

## **Sleep-Deprivation Linked to Major Health Risks**

New and fascinating research in the field of sleep medicine suggests that an accumulated sleep debt is as potentially detrimental to our health as poor nutrition or a sedentary lifestyle.

In this section, I share some of the scientific evidence indicating that insomnia, sleep disruption, difficulty falling asleep, lack of deep stage and REM sleep contribute significantly to so very many very serious health problems: obesity; cardiovascular disease; adult onset diabetes; fibromyalgia and chronic fatigue; hormonal imbalance; and more.

Here is the research. Yet, there are lots of options available to help me identify why you are having sleep-related problems. I treat such disorders with non-pharmaceutical strategies. This is a very serious matter, although most people with sleep deprivation and sleep disorders are rather dismissive of these problems. So many of us believe we can get by very nicely with very little sleep. In fact, you may have heard friends or colleagues brag about this from time to time. Others believe that as long as they are in bed for a certain number of hours they have gotten a decent night's sleep. The research suggests otherwise. We need sleep, and we need a particular kind of sleep during which we reach deep sleep and REM sleep. It seems like such a simple matter. Actually, it is a very serious and potentially very dangerous matter. Read the research for yourselves.

### **Sleep-deprivation may be a serious health risk for obesity, diabetes and high blood pressure.**

*National Sleep Foundation "Sleepmatters" Newsletter, Spring 2000*

The Chicago study involved 11 healthy young men between the ages of 18-27 years over 16 consecutive nights in a clinical research center. The study concluded that participants showed a significant loss of ability to process glucose. The evidence suggests this inability to process glucose then creates a rise in the level of blood glucose prompting the body to produce more insulin, which can lead to insulin resistance, a classic characteristic of adult onset diabetes. Excess insulin also promotes the storage of body fat, linking it to two other major health risk factors, obesity and blood pressure.

Weight gain is widespread symptom that has been discovered about people with severe sleep debt. We spend billions of dollars on diets to control weight. But what we haven't realized is lack of adequate sleep is making our efforts counter productive. Think about it. When we are overtired and energy-drained, what do we do? We reach for a cookie, doughnut, candy bar or soft drink—any quick, high carbohydrate or high sugar food that provides us with fast energy. Unfortunately, these kinds of foods are not long-lasting energy producers.

High carbohydrate and high sugar foods provide us with that quick boost shortly followed by a dip in energy, and eventually we end up more tired than we were before. In the meantime our bodies build up those extra calories causing unwanted weight gain. Just by shedding a few pounds and getting regular exercise, we can significantly improve our general health. Losing as little as 5% of our body weight can lower elevated blood pressure and reduce blood sugar levels in the body.

When we are sleep-deprived and just keep going anyway, we may not realize the toll it is taking. Besides putting our health and safety at risk, we are operating at lower performance levels, and placing a strain on important relationships. If we want to be productive and creative and function at our best, then the best thing we can do is get a good night's sleep every night. Make sleep fit your life. It can truly make a difference in how you feel. I hear people who begin sleeping normally after carrying a chronic sleep debt exclaim:

"I didn't know what it felt like to be fully rested!"

"I feel so much better now that I'm getting more sleep!"

"I didn't realize what it was like to be fully awake and alert until now!"

"I have so much more energy!"

"I'm thinking and remembering so much better!"

"My spirits have lifted!"

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## **Mediators of Inflammation and Their Interaction with Sleep *Relevance for Chronic Fatigue Syndrome and Related Conditions***

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In humans, activation of the primary host defense system leads to increased or decreased NREM sleep quality, depending on the degree of early immune activation. Modest elevations of certain inflammatory cytokines are found during experimental sleep loss in humans and, in addition, relatively small elevations of cytokines are seen following commencement of pharmacological treatments with clozapine, a CNS active antipsychotic agent, known to have immunomodulatory properties. Cytokines such as TNF- $\alpha$ , its soluble receptors, and IL-6, present in the periphery and the CNS, comprise a link between peripheral immune stimulation and CNS-mediated behaviors and experiences such as sleep,

sleepiness, and fatigue. The debilitating fatigue experienced in chronic fatigue syndrome and related diseases may also be related to altered cytokine profiles.

### **Disrupted Hormonal Circadian Rhythms May Trigger Brain Atrophy**

Anyone who's ever gone through the whole night without a wink knows what a struggle the next day can be. Eyelids feel like lead weights, muscles ache, and the body feels trapped in slow motion. Just thinking clearly suddenly becomes an insurmountable intellectual challenge.

