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Cory Austin Mullins

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CAFFEINE USE WITHIN THE SAFETY SENSITIVE INDUSTRY

by

Cory Austin Mullins

Bachelor of Science, Utah Valley University, 2012

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Abstract

This study is an in-depth look at caffeine use and its effect on individuals who work within a safety and security sensitive job industry. The focus of this paper is on the current use of caffeine in our society as well as the overuse/abuse of the drug and the causes behind it. This paper will highlight the negative impacts caffeine has on the human body and its cognitive thinking skills but does not neglect the positive impacts as well. Caffeine in energy drinks and similar products is used in an attempt to retain one's alertness and focus, with little regard to one's health. Possible risks and/or side effects are outweighed in many circumstances by the potential benefits of caffeine when combatting fatigue. Long workdays and lack of adequate sleep are considered common drivers of this need for caffeine and its potential for overuse. With unregulated marketing of these products, the trend of caffeine consumption continues to rise as the demands of a competitive job industry increases.

Keywords: caffeine, energy drinks, energy shots, pilots, aviation industry

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Introduction

Since this author first began his career in the aviation industry, a common perception is that there has been a substantial increase in the use of coffee, energy drinks, and energy shot products has occurred within this safety sensitive job industry and within airports in their entirety. The energy drink industry saw a great increase in popularity, with sales over \$10 billion in the United States alone for the fiscal year of 2012. The aviation industry has been expanding each and every year at a rapid pace since 2008. With this, longer hours are scheduled, staffing requirements must be increased, and more fatigue fighting products are used.

When arriving at an airport, it is easy to notice caffeine-based products used in the terminal, at the gates, and in the cockpits of aircraft. Common sights at the airport include taxi cab drivers with coffee, ticketing agents with espresso shots, and TSA agents, airport vendors, and gate and ramp agents with energy drinks. Pilots wait in long lines in front of popular coffee vendors prior to doing their pre-flight procedures.

It's as if the industry revolves around the use of caffeine, but more so, individuals may perceive their performance as dependent on these products for a positive outcome. Caffeine use, however, does come with unknown or surprising risks when abused or not carefully administered.

Human Performance Challenges

Many individuals working in the aviation industry report that they are often too tired to work safely, and they recognize the need for some sort of stimulant to help them perform their duties (Beyea, 2004). The aviation industry is experiencing rapid growth in all aspects of the industry and will continue to see rapid increases for years to come (Massachusetts Institute of Technology, 2015) With the airlines increasing their numbers of flights and competing to have

the best services and shortest in-flight times, the pilots of these airlines find their physical and mental workloads pushed to capacity.

Furthermore, the TSA agents working at these airports are required to stay fully awake while screening bags and passengers. This job applies a great amount of stress to the body and brain. This is due to the amount of alertness and focus that must be used while watching baggage go through X-ray machines and scanning passengers for prohibited items. Gate agents are pushed to deplane and enplane flights one right after another while handling customer issues to keep the customer service level high. Ramp agents are also pressured to remove baggage from aircrafts, sort the baggage by their destinations, get those bags to and loaded on their correct aircraft, clean aircraft cabins, and service the aircraft, all within a very short time frame. On quick turns, these turnaround times are typically 40 minutes or less. Caffeine is used daily in excessive quantities. Excessive quantities are defined as more than 500 to 600 mg a day, which may cause side effects such as insomnia, nervousness, restlessness, irritability, stomach upset, fast heartbeat, and muscle tremors (Pruthi, 2014).

Caffeine Use in Pilots

Commercial pilots typically start their mornings off with a caffeine product to gain alertness, motivation, and situational awareness prior to their originating flight. The consumption of caffeine can be potentially dangerous medically and operationally because much of the adult population consumes it in quantities large enough to have adverse effects on multiple organ systems within the human body (Mrazik, 2004). Those occupations that include operating complex equipment are especially at risk (Smith, 2015), the reason being that a human's senses (sight, sound, and touch) and other cognitive performances are heavily relied upon to function at the level needed for these occupations. "Consumption of high amounts of caffeine (more than

300mg a day) can produce deterioration of psycho-motor performance and changes in mood which can impair a pilot's efficiency and effectiveness to operate an aircraft. It should be noted that since some tolerance to caffeine develops, that over time, a bit more caffeine is require to produce the same effect" (Antuanano, 1988).

