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Powering Up or Stressing Out?: A Look at the Effects of Caffeine on Stress in College-Aged Youth

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A Look at the Effects of Caffeine on Stress in College-Aged Youth

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Abstract

The Zoe Transformation 2.0 sleep challenge research study took place February 2015, on the campus of Southern Adventist University (SAU). This was a study to determine what effect a 28 day sleep challenge coupled with a daily devotional would have on sleep quality, stress, and the daily spiritual experience in the life of a college student attending a private Christian university. Research assistants were involved in each aspect of the study. Among other duties, my role as a research assistant included comparing the databases of the study questionnaires to ensure accuracy. It was in performing this procedure that I became interested in researching the effects of caffeine on stress in the college-aged group. This paper will describe literature review findings and research findings using the Zoe Transformation 2.0 data.

Considered the most widely consumed psychoactive drug worldwide, caffeine is readily available for human consumption. It occurs in its natural form in specific plant sources, such as coffee beans, cocoa beans, and leaves used to make tea. For centuries, people have ingested caffeine when they consumed chocolate and when they drank coffee and tea. Generations of people drank coffee and/or tea in an effort to stay awake and alert. Then, soft drinks were invented and gained popularity throughout the 1800s and 1900s. Some of these early carbonated, non-alcoholic drinks contained cocaine. Due to the highly addictive properties and serious health risks of cocaine, this drug was later removed and replaced with caffeine. Today, many soft drinks contain caffeine, although the United States Federal Drug Administration (FDA) will only allow a maximum of 71 milligrams of caffeine per 12-ounce serving (Center for Science in the Public Interest, 2014). To avoid this caffeine restriction, energy drinks were introduced as a less regulated dietary supplement.

Energy drinks contain some of the highest concentrations of caffeine. These drinks were introduced in Austria in 1987 and in the United States in 1997 (Ressig, Strain & Griffiths, 2009). There are now hundreds of energy drink brands on the market, with varied amounts of caffeine and other stimulants in the ingredients with sales grossing $4.8 billion (Marcizinski, 2011; Ressig, Strain & Griffiths, 2009). These drinks are classified and marketed as supplements, which means they do not fall under the rules and regulations of the FDA. More recently, caffeine has become available in a wide range of dosages in energy drinks, chewing gum, energy waters, candy, medications, pills (NO-Doz), breath fresheners, and even as a very concentrated powder (Sanchis-Gomar, Pareja-Galeano, Cervellin, Lippi & Earnest, 2015; Center for Science in the Public Interest, 2014). It seems that the current worldwide population has become obsessed with increasingly higher dosages of caffeine regardless of the health consequences. By promising increased alertness, strength, and stamina, advertisements for highly caffeinated energy drinks

target adolescents and young adults. Research from all over the world shows the advertisements are successful. The majority of energy drink consumers are between the ages of 18 to 34 (Spierer, Blanding & Santella, 2014; Rath, 2012), and even more men than women are attracted to these drinks (Petit & DeBarr, 2011; Kristjansson, Sigfusdottir, Allegrante & James, 2011; Skewes, DeCou & Gonzales, 2013). Energy drink use begins most frequently during the high school years, and most often between 6 P.M. and midnight (Bulut, Beyhun, Topbas & Can, 2010). In addition to the physical effects, caffeine also has an effect on the brain. Medical science is just beginning to learn the depth and breadth of the effects of caffeine on all people, especially on young people whose brains have not yet fully developed. This paper shall look at one small aspect of the side effects of caffeine: Do caffeinated drinks increase stress in the college-aged group?

Literature Review

Physiological Stress of Caffeine

Many of the effects of caffeine on the body are well known. What is not known is the full extent of damage that caffeine might render long-term, even with short-term high dose caffeine use. It is also not known if the variety of ingredients in energy drinks might have a synergistic effect, causing the measured caffeine to have an even stronger effect on the individual (Stacio, Curry, Wagener & Glassman, 2011). One of the ingredients often found in energy drinks is Guarana. Guarana seeds contain two to three times as much caffeine as coffee beans (Rath, 2012; Sanchis-Gomar et al., 2015). For reference, approximately 100 mg of caffeine are in the average eight-ounce cup of coffee; and about 7 to 80 mg of caffeine are in an eight-ounce cup of tea (5 mg in decaffeinated tea); from 23 to 69 mg of caffeine are found in a 12-ounce serving of caffeinated soft drinks. Energy drinks contain anywhere from 50 mg in a 12-

ounce Starbucks Refresher to 537 mg of caffeine in a 16-ounce Bang energy drink (Center for Science in the Public Interest, 2014).