What's happening in the body to precipitate these responses? Mounting evidence suggests that sleep deprivation may upset the normal secretion pattern of hormones, causing short term - and possibly even longer term - effects on cognitive health.

In one recent experiment, researchers used timed salivary sampling to measure hormone levels in military service personnel on the day after they were completely deprived of a night's sleep. They found that levels of melatonin in the sleep-deprived subjects were much higher the afternoon after the subjects lost sleep, compared with controls. Surges of this pineal hormone would be likely to induce more intense feelings of sleepiness.

At the same time, levels of the stress hormone cortisol were also higher the afternoon following sleep loss. That may be because the body pumps out more cortisol in the psychological stress that results in the ongoing struggle to stay awake, the researchers surmised.

These and other hormonal disruptions are potentially significant because they may underlie side effects of chronic sleep deprivation, such as excessive fatigue, mood deterioration, and poor concentration. In fact, over time, the resulting hormonal imbalances could even change the physiognomy of the mind.

According to a brief communications appearing in a recent issue of the journal *Nature Neuroscience*, chronic jet lag can disrupt the body's natural circadian rhythms and trigger cortisol elevations that may "erode" the part of the brain that controls spatial learning and memory.

**(MY NOTE: SLEEP DEPRIVATION CAN UPSET THE NORMAL RYTHYM AND FLOW OF ADRENAL HORMONES, THYROID HORMONES, SEX HORMONES, AMONG OTHERS)**

### **Fibromyalgia and Sleep Deprivation: Fatigue Can Be Dangerous**

**By Nicholas Rummell**

Judy Fry says her symptoms of sleep deprivation began long before she was diagnosed with severe fibromyalgia in 1983.

A hyperactive child, Fry said she would awaken 10 to 30 times a night, then have trouble getting out of bed the next morning.

Today, Fry says her sleeplessness feels like what a "normal" person would experience after 48 hours of insomnia followed by working a full day's shift.

"You don't have the energy to make new friends. You also learn not to make plans, because 99 percent of the time you can't keep them," said Fry, 53.

That means Fry picks her free-time activities carefully. While holding down a full time job, she makes sure she saves energy for her favorite hobby, tagging hummingbirds for the federal government.

Fry has tried various medications, but none seem to work for very long.

About 90 percent of people with fibromyalgia syndrome (FMS) suffer from consistent sleep deprivation, according to the Fibromyalgia Network, a nonprofit organization headquartered in Tucson, Arizona.

Lack of sleep exacerbates the fatigue, stiff joints and depression common with fibromyalgia, a disease that affects 3.7 million people.

Sleep deprivation is not always immediately recognized, said Anne Winkler, M.D., medical director of the Smith-Glynn-Callaway Medical building's fibromyalgia program in Springfield, Missouri.

Some researchers say sleep deprivation lead to FMS, although the exact cause of FMS remains unknown. Winkler said she is not convinced sleep deprivation causes FMS but notes there is some clinical relationship.

For people with fibromyalgia, sleep difficulties can stem from the powerful medications necessary to counteract the severe pain that characterizes fibromyalgia.

## **DANGERS OF FATIGUE**

Fatigue isn't just being sleepy. It can be dangerous as well.

"People with FMS should watch out for long road trips, as well as heavy or dangerous equipment," said Winkler.

The four signs of fatigue include:

1. Lack of attention
2. Memory loss
3. Frustration at coworkers or friends
4. Poor concentration

In many cases, a person with fibromyalgia suffers from sleep disorders beyond insomnia.

Adults with fibromyalgia may suffer from a lack of deep sleep as well as from constant waking throughout the night.

Deep, restorative sleep, also known as delta sleep, is the most crucial stage of sleep. It is during this stage that the body recovers energy and repairs muscle tissue.

Without delta sleep, a person with fibromyalgia might sleep eight hours yet wake feeling unrefreshed. This untraditional sleep problem can be difficult to detect - let alone treat.

In addition, a person with FMS may have traditional sleep disorders, as well such as apnea, or obstructed breathing, and periodic limb movement.

"People should get checked out by a doctor," said Winkler. "Not only to diagnose fibromyalgia, but because some of the other problems, like sleep apnea, can be life-threatening."

