Effects of caffeine and nicotine on the body and mind

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Caffeine and nicotine are two of the most commonly consumed psychoactive drugs in society today. Both substances are currently legal to use, easily accessible and both are very addictive therefore both are abused regularly. The average daily caffeine intake ranges from 200 to 500 milligrams which is the equivalent of two to five cups of coffee. It has also been used in a variety of medications especially in pain relievers. Even though the use of nicotine has decreased since the 1960's after years of U. S. government reports on the dangers of tobacco use, there are still approximately 900, 000 individuals who become addicted to nicotine yearly. Nicotine has so far shown little medicinal value however approximately 443, 000 Americans die yearly from nicotine related causes. Both caffeine and nicotine continue to be used daily even though they have major impacts on the individual mind and body (Julien, 2011). In this paper the author will explore what effects caffeine has on the body and mind; what effects nicotine has on the body and mind and finally what effect caffeine and nicotine have on each other.

Caffeine

Caffeine affects the central nervous system (CNS) by binding to adenosine receptors however does not act like adenosine. Instead caffeine acts as an adenosine antagonist. Since adenosine causes a sleep-inducing effect in the brain, the effects of caffeine blocks the receptors and produces wakefulness (Julien, 2011). Caffeine's effects on the individual's body have produced some desirable effects. Because of this caffeine has also been used therapeutically to treat such disorders as asthma, narcolepsy, and migraines

and when taken in conjunction with aspirin or other analgesics caffeine can aid in the treatment of headaches and other pain (Julien, 2011).

Caffeine is normally taken orally and is rapidly absorbed reaching significant blood levels within 30 – 45 minutes. Caffeine can reach complete absorption over the next 90 minutes with a half-life of elimination that can vary from 2. 5 hours to 10 hours depending upon whether an individual is a rapid metabolizer of caffeine or a slower metabolizer of the drug. The drug is equally distributed throughout the water in the body and it is found in almost equal concentrations in all parts of the body and brain. The liver metabolizes most of the drug before it is eliminated through the kidneys where only about 10 percent of caffeine is eliminated unchanged (Julien, 2011). At peak levels of 0. 25 mg/L to 2 mg/L caffeine produces overall psychostimulant effects. These effects include reducing fatigue, and enhancing performance with relatively minor risks of harmful effects. At higher dosage levels, however caffeine can produce undesirable effects. These can include such results as heightened anxiety, increased blood pressure, headaches and confusion (Chen, 2010). The drug can also effect gastric acid secretions, colonic activity, urine volume, calcium excretion, and increased levels of adrenocorticotropic hormone (ACTH), insulin and cortisol (Anderson, 2009).

Caffeine effects both male and female consumers however it can have significant effects on women’s health and reproductive processes. While the drug can produce insomnia and anxiety in both sexes, these effects seem to manifest at a higher rate in women than in men. Heavy use of caffeine in women can be associated with shorter menstrual periods and shorter menstrual cycles. These effects can cause the individual to experience

difficulty during menstruation and difficulty with conception. These side effects have led some doctors to suggest that patients reduce or eliminate caffeine from their diets if they are experiencing issues in these areas (Anderson, 2009). Caffeine ingested during pregnancy does cross the placenta to the fetus (Julien, 2011). Women who continue to ingest caffeine during pregnancy experience slower metabolism of caffeine during the second and third trimesters of pregnancy which leads to higher blood plasma levels in women who maintain their regular intake during pregnancy (Anderson, 2009).

When taken in lower doses caffeine can increase the individual’s mental alertness and promote clearer flow of thought because of the psychostimulant effects of the drug. Increased mental awareness can result in the ability to engage in sustained intellectual efforts and coordinated intellectual activity. On the other side of this situation, use of caffeine can cause problems with delicate muscular coordination as well as causing accurate timing and math skills to be impaired (Julien, 2011). Caffeine has also been linked to increases in false memories in individuals who do not regularly use it however no change was noted in those individuals who regularly ingest caffeine (Mahoney, 2012). The effects of higher doses of caffeine especially in individuals who are sensitive can cause a clinical syndrome called “ caffeinism.” This condition is characterized by CNS and peripheral symptoms that can include anxiety, restlessness, nervousness, dysphoria, insomnia, excitement, psychomotor agitation, and rambling thoughts and speech. Caffeinism can also produce peripheral symptoms

such as tachycardia, hypertension, cardiac arrhythmias and gastrointestinal distress (Julien, 2011).

Caffeine withdrawal symptoms, while not as intense as symptoms associated with other drug withdrawal, may still cause the individual to experience discomfort and distress. Abstinence from caffeine can produce withdrawal symptoms including headache, fatigue or drowsiness, anxiety and depressive symptoms. The individual may also experience decreased energy, decreased alertness, drowsiness, decreased contentedness, depressed mood, difficult concentration, irritability, “ foggy-headedness,” flu-like symptoms, nausea and muscle pain. Increased in severity of the symptoms and duration of withdrawal is directly associated with the amount of caffeine intake and the length of time the individual has used caffeine as well as the frequency of use (Ozsungur, 2009). These symptoms can peak within one to two days or can take up to a week after cessation of intake (Lara, 2010).

