying

HEADS UP: KNOWLEDGE IS POWER

NIDA scientists have made amazing discoveries about the connection between drug addiction and obesity. Although these discoveries are fascinating, can they help people? Yes, definitely. This new information can help people addicted to drugs, obese people, and healthy teens who want to avoid drug addiction or obesity.

How? First, the research shows us that having a healthy supply of D2 receptors in the brain can help stave off addictive behaviors. So, anything that increases D2 levels could be a valuable weapon in the battle against drug abuse and obesity. With this in mind, NIDA researchers are looking to develop new medications.

But is there anything safe and available now that can boost the level of D2 receptors in your brain?

Facts for Real Life

Q. Why is the number of overweight teens growing so rapidly?

A. Nobody knows for sure. It could be that today’s teens are less physically active than those a generation ago. It may be that people are eating bigger portions of food than ever before. Dr. Volkow thinks one factor is the increasing ease with which people can get food today. Researchers are finding that there’s a region of the brain—called the dorsal striatum—that is programmed to draw people to food even when they’re not hungry. “This system was once very important for survival,” says Dr. Volkow. “It was important to want food whenever you could get it, because you never knew when it was going to be around.” In the contemporary United States, though, where there are fast-food outlets and convenience stores on every corner, “the system doesn’t serve any purpose anymore,” says Dr. Volkow. Now, with food so easy to get, people who follow their brains’ instructions to eat, eat, eat are not staving off starvation—they’re growing overweight.