**(MY NOTE: SLEEP DEPRIVATION INCREASES SENSITIVITY TO ALL KINDS OF PAIN, NOT SIMPLY MUSCLE PAIN. ANYONE SUFFERING FROM CHRONIC PAIN OUGHT TO MAKE SOUND, UNINTERRUPTED SLEEP A PRIORITY).**

### **Missed ZZZ's, More Disease?**

Skimping on sleep may be bad for your health

By Kristin Cobb

As bleary-eyed college students in exam week will attest, lack of sleep impairs mood, performance, and judgment. They might guess, however, that the fast food and candy gobbled down during an all-nighter are far worse for bodily health than are the lost hours of slumber. After all, scientists have long been preaching that too many Big Macs and too few workouts are bad for you, but they have yet to demonstrate any definitive health costs of chronic sleep loss.

Bolstered by new evidence, however, some scientists are suggesting that poor sleep habits are as important as poor nutrition and physical inactivity in the development of chronic illness. They say that this country's sleep debt may be contributing to its current epidemics of obesity, diabetes, and cardiovascular disease.

People in the United States sleep an average of 7.0 hours on weeknights, 1.5 hour less than they did a century ago, according to the National Sleep Foundation in Washington, D.C. One-third of the population sleeps 6.5 or fewer hours, far less than the 8 hours that many sleep specialists recommend.

Several recent studies report that reducing sleep to 6.5 or fewer hours for successive nights causes potentially harmful metabolic, hormonal, and immune changes, at least in test volunteers in the sleep lab. "All of the changes are what you find in normal aging," says sleep researcher Eve Van Cauter of the University of Chicago.

It's still too early for doctors to start prescribing sleep to ward off age-related disease. Scientists agree that the findings are preliminary and that larger experiments are needed. If the story bears out, however, U.S. sleep habits may be having enormous public health consequences.

### **Dieter's nightmare**

Early sleep-loss research focused on military personnel, rescue workers, shift workers, and others for whom on-the-job wakefulness is crucial. These studies examined the performance declines that occur with extended periods of total sleep loss.

Investigating the relationship between health and the pattern of partial sleep deprivation that the average American faces is a much newer research endeavor. Van Cauter and her colleagues helped launch the field with a surprising 1999 study that showed that sleep deficits of several hours a night can impair the body's processing of the sugar glucose.

The study reported that 11 healthy, lean young men showed signs of insulin resistance after several nights of sleep restriction. Insulin resistance, a condition in which the body handles glucose poorly because cells respond inefficiently to insulin, is a precursor to type II diabetes.

Experimenters carefully controlled the men's sleep time, food intake, and exercise during their 2-week stay in the sleep lab. During the sleep-restriction phase of the experiment, the men were kept awake by minimally stressful activities, such as watching television, joking with the staff, and playing games, Van Cauter says.

The restraints imposed in the study, which permitted only 4 hours of sleep a night for 6 nights, were more severe than most people in the United States experience. The study also excluded women. So, the scientists next compared 13 men and women who habitually slept 6.5 hours or less per night at home with 14 men and women who regularly slept about 8 hours. On the weekends, the short sleepers slept extra hours, indicating that their weekday patterns resulted from social constraints rather than biological constitution, Van Cauter notes.

Researchers verified the test volunteers' sleep patterns at home for a week and then brought them into the lab for a glucose-tolerance test. The short sleepers showed 50 percent more insulin resistance than the others did (SN: 7/14/01, p.

31: Available to subscribers at <http://www.sciencenews.org/20010714/note13.asp>).

Short sleep may accelerate the onset of diabetes, Van Cauter speculates. "If you are predisposed to diabetes, and you might become diabetic at 55, are you becoming diabetic at 45?" she asks.

In further experiments, sleep-deprived test volunteers showed other hormonal changes that promote weight gain. Men who were held to 4 hours a night had markedly reduced 24-hour leptin concentrations compared with when they were fully rested, Van Cauter's research team reported at the 2001 Association of Professional Sleep Societies meeting in Chicago. Leptin is a hormone that signals satiety and regulates energy balance; mice that lack leptin overeat and become morbidly obese.

Van Cauter reported that although the men's food intake was adequate, the dip in leptin they exhibited was equivalent to that seen in people underfed by 1,000 calories a day for 3 days. In other words, the leptin signal was telling the men's bodies that they were short nearly a pound's worth of calories. That misleading signal might cue the body to slow metabolism, increase fat deposition, and overstimulate appetite.

A separate, ongoing study is examining sleep restriction and hunger. When held to 4 hours of sleep, volunteers reported being hungrier than when they had adequate slumber, Van Cauter says. The sleep-deprived people overwhelmingly asked for candy, starchy foods, and salty snacks such as potato chips. "There were no cravings for fruits and vegetables," she quips.

