

The Effects of Sleep Deprivation on the Body

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## Abstract

Sleep is crucial for optimal functioning of the human body. Without sleep, important bodily processes can be severely impaired. Unfortunately, sleep deprivation is becoming increasingly common in modern society, especially in undergraduate students. Research was conducted to determine the causes and effects of sleep deprivation. Recent scholarly articles were analyzed in order to obtain information regarding this topic. Results of the research show that a lack of sleep can be detrimental to the body both physically and mentally. Studies conducted on sleep deprivation can be used to inform the public about the harmful effects that can occur if sleep is disregarded. With this knowledge, society members are better equipped to take preventative measures to avoid sleep deprivation. Most importantly, individuals can gain an understanding of the true importance of sleep and the significance of setting aside adequate time for this essential biological process.

*Keywords:* sleep deprivation, physical health, mental health, sleep, body, students

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Sleep is a complex biological process that is an essential component of human health and

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well-being. The way that sleep is regulated in the body is similar to the manner in which other necessary bodily functions are controlled, such as eating and breathing. Sleep plays a vital role in promoting physical, mental, and emotional health. Receiving adequate sleep each night ensures proper maintenance of bodily processes. Unfortunately, sleep deprivation is becoming an increasingly common problem in society today. Many individuals in society suffer from illnesses resulting in severe sleep loss. Many other individuals, however, disregard the need for sleep in order to accommodate the daily activities of life. Sleep deprivation is becoming especially prevalent as longer working hours and longer work shifts are becoming an acceptable part of world culture (AlDabal & BaHamam, 2011). Insufficient sleep time is particularly common in undergraduate students. Pace-Schott et al. (2009) found that the average sleep duration among university students has drastically decreased over the last 30 years. Countless studies have been performed that indicate bodily organs and systems are greatly affected by such sleep loss. Sleep deprivation is a common problem in society and can have serious consequences on both physical and mental health.

### **Functions of Sleep**

Sleep is a state of rest in which consciousness and responsiveness are greatly decreased. Sleep consists of two stages, rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep. REM and NREM sleep alternate in cycles throughout a night of sleep, with each cycle lasting between 90 and 110 minutes. On average, adults go through four to six cycles each night (Chokroverty, 2010). During REM sleep, individuals are easily awakened because this stage is similar to an awake state. This is the stage in which dreams usually occur. NREM sleep, on the other hand, is considered to be the deepest stage of sleep. Heart rate and blood pressure decrease significantly during this stage (Vallido, Peters, O'Brien, & Jackson, 2009). NREM

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sleep is broken down into four stages. Stages 1 and 2 of NREM sleep are light sleep stages defined by little to no eye movement. Stages 3 and 4 are deep sleep stages consisting of slower brain waves and functioning. It is during stages 3 and 4 of NREM sleep that essential restoration of bodily functions occurs. A few of these rejuvenating processes include the regeneration of new tissue, a strengthening of the immune system, and the constitution of stronger bones and muscles. NREM sleep accounts for 75 to 80 percent of human sleep (Chokroverty, 2010). Because of the important bodily processes that occur during this lengthy period of sleep, it is crucial that individuals sleep long enough to allow the body to respond to the changes that occur. The most damaging effects of sleep deprivation are from inadequate NREM sleep. If possible, individuals should avoid working night shifts, smoking or drinking near bedtime, or being disturbed by outside factors while sleeping (Marzano, Ferrara, Curcio, & Gennaro, 2010). By following these guidelines, individuals can reduce the chances of experiencing the negative effects of sleep deprivation.

Patterns of sleep and waking are controlled by two biological processes, which are the circadian rhythm and hormonal secretion. The circadian rhythm is based on 24-hour intervals, and it is regulated by the suprachiasmatic nucleus located in the area of the brain known as the hypothalamus. The circadian rhythm is influenced by components within the body such as temperature, as well as factors in the environment. Daylight and mealtimes are common external factors that affect the circadian rhythm. The production of melatonin, a hormone produced by the body that induces sleepiness, is controlled by the suprachiasmatic nucleus. The body becomes tired at nighttime because when there is less light present, the suprachiasmatic nucleus tells the brain to produce more melatonin (Vallido et al., 2009). Certain types of sleep disorders are related to circumstantial circadian rhythm disruptions. Such disruptions can be caused by jet lag

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or shift work, such as individuals who work night or rotating shifts. Individuals with such disorders are unable to sleep and wake at normal times that fit social standards (Orzel-Gryglewska, 2010). It is important that individuals try to minimize disruptions to the circadian rhythm in order to maintain a healthy sleeping schedule.