Caffeine Use in Air Traffic Controllers (ATC)

By April 2011, the reports of air traffic controllers (ATC) falling asleep on the job were already at five incidents for the year (Stark, 2011). There have been numerous incidents between 2009–2014. However, the FAA–NASA research results “have remained in a ‘for official use only’ format” since 2009 and have not been released to the public (Lowy, 2014).“Due to the increasing public awareness of these situations, caffeine use is being greatly increased as well by employees working in these capacities (Pasztor. 2011).

What is Caffeine?

Caffeine is a central nervous system stimulant, with other uses in nature. From an evolutionary perspective, plants use caffeine as a natural pesticide, paralyzing and potentially killing the insect. For humans, however, it is most commonly consumed through processing seeds of the coffee beans or tea bush. Caffeine acts as a stimulant to the central nervous system and its use began in the middle of the 15th century (Hildebrandt, Tantbirojn, Augustson, & Guo, 2013). Caffeine has been extremely popular in Europe and North America. It's estimated that over 90% of adults in North America drink or ingest some form of caffeine daily, and when combined with soda drinks containing caffeine, those statistics rise (Hildebrandt et al., 2013).

In fact, not only adults consume caffeine-related beverages, but increasingly more and more young adolescents do as well (Food and Drug Administration, 2010).

In 1980, the FDA looked to remove caffeine from all soft drinks, citing health concerns

about caffeine. With soft drink manufacturers looking for a way to avoid this new requirement, manufacturers responded by saying that caffeine was added to soft drinks as a flavor enhancer. If the FDA had not accepted that response from the soft drink makers, then the FDA would have regulated them as drugs. When the FDA gave the approval for caffeine, it did so, on the grounds that the makers would limit caffeine amounts to a maximum of 0.02% caffeine or 71 mg/12 fluid oz (Reissig, Strain, & Griffiths, 2009). Caffeine is used within the products listed in Table 1.

Caffeine's Effects on the Body

Caffeine takes effect on the human body within 15–30 minutes of being consumed. Peak caffeine concentrations are typically reached in 30–60 minutes after initial consumption. The effects of caffeine can last up to four hours. Once caffeine is consumed through the mouth, it is quickly and almost fully (99%) absorbed through the gastrointestinal tract into the bloodstream (Barron, 2009)

During the process, caffeine is distributed throughout the entire body and passes through all biological membranes. This also includes the blood-brain barrier and the placental barrier during pregnancy. Once the caffeine has been absorbed and used by the body, only 5% of it is recovered and remains unchanged as it passes in urine. Caffeine does have a half-life once it has been consumed and ingested into the body (Bauman, 2006). The definition of half-life is as follows: “Also called biological half-life. *Pharmacology*. The time required for the activity of a substance taken into the body to lose one half its initial effectiveness” (Dictionary.com, 2015).

Caffeine stimulates the nervous system to produce clearer thought patterns and focus, and even general body coordination (Veracity, 2005). The amount of caffeine needed to fully stimulate the nervous system varies from person to person and is dependent on a large number of statistical variables (gender, weight, daily intake, type of caffeine—coffee, tea, and energy

drinks/shots). “Research also suggests that men may be more susceptible to the effects of caffeine than are women” (Pruthi, 2014).

Negative Effects of Caffeine

As the number of new products containing caffeine increases every year, the amount of caffeine in these products increases as well. Consumers are typically ignorant to this fact due to laws on caffeine disclosures often overlooked and left unmodified by manufacturers if an increase is made. Caffeine intoxication is defined as “recent consumption of caffeine and five or more symptoms that develop during, or shortly after, caffeine use including restlessness, nervousness, excitement, insomnia, flushed face, diuresis, and gastrointestinal complaints” (Kovacs, 2011). Caffeine intoxication is classified as a clinical syndrome. People who consume large quantities of caffeine on a regular basis are not at as high of a risk of caffeine intoxication as those who normally consume smaller amounts (See Table 1).