Animal studies also suggest that partial sleep deprivation leads to hormonal and metabolic changes. In one experiment, rats that normally sleep 8 to 10 hours a day were restricted to 4 hours of daily sleep for a week, mirroring Van Cauter's studies in people. During that time, the rats showed increased concentrations of stress hormones and an altered hormonal response to stressful situations, such as being confined in a small space.

Initially, such changes may help the body cope with lack of sleep, says Peter Meerlo of the University of Groningen in the Netherlands, who reported the results in the May *Journal of Neuroendocrinology*. If stress hormones are chronically altered, however, sleep deprivation may have adverse health effects, Meerlo speculates.

### **Inflammatory ideas**

Modest sleep deprivation may also be associated with low-grade inflammation, which can lead to a host of cardiovascular problems, according to Alexandros N. Vgontzas of the Pennsylvania State University College of Medicine in Hershey.

Trying to mimic the modest chronic sleep loss that many people in the United States endure, Vgontzas and colleagues deprived 25 healthy young men and women of just 2 hours of sleep per night for a week. The scientists measured blood concentrations of immune-system molecules called cytokines, which are normally secreted during inflammation and infection.

After a week of sleeping 6 hours per night, the test volunteers had higher blood concentrations of the cytokine IL-6, than they did in their pre-deprivation state. Furthermore, the men, but not the women, had increased concentrations of the cytokine TNF- $\alpha$ . Increased cytokines may reflect pervasive inflammatory action, the researchers speculated last June in San Francisco at the annual meeting of the Endocrine Society.

Unremitting low-grade inflammation can damage the inner walls of the arteries, which sometimes leads to vessel narrowing, high blood pressure, stroke, and heart disease. Also, cytokines have been associated with insulin resistance, diabetes, and obesity.

Cytokines cause fatigue. By overproducing cytokines, a person's body is probably trying to say, "Go to sleep," Vgontzas says. Test participants fell asleep faster and slept more deeply when they were sleep deprived, demonstrating that their bodies were trying to compensate for the reduced sleep time, he adds. However, the more efficient sleep didn't thwart the cytokine response, which lasted the entire week. The volunteers were also sleepier and performed more poorly on an alertness test at the week's end than at the beginning of the experiment.

"There are some researchers, even in the sleep area, that say that these extra couple of hours of sleep are not important," Vgontzas concludes. "Our data say that 6 hours is not good for healthy, young people."

In a separate study, sleep of 4 hours a night for 10 nights was also associated with increased concentrations of C-reactive protein, another key inflammation mediator. Boosts in C-reactive protein might have a negative effect on health, says David F. Dinges of the University of Pennsylvania School of Medicine in Philadelphia, a researcher on the study.

Currently, the evidence linking increases in inflammatory molecules and cardiovascular disease is stronger for C-reactive protein than for the cytokines, adds Dinges' collaborator Janet Mullington of Beth Israel Deaconess Medical Center in Boston.

A recent epidemiological study also showed a direct association between short sleep and heart disease. After controlling for other factors, researchers found that men who slept 5 hours or less a night had twice as many heart attacks as men

who slept 8 hours, report Japanese scientists in the July *Occupational and Environmental Medicine*.

Obstructive sleep apnea, a condition marked by temporary pauses in breathing during sleep, is a natural model of chronic sleep loss because people with the condition repeatedly wake up through the night. Several recent studies have linked sleep apnea to elevated blood concentrations of IL-6, TNF- $\alpha$ , and C-reactive protein and to high blood pressure, cardiovascular problems, and stroke. However, it's hard to tease out whether these effects result from lack of oxygen due to the apnea, loss of sleep, or both, says sleep-apnea researcher Virend K. Somers of the Mayo Clinic in Rochester, Minn.

So, as to whether millions of cases of obesity, diabetes, and cardiovascular disease could be prevented if people in the United States were simply to increase their sleep from 7 to 8 hours a night, the issue hasn't been put to bed. But the early data are at least provocative.

"We have all the dots or a lot of the dots, and it looks like there's a picture there, but the science that actually connects those dots hasn't been done yet," Dinges says.

Sleep disorders, such as sleep apnea, that were once seen as mere nuisances are now recognized by the community of sleep researchers as serious health concerns. The data suggest that even young, healthy people should give more consideration to sleep.

Of all the health prescriptions out there, it may be easier to convince people to change their sleep habits than to make other lifestyle changes.

After all, in a time when we are constantly told to eat more broccoli, eat less chocolate, and do more push-ups, wouldn't it be nice if hitting the snooze button were just what the doctor ordered?

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