### **Diagnosis**

Sleep deprivation can be diagnosed when sleep has been disturbed for an extended amount of time, and it begins to have a significant effect on daily activity (Vallido et al., 2009). Sleep deprivation can either be acute or chronic. Acute sleep deprivation occurs when the amount of sleep an individual receives is significantly decreased for a period of two days. Acute sleep deprivation can be associated with severe conditions that are sudden in onset. This type of sleep deprivation can be caused by everyday stresses, such as illness, work-related stress, or extreme temperatures. A chronic condition, on the other hand, is a long-lasting syndrome. Chronic sleep deprivation occurs when an individual develops a routine of decreased sleep. These individuals typically get less sleep each night than what is necessary for ideal bodily functioning. Such long-term sleep deprivation is usually caused by factors such as depression, chronic stress, and discomfort at night (Pace-Schott et al., 2009).

### **Causes of Sleep Deprivation**

Whether the sleep problem is acute or chronic, there are countless causes of sleep deprivation. Although many causes of sleep deprivation involve the brain and nervous system, it is often environmental and behavioral problems that cause insufficient amounts of sleep. According to Thacher (2008), stress is a leading contributor to sleep difficulties. Common circumstances that may trigger stress-related sleep deficiency include demanding school requirements, work pressures, relationship troubles, or a death in the family. Typically, when the

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stressful situations pass, the sleeping disturbance is resolved within a few days. If an individual does not take care of the sleep problem immediately, however, it can develop into a long-term ailment that continues to disturb sleep long after the original stress is resolved.

According to Orzel-Gryglewska (2010), the most common causes of sleep deprivation are associated with lifestyle and work-related factors. College students in particular are faced with countless social and emotional adjustments at the beginning of each school year. Adjustments such as new living conditions, roommates, academic expectations, and jobs can be taxing on college students (Liguori, Schuna, & Mozumdar, 2011). Students are often required to find a balance between schoolwork, social activities, and careers. In many cases, sleep is sacrificed for other activities. A study conducted by Pace-Schott et al. (2009) suggested that most university students accumulate sleep debt over time. Often this debt is compensated on the weekends. Although an individual cannot catch up on sleep once sleep debt has been acquired, healthy sleeping patterns can return with time. It is a common myth that the body can be trained to not require as much sleep. This is not true because sleep is an essential process that regenerates the body so that it can function optimally. Studies done by Chokroverty (2010) show that most individuals need an average of eight hours of sleep per night, but many people can tolerate an average of six hours. Usually, however, such sleep habits result in a decreased effectiveness in production and performance. Continual loss of sleep by receiving less than six hours of sleep over the duration of days or even weeks results in sleep debt. Individuals, especially college students, should take steps to avoid this unhealthy pattern of sleeping in order to limit the negative effects that sleep deprivation can have on the body.

### **Effects of Sleep Deprivation**

In modern culture, many more people are experiencing the harmful effects of sleep

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deprivation than in previous years due to the recent trend toward maintaining a 24/7 lifestyle (AIDabal & BaHamman, 2011). Cultural norms of today's society include longer working hours and sacrificed sleep time. As a result of this trend, sleep deprivation has become a worldwide problem. In society today, the effects of sleep deprivation on the body are often underestimated. The negative effects of a lack of sleep can be detrimental to an individual's health and body. Studies show that sleep deprivation has been linked to both mental and physical complications. A lack of sleep can negatively affect mood, performance, and overall health (Shulan, I-Chen, & Ling-Ling, 2007).

### **Physical damage**

The physical damage done to the body as a result of sleep deprivation is often the most overlooked aspect of sleep complications. Physiologically, a reduction in the amount of sleep received each night results in damage to each of the bodily organs and systems. For example, sleep deprivation can lead to an elevated risk of high blood pressure and heart attack (Marzano et al., 2010). Individuals may not even know the damage that is being done to these internal systems as a result of sleep deprivation. According to AIDabal and BaHamman (2011), sleep is essential for certain bodily functions such as learning, cellular repair, and memory processing. Without sleep, these processes do not function properly. These studies also show that there is a strong correlation between the immunity of the body and adequate sleep. When adequate amounts of sleep are not received, the overall immunity of the body is significantly damaged. A weakened immune system increases the likelihood of contracting infections, viruses, and diseases. This evidence demonstrates the true importance of sufficient sleep.