Nicotine

Nicotine is the primary active ingredient in tobacco but is also found in low quantities in plants such as the tomato, potato, eggplant and green pepper in the Solanaceae or nightshade family. Nicotine alkaloids have also been found in the coca plant (Martin. J., 2009). Nicotine is only one of about 4, 000 compounds that are released by burning cigarette tobacco. Because of the widespread use of nicotine, the belief that there are very few therapeutic applications for the drug coupled with its responsibility for numerous health problems that tobacco causes, nicotine has been the focus of many studies.

Cigarette smoking and tobacco use is attributed with the death of 443, 000 Americans and 4. 3 million people worldwide yearly and is considered the leading cause of preventable death in the United States (Julien, 2011).

Nicotine is taken into the body in many forms. Through smoking cigarette tobacco, using smokeless tobacco such as snuff or “ dip,” dissolvable tablets, strips or sticks and electronic cigarettes in the form of a vapor. Nicotine can be readily and completely absorbed through the lungs, buccal and nasal mucosa, skin and gastrointestinal tract. It is quickly absorbed into the bloodstream from the lungs. About 20 percent of the nicotine inhaled through smoking is absorbed into the bloodstream and the remainder is metabolized by the hepatic enzyme CYP-2A6. Smokers are able to self-regulate the rate of drug intake by controlling the frequency of breaths, depth of inhalation, time the smoke is held in the lungs and the number of cigarettes smoked (Julien, 2011).

Nicotine produces many effects on the CNS which can result in increased psychomotor activity, sensorimotor performance, and cognitive functioning, attention and memory consolidation. It increases the blood flow to the CNS structure that produces the sense of reward. Nicotine can improve performance in cognitive tasks possibly by the effect on the frontal cortical executive functioning area of the brain. Nicotine has also been associated with an antidepressant effect and transdermal nicotine patches have been noted to produce a dramatic antidepressant effect in individuals with major depression and who do not smoke (Julien, 2011).

In addition to the effects of the CNS, nicotine can increase the heart rate, blood pressure and cardiac contractility. In individuals who do not have atherosclerosis, nicotine causes the coronary arteries to dilate which increases the blood flow to meet the oxygen demand (Julien, 2011). Smoking cigarettes however can cause atherosclerosis and endothelial dysfunction. Cigarette smoking and tobacco use is implicated in many cardiac rhythm disorders such as transient sinus arrest, bradycardia, sinus tachycardia, atrial fibrillation, and ventricular tachyarrhythmia (Akturk, 2012).

In addition to cardiovascular disorders, nicotine and most specifically cigarette smoking has also been linked to pulmonary disorders such as chronic bronchitis and emphysema as well as susceptibility to respiratory infections (Julien, 2011). Even though these disorders are debilitating and in the case of chronic obstructive pulmonary disease (COPD) which encompasses chronic bronchitis and emphysema can lead to death, many smokers still find it difficult to stop smoking. In many cases the patient may experience depression and feelings of alienation because they view the disorder as their own fault. This emotional state of the patient can present the physician with a perplexing position. In this situation he or she must balance the need to encourage the patient to stop smoking and the need to help the patient therapeutically and assure him or her that he or she is not “ blamed” for their illness (Wilson, 2010).

Cancer is another major health issue that nicotine and tobacco users face. Nicotine is not a carcinogen, however its primary delivery system tobacco is. Cigarette smoking and the use of smokeless tobacco has been linked to lung, mouth, voice-box and throat cancer (Julien, 2011). Lung cancer is the leading

cause of cancer death in the United States and the leading cause of male death world-wide (Bloch, 2012). In addition to these forms of cancer, tobacco use has also been linked to bladder and pancreatic cancer in both sexes as well as uterine, cervical and breast cancers in women (Julien, 2011). Despite the major successes that have been realized through informational campaigns, surgeon general warning and policies prohibiting smoking in public areas and work places the number of cancers diagnosed that are directly associated with tobacco use are still high (Bloch, 2012).

In addition to the health issues that smoking presents to the smoker, cigarette smoking also presents health issues for those who are exposed to “ second-hand” smoke. Second-hand smoke can cause lung cancer, coronary heart disease, and death in non-smokers exposed to cigarette smoke in addition to other non-fatal health issues such as coughing and reduced lung function (Julien, 2011). Exposure to cigarette smoke reduces the oxygen supply and increases the instances of lowered birth weight of the babies born to pregnant women who smoke or are exposed to second-hand smoke. Second-hand or passive smoke has also been linked to sudden infant death syndrome (SIDS) as well as other immunological disorders and medical problems. Children exposed to second hand cigarette smoke may also be at risk for lower intelligence quotients (IQs) and ADHD (Julien, 2011).