There are multiple brands of candy containing various amounts of caffeine. One of these is a candy called Crackheads, which are white and dark chocolate-covered espresso beans. The regular 1.3-ounce box claims to contain as much caffeine as two cups of coffee, and the exact same size (1.3-ounce) box of Crackheads-2 claims to contain the caffeine equivalent of six cups of coffee or 11 cans of Mountain Dew (Osmanium Candy Company, 2015).

A literature review of caffeine use in adolescents and young adults would be incomplete if it did not mention the dangerous practice of combining alcohol with caffeine, especially in the form of energy drinks. From 2006 to 2011, the frequency of emergency department visits in the United States (US) involving energy drink consumption increased tenfold, with half of those visits related to combining alcohol with energy drinks (Marczinski, C., Fillmore, M., Henges, A., Ramsey, M., & Young, C., 2012). Alcoholic beverages mixed with energy drinks are now mainstream behavior in college students (Marczinski, 2011). Those who combine the two drinks also perceive they have less weakness and incoordination than what they would have experienced with the same alcohol but no stimulant. Also, this alcohol and caffeine combination has been found to increase one's desire for more alcohol, more so than if only drinking alcohol (Marczinski et al., 2012). Combining the two drinks was also shown to increase binge drinking (Skewes et al., 2013; Marczinski, 2011). Motor incoordination, impairment of visual reaction time, and breath alcohol levels still persist when mixing caffeine with alcohol (Rath, 2012). This leads to increased poor judgment, as seen in driving while impaired (Rath, 2012), and other risk-taking behavior including high-risk sexual contact (Miller, K., 2012; Stacio et al., 2011; Spierer et al., 2014; Petit & DeBarr, 2011; Trunzo et al., 2014) and extreme sports risks (Spierer et al., 2014). This caffeine and alcohol combination also leads a person to not feel the sedating effects

of the alcohol, and therefore drink more alcohol than they would normally (Marczinki, C., Fillmore, M., Henges, A., Ramsey, M., & Young, C., 2012; Marczinski, 2011).

It is not known exactly how much caffeine is toxic or lethal, and much depends on the person's size, baseline health, and concurrent substance intake. Caffeine consumption of up to 300 mg daily is considered safe for most adult consumers (Rath, 2012). While the systemic effects were considered individually, in reality, our body and our brain work together as a unit.

Cardiovascular effects. Caffeine increases the heart rate ($p < 0.05$), myocardial load ($p < 0.005$), and blood pressure initially ($p < 0.005$) (Grasser, Yepuri, Dulloo & Montani, 2014). An unsafe increase in heart rate (140-180 beats per minute) will actually cause the blood pressure to drop because the heart chambers do not have time to refill between heartbeats. Higher dosages of caffeine cause chest pain, palpitations, myocardial irritability, and cardiac arrhythmias, such as atrial fibrillation, ventricular tachycardia, supraventricular tachycardia, and ventricular fibrillation (Rath, 2012). Energy drinks have been found to induce a cumulative cardiovascular load (Sanchis-Gomar et al., 2015; Grasser et al., 2014; Grasser, Dulloo & Montani,, 2015) and cause the veins to stick together, which contributes to cardiovascular disease (Rath, 2012). The cardiovascular effects are more pronounced when caffeine is mixed with alcohol (Rath, 2012). Heart failure and death of young people have been reported as a consequence of energy drinks (Bulut et al., 2010).