Not only is the immune system affected by sleep deprivation, but also the metabolic and endocrine systems of the body. The endocrine system secretes hormones into the bloodstream in

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order to regulate certain processes such as metabolism, growth, development, and tissue function. Of these processes, metabolism is affected the most by sleep deprivation. Metabolism is the process that controls the conversion of fuels from food into the energy necessary for proper bodily function (Shulan et al., 2007). Studies done by AlDabal and BaHammam (2011) show that there is a relationship between obesity and sleep deprivation. Sleep deprivation causes a decrease in metabolic function, causing the metabolic rate to slow. Slower metabolic rates result in an increased likelihood of obesity. Over recent decades, there has been a global increase in body mass index (BMI) due to shorter sleep durations. This research also indicates that the average length of sleep in the world has decreased substantially in the past decade. The average is now less than seven hours of sleep per night. The increase in obesity due to this decrease in average sleep time is worrisome. Obesity is strongly related to serious medical illnesses such as diabetes mellitus and obstructive sleep apnea. Health care providers are alarmed at the increase in such illnesses and have been taking steps in recent years to inform the public on the dangers of sleep deprivation.

### **Mental damage**

Aside from the physical damage sleep deprivation causes to the body, there are also severe mental and behavioral side effects of inadequate amounts of sleep. According to Vallido et al. (2009), results of sleep disturbances often include irritability, reduced vigilance, and lack of energy. Anxiety and depression are also commonly linked with sleep deprivation, which can lead to feelings of hopelessness and worthlessness that last for long periods of time. Often when an individual becomes depressed, the likelihood of sleep deprivation is increased significantly. The fatigue that is present due to a lack of sleep results in less physical activity and exercise. Individuals with such circumstances find themselves in a vicious cycle of inactivity and sleep

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deprivation. This research also shows that individuals who are sleep deprived are at an increased risk of suicidal behavior. Individuals, especially adolescents, who sleep less than eight hours per night are about three times more likely to have suicide ideation than those who receive more than eight hours per night. The knowledge that sleep deprivation can lead to suicide ideation has provided important information for suicide prevention programs.

Although suicidal thoughts usually only occur in extreme cases of sleep deprivation, there are a few common health risk behaviors that are associated with poor sleep quality. According to studies conducted by Vail-Smith, Felts, and Becker (2009), individuals who receive less than six hours of sleep per night are more likely to smoke and drink alcohol more than five times in a day. These studies also indicate that college students are at an especially high risk for the negative effects of sleep deprivation. There is a strong relationship between sleep deprivation and student risk behaviors, such as voluntary lifestyle choices. These choices may include unhealthy drinking patterns, drug use, and smoking addictions. Students involved in this study also showed an increase in physical aggression. Sleep deprivation causes irritability and an increased desire to fight. Students should be cautious about their sleeping patterns in order to avoid these unhealthy life choices.

### **Effects on Others**

It is evident that sleep deprivation can have serious consequences on the health of an individual. Most people do not realize, however, that a lack of sleep can also be detrimental to those who associate with a sleep-deprived individual. Sleep deprivation causes a lack of concentration, longer reaction times, increased errors, and a lack of coordination. As a result, sleep loss can cause impaired performance (Chokroverty, 2010). According to Goldich et al. (2010), insufficient sleep is becoming a public health concern because the lack of sleep has been

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identified as one of the leading contributors of traffic accidents. Sleep deprivation causes slower reaction times, which ultimately slows down reflexes. Therefore, vehicle operators who are sleep-deprived are often unable to stop in times of danger. A decrease in concentration can also cause traffic accidents if an individual falls asleep at the wheel. Finally, information processing is severely impaired by the influence of sleep deprivation. Therefore, sleepiness causes a reduction in mental and psychomotor skills. Drivers are continuously warned not to operate a vehicle when they have experienced a loss of sleep. If drivers would heed these warnings, there would be a significant decrease in traffic accidents.