Although it seems unlikely, people can and do overdose on caffeine. An overdose can be fatal. The fatal dose amount of caffeine for adults has been shown to be anything more than 10 grams. For example, “a British man died after consuming caffeine powder at a party. The spoonful that he consumed was equal to consuming 70 energy drinks. The only warning that this writer could find on one of these caffeine powders is limit the use of caffeine-containing medications, foods or beverages while taking this product because too much caffeine may cause nervousness, irritability, sleeplessness, occasionally rapid heartbeat, restlessness, and even mild-involuntary trembling” (Hassan, 2011). “Do not give to children under 12 years of age. In case of accidental overdose, seek professional assistance or contact a poison control center immediately” (Kovacs, 2011). “More than 500–600 mg. of caffeine per day can cause restlessness, anxiety, headaches, and other problems” (ALPA, 2010)

Human Performance Enhancements

Ingesting caffeine does increase performance in certain situations. A study that used centrifuge subjects completed three separate studies using the variable of bodyweight, an energy drink without caffeine, and a placebo. Relaxed G tolerance was 13% higher when using a caffeinated energy drink, and increased tolerance was shown at higher altitudes. The altitude, however, does not increase tolerance duration and, after a time, has a diminishing effect (Walker et al., 2010).

Caffeine does improve performance during periods of fatigue and sleep deprivation, and evidence shows that caffeine effects are more pronounced at higher altitudes; this has a direct effect on pilots (see Astorino et al., 2010; Hackett, 2010). Scholarly statistics indicate that there are significant performance enhancing properties (reaction time, concentration, memory, subjective alertness) that come from the use of caffeine and caffeine products such as energy drinks, energy shots, and espresso shots. Certainly psychomotor skills and cognitive attention to detail are important parts of expected pilot performance (Childs et al., 2008). “Sleep deprivation and environmental stress adversely affected performance and mood. Caffeine, in a dose-dependent manner, mitigated many adverse effects of exposure to multiple stressors. Caffeine (200 and 300 mg) significantly improved visual vigilance, choice reaction time, repeated acquisition, self-reported fatigue and sleepiness with the greatest effects on tests of vigilance, reaction time, and alertness. The greatest effects of caffeine was present within 1 hour post-administration, but significant effects persisted for 8 hours” (Lieberman, 2002).

Fatigue

According to ALPA, scientific studies have shown that humans have difficulty determining the following: (a) forgetfulness; (b) poor decisions/mistakes; (c) slowed reaction

time; (d) reduced vigilance; (e) poor communication; (f) fixation; (g) lethargy/complacency; (h) mood swings or poor mood; and (i) nodding off. When one or more of the symptoms listed above is present, fatigue is the culprit. Yet, the introduction of the Safe Skies Act of 2012 has gone a long way toward legally mandating safer guidelines for reducing fatigue and thus the predisposition for fatigue as a cause of pilot error (Air Line Pilots Association International, 2012). Flying while fatigued (awake over 17 hours) has similar symptoms to being impaired by alcohol, and thus, in combination with avoiding certain foods (turkey, dairy, etc.), should be avoided (ALPA, 2010).

Military pilots often use “Go Pills.” Due to the side effects and addicting habits that “Go Pills” (known by their medical name as dextroamphetamine, Dexedrine), they are controlled amphetamines used for over 50 years by the Air Force. “Go Pills have been proven effective for temporarily overcoming sleep deprivation in laboratory studies and in field environments. This explains why medicines such as amphetamines have been used extensively in several military conflicts. Despite debate on this topic, dextroamphetamine (Dexedrine®) remains one of the best Go Pill choices because its actions are well understood and its effectiveness in sleep-deprived personnel is well known (Caldwell, 2003).

Why is Fatigue Increasing?