While there are few current therapeutic uses for nicotine, studies have been and continue to be conducted in using the drug for treatment of disorders such as ulcerative colitis, Alzheimer’s disease and Parkinson’s diseases in addition to using lower doses to help individuals during smoking cessation. A more recent possible positive side effect of nicotine use that is being

investigated is the drug’s implications for tissue and wound repair. Smoking cigarette tobacco can deter the wound healing and tissue repair process by depleting the oxygen and nutrients necessary for healing. Currently a topical form of the drug is being investigated for use in those areas because of nicotine’s endothelial stimulating ability to enhance healing. The stimulation of endothelial progenitor cells (EPCs) causes the formation of new blood vessels. These new blood vessels carry better blood flow to the injured area which provides it with more oxygen and nutrients to enhance healing (Martin. J., 2009).

Withdrawal from nicotine may be intense and difficult however these symptoms are not usually life-threatening. These symptoms can include strong cravings for nicotine, irritability, anxiety, anger, difficulty in concentration, restlessness, impatience, increased appetite, weight gain and insomnia (Julien, 2011). Withdrawal from nicotine use can be a long term experience which can last in some cases for many months. Some individuals who are treated for other addictions have found abstinence from cigarettes more difficult than stopping other drug use including heroin and cocaine (Julien, 2011). Individuals who attempt to quit smoking may seek help to alleviate these withdrawal symptoms. Many products are available to help individuals stop smoking some of which contain nicotine in various forms such as gum, lozenges, inhalers, nasal sprays and patches. Other medications are available to help with withdrawal should the individual choose to avoid using nicotine in any form during this time. Antidepressants such as bupropion and nortriptyline have been successful in alleviating withdrawal symptoms. Recently varenicline, a partial nicotine receptor

agonist, has been used to reduce the effects of withdrawal as well and those taking it have experienced some degree of success (Julien, 2011).

Caffeine and Nicotine

Caffeine’s effect on adenosine receptors appears to be capable of controlling distinguishing stimulus effects of nicotine. This capacity however diminishes substantially during chronic exposure to caffeine (Justinova, 2009). On the other side of the situation nicotine seems to have an accelerating influence on the metabolism of caffeine (Grela, 2013). Caffeine’s half-life is shortened in those coffee drinkers who are also smokers which can result in a decrease in caffeine levels in plasma (Julien, 2011).

A reduction of or abstinence from nicotine can slow down the individual’s caffeine metabolism. This in turn can cause an increase in caffeine plasma levels which can induce or intensify anxiety (Julien, 2011). Caffeine consumption not only sustains nicotine cravings but can also cause nicotine seeking behaviors to be reinstated in rats that had been trained to self-administer nicotine. These findings would indicate that in order for the individual to succeed in smoking cessation he or she would be well served to discontinue use of caffeine as well (Liu, 2012).

From a Biblical perspective becoming addicted to anything is a product of one’s desire no matter what that desire is for. Those who are able to break those addictions and remain free of them are strong and blessed. “ Blessed is the man who remains steadfast under trial, for when he has stood the test he will receive the crown of life, which God has promised to those who love him. Let no one say when he is tempted, ‘ I am being tempted by God,’ for

God cannot be tempted with evil, and he himself tempts no one. But each person is tempted when he is lured and enticed by his own desire. Then desire when it has conceived gives birth to sin, and sin when it is fully grown brings forth death,"(James 1: 12-15, ESV). God also gives promise of help for those who attempt to break those addictions. " No temptation has overtaken you that is not common to man. God is faithful, and he will not let you be tempted beyond your ability, but with the temptation he will also provide the way of escape, that you may be able to endure it,"(1 Corinthians 10: 13, ESV). While other assistance may be needed to break those addictions, the Lord will be there to help the individual move forward and continue on his or her new path away from those addictions. Individuals suffering or trying to break free from addiction can find strength in the Lord to make it through. " I can do all things through Him who strengthens me," (Philippians 4: 13 ESV).

Caffeine and nicotine are two of the most widely used and abused legal substances in the world today and have many effects on the individual's body and mind. One of the most prominent effects is that the use of either substance can lead to a strong dependence since they are both extremely addictive and in some instances can take a long time to break away from. Even though these substances hold many negative, both substances have positive attributes and can be used for beneficial purposes. Caffeine has been used not only as a stimulant but to aid in the treatment of various disorders including the treatment of pain. While nicotine may have some positive attributes the health problems caused by its main source, tobacco, have created much negative publicity. With further studies more positive effects of both caffeine and nicotine may be uncovered however at that time

it would be necessary to ascertain whether the positive effects will outweigh the negative consequences produced by the substances.

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