### **Academic Performance**

In society today, undergraduate students are faced with the need to manage the countless demands of college life. It is not surprising that students often push the need for sleep aside in order to meet the demands of school, work, and social activities. However, this is not the best course of action. Studies done by Thacher (2008) show that both quality and quantity of sleep are associated with academic performance of undergraduate students. This research shows that there is a correlation between sleep loss and decreased grades and academic achievements. Many undergraduate students experience countless sleepless nights. This actually results in lower levels of alertness in the following days. As a result, students experience a lack of motivation for schoolwork. Sleep loss interferes with the consolidation of memory and the learning process. Therefore, sleep loss has implications on students' ability to process and retain information. With this knowledge, it is interesting to consider why students continue to believe that poor sleeping patterns are a harmless and normal part of a college career.

### **Treatment and Prevention**

Due to the countless physical and mental damages that sleep deprivation can have on the

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body, there are a variety of treatment options available for individuals who suffer from sleep problems. According to Chokroverty (2010), health care professionals must follow a certain protocol when assessing patients with sleep complaints. Physicians must obtain a proper sleep history of the patient before any treatment plans can be created. Such a report would include details about sleep habits, a complete history of current or previous neurological or psychiatric illnesses, and details about drug and alcohol consumption. Sleep history reports should also include family history information to diagnose any genetic disorders that may appear. Physicians should pay specific attention to the frequency and the time of onset of the sleep deprivation symptoms. This can aid greatly in determining the source of the sleeping disorder.

Once the source of the problem has been identified, health care professionals can take the proper steps to provide appropriate care to the patient. Many doctors will prescribe sleeping medication to individuals with sleep complaints. This is not always the best solution, however, because sleeping pills do not allow individuals to receive the proper amount of deep sleep, or NREM sleep. Individuals who take sleeping medications often feel tired and drained of energy in the mornings. The medication can also cause side effects that can be more troubling than the actual sleep ailment. Sleeping medication can actually make the sleep condition worse by causing a vicious cycle of constant sleepiness (Orzel-Gryglewska, 2010).

In order to avoid the use of harmful sleeping medications, some doctors will advise patients on how to make lifestyle adjustments that aid in minimizing sleep deprivation. According to the studies of Marzano et al. (2010), one adjustment recommended by doctors is to practice daily relaxation techniques. One popular relaxation technique is meditation. Such techniques allow individuals to relax both the mind and body. This is an excellent way to reduce stress and encourage better sleeping habits. Doctors also strongly advise patients to practice

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healthy diet and exercise routines. Studies show that sleep can be affected when food is consumed within two hours before bed. Alcohol and caffeine are also substances that should be avoided before bedtime (AlDabal & BaHamman, 2011). Along with the proper diet, 15 to 30 minutes of daily exercise is recommended to individuals who suffer from sleep ailments. Exercise can help release muscle and nervous tension, which can greatly reduce the side effects of sleep deprivation (Liguori et al., 2011). These simple and useful guidelines are crucial to the reduction in sleeping problems that many individuals experience.

Although sleep deprivation is a growing concern in the world today, it is evident that there are ways it can be prevented if members of society stay informed. Sleep is a vital process that is required for the optimal health and well-being of the body. Many individuals overlook the damage, both physical and mental, that a loss of sleep can do to the body. In recent years, sleep deprivation has become a rampant problem in the United States due to the country's fast paced lifestyle. Many others in the country unfortunately suffer from sleep disorders, which usually lead to severe sleep deprivation. If steps are taken to raise public awareness about the dangers of sleep deprivation, individuals in society will be more informed about the seriousness of this rapidly growing problem. If society members are informed, individuals can understand the importance of sleep to the body. They will then be able to take steps and make lifestyle adjustments to prevent sleep deprivation. Also, individuals who are unable to prevent sleep deprivation, such as those who suffer from chronic sleep disorders, will be more informed about the treatment options that are available. By increasing public awareness throughout the world, the amount of accidents, hospitalizations, and losses in production that result from sleep deprivation can be greatly reduced. Once the public becomes aware of the shocking harmful effects of sleep deprivation, individuals will be more willing to set aside proper amounts of time

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for sleep, which will result in an increase in the nation's overall health.

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