Renal effects. Caffeine is a diuretic. Consuming large quantities of caffeine results in water loss and dehydration (Bulut et al., 2010). Athletes' consumption of large quantities of caffeine, combined with sweating, have been known to result in profound dehydration and electrolyte imbalance (Rath, 2012; Bulut et al., 2010). Consumption of energy drinks has been known to cause acute renal failure and also rhabdomyolysis (Rath, 2012; Bulut et al., 2010). When rhabdomyolysis occurs, muscle fibers are broken down quickly, and then muscle cell

contents (enzymes and electrolytes) are dumped into the blood circulation, leading to kidney failure.

Endocrine effects. Caffeine increases norepinephrine release from the adrenal glands (Rath, 2012). Metabolic acidosis, hyperglycemia, and ketosis have also been reported as a result of high doses of caffeine (Rath, 2012). Caffeine in any dose has been implicated in fibrocystic breast disease in women (Rath, 2012).

Gastrointestinal effects. Caffeine increases the production of gastric acid and digestive enzymes; it also relaxes the smooth muscle of the lower esophageal sphincter, which will result in gastroesophageal reflux (Rath, 2012). Increased gastric acid, when combined with the acidity of alcoholic beverages, worsens nausea and gastric damage in alcohol induced gastritis (Rath, 2012).

Musculoskeletal effects. Caffeine has been known to induce muscle spasms, tremors, and rhabdomyolysis (Rath, 2012). Rhabdomyolysis is a syndrome caused by a large amount of muscle injury or death. As the muscle cell contents spill into the blood stream, it causes electrolyte disturbances and protein overload. The electrolyte disturbances can lead to cardiac arrhythmias and the protein overload can result in kidney failure if not identified and treated promptly (WebMD, 2014).

Central nervous system (CNS) effects. Caffeine easily crosses the blood-brain barrier and placental barrier (Rath, 2012). Mild CNS stimulation in average dosages (85 to 250 mg) may produce increased alertness, decreased fatigue, and increased ability to concentrate. Higher dosages (250 to 500 mg) can cause anxiety and insomnia (Rath, 2012), with the insomnia lasting more than 12 hours. Comas have also been reported as a result of caffeine toxicity (Petit & DeBarr, 2011). The anxiety, nervousness, insomnia, restlessness, and agitation of caffeine intoxication are also symptoms of anxiety and mood disorders (Rath, 2012).

Neural effects on the brain. Since caffeine crosses the blood-brain barrier, it increases calcium reserve in the cells causing the stress hormone norepinephrine to be released. The release of norepinephrine causes the shaking or tremors known as the fight-or-flight response (Rath, 2012). By stimulating dopamine receptors, caffeine causes one's heart rate to increase and contributes to dependence, sleep disruption, anxiety, agitation, and seizures (Rath, 2012; Sanchis-Gomar et al., 2015). Energy drinks reduce cerebral blood flow, even under mental stress (Sanchis-Gomar et al., 2015; Grasser et al., 2014; Grasser et al., 2015). Grasser et al. (2014) found the cerebral blood flow to decrease by 11% from baseline (-9 vs -3 cm/s, $p < 0.005$) after drinking Red Bull. Caffeine is a CNS stimulant that also opposes adenosine. Adenosine promotes sleep and influences autonomic nervous system activation, helping one to relax (Stacio et al., 2011; Kristjansson et al., 2011).

Neural effects on the body. Tremors, restlessness, hyperactivity and insomnia have all been reported among users of high dosages of caffeine (Rath, 2012). Withdrawal of caffeine allows the vessels to relax. When this happens inside the skull, it results in the person having a headache.

Psychological Effects: Perceived Emotional Stress in Young Adults

Newlon (2015) found that those students who consumed caffeine in the form of energy drinks were prone to higher perceived stress levels than those who did not consume caffeine. A study of young adult men in Australia found a linear correlation between quantity of energy drink consumption and perceived stress ($p < .05$; 95% CI = 0.05, 0.58) (Trapp, Allen, O'Sullivan, Robinson, Jacoby & Oddy, 2014). Fatigue and depression returns once caffeine is discontinued (Rath, 2012; Stacio et al., 2011). Anxiety and insomnia are frequently reported among caffeine users, especially in the college-aged group (Rath, 2012; Stacio et al., 2011 ($r = .54$, $p < .001$); Petit & DeBarr, 2011). A study by Petit and DeBarr (2011) not only found higher