Fatigue is not something new or unique to the aviation industry. For many workers, fatigue is mitigated by short and regular breaks. Fatigue, though, is individualized and has a number of different variable effects upon people in terms of lifestyle and sleep patterns. In pilots, TSA agents, and gate and ramp personnel, though, the consequences of fatigue are often more serious. Indeed, it is difficult to find a cogent and standard definition of fatigue, as the issues are often individualized and have varying causes. They may be age dependent, health dependent,

nutrition dependent, or other issues that are specific to each individual.

The Federal Aviation Administration defines fatigue as more than simple weariness or being tired: “Fatigue is a condition characterized by increased discomfort with lessened capacity for work, reduced efficiency of accomplishment, loss of power or capacity to respond to stimulation, and is usually accompanied by a feeling of weariness and tiredness” (Federal Aviation Administration, 2007). Fatigue in pilots is largely due to long duty periods, insufficient sleep, and circadian disruptions in both military and civilian flight operations (Lieberman, 2003).

Short-term effects experienced by pilots with sleep deprivation are memory difficulties, thinking and moving slowly, and making a great deal of mistakes. The long-term effects of flight crews working irregular schedules are increased incidences of stomach problems, menstrual irregularities, flu, weight gain, cardiovascular problems, and colds. Yet, combined with caffeine, many of the ingredients in energy drinks (amino acids, for instance), when combined with fatigue and/or medical issues, may have the opposite effect on performance than intended (Lieberman 2003).

Since sleep recommendations, flight time limitations, and suggested layover durations were first introduced in the 1930s, there have been few modifications or changes. Despite this, progress has been made in the scientific discovery and knowledge of fatigue, shift work, sleep, and circadian physiology (Caldwell, 2005). Nevertheless, practices within the aviation industry may not yet have properly incorporated new discoveries and information regarding these findings. Thus, the issue of pilot fatigue has greatly increased over time and has been proven by the growing number of reports from pilots, accident statistics, and operational flight studies (Miller, 2001).

Domestic pilots (short-haul) blame their fatigue issues on high workloads and sleep

deprivation while international pilots (long-haul) associate their fatigue with time zone transitions that incorporate sleep deprivation and circadian disturbances (Caldwell, 2005). Both short- and long-haul pilots blame their fatigue on jet lag; early waking times, night flights, multiple flight legs, time pressures, and consecutive duty periods without a sufficient amount of time for recovery breaks. Corporate and executive pilots also add that night flights, early awakenings, late arrivals, multi-segment flights, turbulence, and weather are contributing factors (Caldwell, 2005; Caldwell et al., 2009).

Combating Fatigue

There are several scholarly studies that continue to show slower reaction time and a greater likelihood of error. Specifically, the aviation industry has a greater interest in solutions to fatigue issues. In this current environment, pilots are moving past coffee as a way to remain awake and seeking a greater boost in reaction time and their ability to remain alert during long flights or shifts (see Caldwell, 2003; Caldwell, 2009; Fatigue in Aviation, 2005; Deppendschmidt, 2010). Pilots are seeking a solution to help offset fatigue or at least prolong the effects and symptoms of fatigue as long as possible.

Fatigue Management Systems

With the introduction of new ultra-long-range (ULR) aircraft by both Boeing and Airbus, flight crews will experience even longer operations. ULR aircraft have also led to the use of augmented crews as a means of mitigating fatigue levels that can impair airline safety (QinetiQ, 2002). Moreover, largely due to scientific research and increased workloads during long-range flights, a fatigue risk management system has encouraged the aviation industry to move from a regulatory to a more proactive approach to fatigue management, defined by the ISCO as “a data-driven means of continuously monitoring and maintaining fatigue related safety risks, based

upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness” (Sky-Bray, 2014) “This process leads to continuous safety enhancements, by identifying and addressing fatigue factors across time and changing physiological and operational circumstances. Structurally, it is composed of processes and procedures for measuring, modeling, managing, mitigating, and reassessing fatigue risk in a specific operational setting” (FAA, 2013). Management systems combine the following items when conducting an evaluation of fatigue: schedule assessment, operational data collection, continuous and systematic analysis, and both proactive and reactive fatigue mitigations, guided by information provided by scientific studies of fatigue. “Overall, a fatigue management system offers a way to more safely conduct flights by offering flexibility not available within regulatory limits” (FAA, 2013).