perceived stress in young people who consumed the highest number of energy drinks, but they also discovered a statistically meaningful inverse relationship between study participants' academic achievement (t (4,481) = -4.39, $p < 0.0001$) and their energy drink consumption. Trunzo et al. (2014) found increased caffeine intake was the single most negative predictor of academic performance. Consuming even moderate levels of caffeine can cause increased anxiety among college students (Trunzo et al, 2014). Caffeine use decreases a person's ability to sleep, handle stress, and cope with life's challenges (Trunzo et al., 2014). There is an urgent need to educate university and athletic administrators on this growing problem and increase student knowledge of the negative consequences of regularly consuming energy drinks, especially when mixed with alcohol (Spierer et al., 2014).

Methodology

Research Design

Conducted by Lilly Tryon, DNP, and Master of Science in Nursing (MSN) research assistants, the *Zoe Transformation 2.0* Twenty-eight Day Sleep Challenge was a quasi-experimental, pretest-posttest design study that lasted for 28 days. Research assistants participated in activities such as writing the research proposal, submitting it to the Institutional Review Board (IRB), drafting the grant application, and identifying survey instruments to be used in the study. The study began February 1, 2015 and ended the night of February 28, 2015. In order to increase the sample size for this study, a second experimental and control group was recruited to be in a 14 day parallel study beginning on February 14, 2015. On March 1, 2015 the research assistants and Tryon prepared breakfast for all of the participants and collected the post-test questionnaires and conducted semi-structured interviews with the participants using the questionnaire *Spiritual Experience Reflections*.

Sample Population

Guided by calculations using the effect size G*Power calculator (version 3.1.7 from Duesseldorf University in Germany-Heinrich Heine Universitat Duesseldorf website, 2007), it was determined that the sample size goal for a multiple regression model would need to be 85 participants in order to reveal any difference in outcomes and to affirm 80% power with a 0.05 significance level (two-tailed hypothesis, alpha = 0.05, power = 0.80, and between 3-5 predictors). The goal was to recruit at least 150 participants to allow for attrition; 86 volunteers were actually recruited. The sample population consisted of volunteer SAU undergraduate students from all majors. The students chose whether they wanted to be in the experimental group or the control group. The early volunteers were placed in the 28 day study, and the later volunteers were placed in the 14 day study.

Ethical Considerations

Three potential areas of risk were identified in pursuing this study and were listed in the proposal to the IRB. The first potential risk was psychological and could have included, but was not limited to, anxiety, sadness, regret, and emotional distress. The second area of potential risk was social risk. If the identity of a participant were to be divulged, it could leave a negative impression of the participant, damaging one's reputation or social standing, potentially leading to political or social reprisals. The final potential risk was a spiritual risk. Potentially, knowledge of one's spiritual beliefs or lack of belief could be divulged resulting in an economic, social, and/or psychological impact (Tryon & Gates, 2015).

In order to protect the privacy of the participants, each student was assigned a participant number. One research assistant assembled a master list linking each student's identity and contact information to their participant number. This master list was then only available to Tryon and it was kept in a secure area (Tryon & Gates, 2015).

Participants were required to be at least 18 years old and sign an informed consent form prior to participating in the study. Students were excluded who had a current diagnosis of sleep apnea, narcolepsy, or took prescription sleep medications (Tryon & Gates, 2015).

Procedures

Participants in the *Zoe Transformation 2.0* sleep challenge were recruited jointly by School of Nursing postgraduate students and by the Campus Ministries wellness program Collegiate Adventists for Better Living (CABL). CABL leaders made announcements at campus gatherings, placed flyers around the campus, and e-mailed invitations. Notices were placed in the university newspaper, *Southern Accent*, and research team members from the School of Nursing made personal appeals to students in several physical education and religion general education classes. To encourage participation, $10 Walmart gift cards were given at the end of the study to the participants who completed the study.