Fatigue management systems aim to ensure high levels of alertness in personnel to maintain acceptable levels of performance and safety. A “just” or “safety” culture is integral to a successful fatigue management system, and it requires a shared responsibility among all levels of the organization, as well as the involvement of regulatory agencies. (FAA, 2013)

Looking at fatigue from a safety aspect, flight operations that are managed incorrectly pose a great risk to passengers, aircraft, and flight crews. A National Transportation Safety Board (NTSB) study of major accidents in domestic air carriers from 1978 through 1990 in part concluded that

[C]rews comprising captains and first officers whose time since awakening was above the median for their crew position made more errors overall and significantly more procedural and tactical decision errors.

Kirsch estimated that fatigue may be involved in 4–7% of civil aviation mishaps, data from the U.S. Army Safety Center suggest fatigue is involved in 4% of Army accidents, and statistics from the Air Force Safety Center blame fatigue, at least in part, for 7.8% of U.S. Air Force Class A mishaps. (Caldwell et. al., 1994)

Fatigue in this industry is a great factor for performance effectiveness, personal well-being, and occupational safety. As humans, individuals are simply not able to operate effectively under the pressures that come with such a globally demanding schedule. This necessitates industry, governmental, and individual ways to manage fatigue.

History of Energy Drinks

In the late 1940s, the first version of the energy drink was created and mass-produced. This drink was created, marketed, and sold by Taisho Pharmaceuticals, a Japanese drug maker (Meier, 2013). Taisho, at the time, marketed and pushed taurine extract while touting its health benefits. Taurine was said to reduce fatigue and improve vision at night (Meier, 2013). The company's slogan (designed to capture consumer attention) claimed it to be "A formula that is so effective in treating unexplained fevers, neuralgia, fatigue, whooping cough and other conditions for which there is no drug is very rare indeed" (Meier, 2013).

In the 1960s, another product branded as an energy drink was released in Thailand. This drink was called Krating Daeng (pronounced "grating deng"). Krating Daeng is better known in society today as Red Bull. Dietrich Mateschitz, an Austrian businessman, ran across Krating Daeng while trying to find a cure for jet lag. Red Bull was officially branded and sold to the public in 1987 by Mr. Mateschitz and the Thai creator (Meier, 2013).

Currently, there are over 500 brands of energy drinks and energy shots on the market.

These drinks all contain various ingredients, many of which are considered stimulants. These stimulants are substances such as caffeine, caffeine-containing agents, and amino acids. They also contain vitamins and sugars. Not one of these products is regulated by the FDA due to manufacturers of these drinks classifying them as dietary supplements.

Non-Regulation for Caffeine-Based Energy Drinks

Many energy drink/shot products have extremely high concentrations of caffeine that can be quite dangerous but are still sold over the counter. “At lower dosages caffeine follows first-order elimination kinetics, however, at higher concentrations, enzymatic saturation occurs and metabolism converts to zero-order kinetics. This may lead to accumulation and increased toxicity” (Nordt, 2012). In other words, low doses of caffeine do not usually cause health problems, whereas high intake can cause numerous issues in the body such as dysrhythmias and seizures.

The FDA does not require that a manufacturer of an energy drink properly display warning labels advising of the amount of caffeine that is contained in that product, as it does for over-the-counter stimulant drugs. The following directions and warnings required by the FDA are posted on each product label and must read as follows:

- The recommended dose of this product contains about as much caffeine as a cup of coffee. Limit the use of caffeine-containing medications, foods, or beverages while taking this product because too much caffeine may cause nervousness, irritability, sleeplessness, and, occasionally, rapid heartbeat.
- For occasional use only. Not intended for use as a substitute for sleep. If fatigue or drowsiness persists or continues to recur, consult a [physician or doctor].
- Do not give to children under 12 years of age.

- Directions: Adults and children 12 years of age and over: The oral dosage is 100–200 mg not more often than every 3–4 hours (Food and Drug Administration, 2014).

Energy drink manufactures state that their products fall under the 1994 Dietary Supplement Health and Education Act. This Act notes that a product derived from herbs and natural sources is a dietary supplement rather than a drug. There are some energy drink makers that simply ignore the requirements of the FDA, but the FDA has yet to enforce the caffeine limits that they set (Heckman, 2010; US Food and Drug Administration, 2012).

Because energy drinks are labeled as dietary supplements as a way to avoid the FDA, the same concept applies to other countries in which the drinks are marketed. However, given all the countries' different regulatory requirements for context labeling and health warnings, the United States has the most relaxed requirements for these drink makers. This has resulted in aggressive marketing tactics primarily targeting young males (Heckman et al., 2010). A valid assumption can be made that pilots, particularly younger pilots who have been part of the post-2000 generation of these products, may be more prone to their use (Childs et al., 2008). Non-scholarly sources report that using energy drinks or heavily caffeinated products is often promoted at air shows, causing some non-commercial pilots to tout their effectiveness, i.e., “within minutes the mental fog lifted” (Godwelski, 2012).

Another study conducted on another popular energy drink/shot, 5-Hour Energy®, shows these marketing campaigns at work. The makers of 5-Hour Energy® claim that their energy drink produces “No Crash Later,” unlike those of their competitors. This is intended to mean no “sugar crash,” yet the physiological effects of this product, despite it containing no sugar, include negative effects on heart rate, blood pressure, and other bodily systems (Meier, 2013). A sugar crash is defined as the following:

A sugar crash is a term used to describe the extreme feeling of fatigue after consuming a large amount of carbohydrates. A sugar crash causes the body to quickly produce insulin, which triggers glucose usage by tissues in the body by either using it as glycogen or using it for energy. The usage causes a drop in glucose levels, which in turn causes the feelings of a sugar crash. So when the blood sugar levels are low, the cells within the body aren't receiving the energy they need to keep the body going. Many people describe a sugar crash as a feeling of lethargy, tiredness, and irritability, while other people compare it to the feeling of a hangover (Sugar-crash.org, 2015)

The use of these energy drinks may also contribute to health concerns that we are only beginning to understand (FDA, 2014; Ressig et al., 2009). The average age of energy drink consumers tends to be 18–34 years (Heckman et al., 2010).

Energy Drinks/Shots Within Safety Sensitive Jobs

Overconsumption of energy drinks can be harmful in the long term, and consumption of energy drinks in general may pose a health risk to certain individuals (Whiteman, 2014). The University Aviation Association notes that there are dangers of consumption of various types of energy drinks in the field, particularly for pilots as workloads and duty times increase (Depperschmidt et al., 2010). Energy drink usage is on the rise. In a study that was conducted in a hospital over the course of a year with 2,158 test subjects, 1,298 reported using energy drinks (60.1%). More males than females regularly consume energy drinks, and the age group is typically younger (with some college education experience). The subjects said they consume energy drinks to increase their energy, and 33.5% of the subjects claimed to have experienced

“bad reactions” while consuming these drinks. These bad reactions consist of feeling jittery, shaking, having difficulty sleeping, or experiencing chest pain, palpitations, or fast heartbeat. Other reactions include nausea, vomiting, diarrhea, headaches, and decreased sexual performance. Other side effects of consumption included anxiety, bad taste, and abdominal pain (Nordt, 2012). Interestingly, the International Society of Sports Nutrition has been critical of energy drinks, particularly for younger populations. While they acknowledge that consumption of energy drinks can enhance performance if ingested 10–60 minutes prior to a significant activity, they do note that individuals with pre-existing cardio, metabolic, hepatic, or other illnesses that typically are found in older adults may contribute to negative effects with indiscriminate use (Campbell et al., 2013).

Negative Effects of Energy Drinks/Shots on the Human Body

The energy drink industry saw a great increase in popularity, with sales over \$10 billion in the United States alone for the fiscal year of 2012. The rapid increase in sales is primarily due to the convincing marketing strategies that the energy drink companies deploy (Malinauskas et al., 2007). These marketing campaigns explain that energy drinks provide a physical and mental edge. Energy drink marketing is primarily targeted at college students, but recent evidence also shows that its use is growing in industries of high stress and long work periods (Malinauskas et al., 2007).