At the kickoff of the study, participants filled out the Demographic Questionnaire, the *Pittsburg Sleep Quality Index* (PSQI), the *Perceived Stress Scale* (PSS), and the *Daily Spiritual Experience Scale* (DSES) to obtain baseline information. Once the study began, participants in the experimental groups were e-mailed a scripture verse daily. The participants were asked to meditate on this verse at bedtime, and the e-mails also served as a reminder to keep up with their sleep log of number of hours slept and to place an emphasis on obtaining quality sleep each night of the study. On February 14, participants in the 28 day study filled out mid-study questionnaires of PSQI, PSS, and the DSES, and the 14 day study began. All participants of the study were given questionnaires of the PSQI, PSS, and the DSES at the conclusion of the study along with breakfast.

The two experimental groups submitted daily sleep logs to determine the actual time they fell asleep, the time they woke up, sleep quality rating on a scale of 1 to 10, and whether or not

they read their daily devotional. The control group did not participate in the sleep challenge or provide daily sleep logs.

Variables

The PICO (Problem, Intervention, Comparison, and Outcome) question from the *Zoe Transformation 2.0* study was, "What effect would a 28 day sleep challenge, coupled with a daily devotional have on sleep quality, stress, and the daily spiritual experience in the life of a college student attending a private Christian university?" The 28 day sleep challenge and the daily devotional were the independent variables. Sleep quality, stress, and spiritual experience were the dependent variables.

Measurements

Pittsburgh sleep quality index (PSQI). The PSQI is a subjective questionnaire where the participant rates his or her sleep quality and common sleep disturbing factors from the previous month. Nineteen items were given weighted scores and the sum of the "component" scores provided one comprehensive score (Buysse, Reynolds III, Monk, Berman & Kupfer, 1989).

Perceived stress scale (PSS). The PSS is a psychological questionnaire that uses a Likert-type scale to measure 14 subjective items of specific stressors a person might have experienced over the previous month (Cohen, Kamarck & Mermelstein, 1983).

Daily spiritual experience scale (DSES). This questionnaire contains a list of 15 statements and a closing question. It is a subjective measurement of the participant's spiritual experience in general, not over a specific time frame (Underwood & Teresi, 2002).

Spiritual experience reflections. This questionnaire contained four questions to determine the impact this study may have had on the student's spiritual experience and sleep quality.

Demographics. All student volunteers were also asked to fill out a demographics form that included general information about the participant, such as age, college major, height, weight, gender, housing situation, level of exercise, how many caffeinated beverages they normally drink, the number of caffeinated drinks per day, and other lifestyle and sleep related questions.

Plan for Data Analysis

A data dictionary was completed for each measurement tool and was provided to the research group. For accuracy, results from each research tool was recorded by two different individuals into IBM™ SPSS software (version 22) or Excel and then moved into SPSS. When this was complete, a research assistant performed a data comparison using SPSS to determine any discrepancies. Any discrepancies were compared to the original data and corrected. This process continued until all discrepancies from each tool were corrected. The databases were then available to the research assistants for independent samples *t*-testing and multiple regression analysis.

Results and Discussion

Literature Findings on Stress in the College-Aged Group

Perceived stress was found to be higher in college-aged students who consumed caffeine. Incidentally, the literature review revealed that academic performance was also lower in college-aged students who added caffeine to their diet.

Review of the literature revealed that caffeine has adverse effects on at least six bodily systems: cardiovascular, renal, endocrine, gastrointestinal, musculoskeletal, and the central nervous system. The potential cardiovascular effects include increased heart rate, increased or dangerous decrease of blood pressure, chest pain, palpitations, arrhythmias, blood vessel damage, heart failure and death. Caffeine is a diuretic, contributing to water loss through the