In the past several years, energy drink companies have paid more attention to the FDA due to the reports of serious injuries and deaths that have been linked to the high levels of caffeine in the drinks. “One thing is clear, interviews with researchers and a review of scientific studies show: the energy drink industry is based on a brew of ingredients that, apart from caffeine, have little, if any benefit for consumers” (Meier, 2013). Energy drink companies do not

promote their products as simply caffeine-containing drinks but rather as specially engineered blends of ingredients that offer more than just a dose of caffeine. They often combine other ingredients to increase the effects of caffeine, as this has become the world's most widely used drug, certainly capitalized upon by companies promising greater performance (Seifert et al., 2011). As you can see, there are a variety of caffeine products on the market to help increase alertness and avoid fatigue. However, the quantity of consumption of these products needs to be controlled, as overdosing and adverse side effects can occur. Energy drinks contain amounts of caffeine that experts consider alarming (Aubrey, 2007). Only 0.73 ounces of 5150 Sweet Juice® would cause an overdose. Certainly, this is an unlikely scenario, but it does show that overconsumption is possible. However, a teenage death has been linked to consumption of only two Monster® energy drinks (Center for Science in the Public Interest, 2014).

Conclusion

As research shows, there are a variety of caffeine products on the market to help increase alertness and avoid fatigue. Studies have shown that caffeine does increase the performance of the human body mind when used and/or regulated. However, the quantity of consumption of these products needs to be controlled, as overdosing can occur without immediate notice. Overdosing can be fatal, as stated previously.

While conducting this study, there were numerous areas of information that were not able to be located. Therefore, further research needs to be conducted in the following areas: airline employees (gate agents, baggage handlers, ticketing agents, aircraft maintenance, customer service and reservations), Transportation Safety Administration agents (passenger screeners, baggage screeners, cargo screeners), and airport vendors (wheelchair pushers, cabin cleaning crews, etc.) to gain a more in-depth look into this problem. Different types of research should

include surveys, questionnaires, human simulation testing, and employee testing while conducting these job functions. The results from these studies will aid in looking in more depth at and understanding of the effects of caffeine, both positive and negative in safety and security job capacities while performing their job functions and/or duties.

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Table 1

Caffeine Content by Product

Coffee	
Plain brewed coffee (8 oz)	102–200 mg.
Instant (8 oz)	27–173 mg
Espresso (1 oz)	30–90 mg
Pain, decaffeinated	3–12 mg
Tea	
Tea brewed (8–12 oz)	40–120mg
Green Tea (8 oz)	25–45 mg
Black Tea (8 oz)	40–70 mg
Soft Drinks (all 12 oz)	
Barq's Root Beer	22 mg
Coca-Cola Classic	35 mg
Diet Coke	47 mg
Dr. Pepper	42 mg
Dr. Pepper Diet	44 mg
Jolt Cola	72 mg
Mountain Dew (Reg. and Diet)	54 mg
Mountain Dew MDX (Reg. and Diet)	71 mg
Pepsi-Cola	38 mg
Pepsi, Diet	36 mg

Sunkist Orange	72 mg
Tab	46.5 mg
Vault	71 mg
Energy Drinks	
Full Throttle (16 oz)	144 mg
Monster Energy (16 oz)	160 mg
Red Bull (8.5 oz)	80 mg
Rip It (8 oz)	100 mg
SoBe No Fear (8 oz)	130 mg
Spike Shooter (8.4 oz)	300 mg
Chocolate, Candies, and Other	
Chocolate-covered coffee bean (40 g per serving)	300 mg
Hot cocoa (8 oz)	3–13 mg
Jolt caffeinated gum (1 stick)	33 mg
Over-the-Counter Medications	
Excedrin Extra Strength (1 tablet)	200 mg
Midol Menstrual Max. Strength	65.4 mg
No-Doz Maximum Strength (1 tablet)	200 mg
Pain Reliever Tablets (1 tablet)	65 mg
Vivarin (1 tablet)	200 mg

Sources: Mayo Clinic, 2014; Higgins et al., 2010