kidneys and dehydration. One's kidneys can be further damaged or thrown into failure in the presence of caffeine-induced rhabdomyolysis. Caffeine affects the endocrine system by stimulating the release of norepinephrine which is a stress hormone leading to the fight or flight response. Other endocrine effects include metabolic acidosis, hyperglycemia, ketosis, and it is involved in fibrocystic breast disease in women. Caffeine affects the gastrointestinal system by stimulating the production of gastric acid and other digestive enzymes, it also relaxes the smooth muscle of the lower esophageal sphincter and this combination of effects leads to gastroesophageal reflux disease (GERD). In the musculoskeletal system, caffeine induces muscle spasms, tremors, and breakdown or death of muscle fibers. Caffeine easily crosses the blood-brain barrier and the placental barrier. The central nervous system effects of caffeine are dose-related, with lower doses resulting in increased alertness and focus. The higher doses of caffeine result in anxiety, insomnia, restlessness, anxiety, and agitation. Caffeine not only affects the brain by causing the release of norepinephrine, it also stimulates dopamine receptors to increase heart rate and cause dependence, insomnia, anxiety, agitation, and seizures. The neural effects on one's body include induction of tremors, restlessness, hyperactivity, insomnia, and withdrawal headaches. The vast information available on physical stress leads one to believe that adding caffeine increases physical as well as mental stress.

Data Analysis and Limitations of the Study

Prior to analyzing the *Zoe Transformation* data on SPSS, I visually analyzed the demographic data that had been entered into SPSS. Of the 86 total participants, 13 people reported drinking caffeinated beverages on a regular basis and none of these 13 reported energy drink consumption. Only two of the 86 participants indicated they drank Red Bull or Monster energy drinks, and those two had reported no caffeine consumption on a daily basis. It is not

known if this sample represents the population of SAU in caffeine consumption, or if the students with overall healthy lifestyles are the ones who volunteered for this study.

To compare the demographic data of the students' caffeine consumption to the stress levels the students reported on the PSS, I first added the variable "consumes caffeine" to the demographics database, with 0 being the value for no and 1 being the value for yes. Caffeine was the independent variable and stress was the dependent variable. The null hypothesis stated that there is no difference in the stress level of the students who drink caffeinated beverages compared to the stress levels of the students who do not drink caffeinated beverages. In an effort to decrease confounding data, as the students were undertaking lifestyle changes designed to decrease their stress during the study, my comparison of caffeinated beverages and stress level was only done on the participants' pretest. An independent samples *t*-test was then performed comparing the means of the levels of stress, as reported on the PSS, to whether or not the student drinks caffeinated beverages as reported on the demographic form.

An independent samples *t*-test was calculated comparing the mean score of perceived stress level in those who consumed caffeinated drinks on a daily basis to those students who did not consume caffeine daily. No significant difference was found (t (83) = 1.084, $p > .05$). The mean stress level of the group who drank caffeine (M = 26.79, SD = 6.266) was not significantly different from the mean of the stress level of those who did not (M = 24.31, SD = 8.067).

Table 1. Group Statistics

	Caffeine use	*N*	*Mean*	*SD*	Std. Error Mean
PrePSSTOTAL	None	71	24.31	8.067	.957
	Yes	14	26.79	6.266	1.675

Table 2. Independent Samples Test

		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
									95% CI	
		F	Sig.	*t*	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PrePSSTOTAL	Equal variances assumed	1.685	.198	-1.084	83	.282	-2.476	2.284	-7.020	2.068
	Equal variances not assumed			-1.284	22.442	.212	-2.476	1.929	-6.472	1.520

Note. CI = Confidence Interval

These findings contradict the findings from the literature review. Factors that could have influenced this contradiction include the fact that this research study was small, the possibility that the convenience sample who volunteered to be in the study was already health conscious, and also that it was performed on a Seventh-day Adventist campus. Thirteen out of 86 people who consumed caffeine regularly on a college campus seems to be a low ratio. In addition, the main focus of the Z*oe Transformation 2.0* study was not on caffeine consumption.

For over a century, Seventh-day Adventists have taught that caffeine is harmful to one's health. In the 1800s, a woman whom the Seventh-day Adventists believe was a prophet, Ellen White, wrote about the harmful and toxic effects of coffee and tea. She said that to the degree coffee energizes a person, it eventually decreases one's energy to that same level below their baseline after the effects have worn off. Multiple times she calls coffee and tea hurtful indulgences. She further wrote that coffee temporarily stimulates one's mind, but this is followed by exhaustion, weakness, and paralysis of the mind, body, and in moral decision-making. Unless one intentionally changes their caffeine habit, the activity of one's brain is permanently decreased (White, 1938/1946). This understanding of the harmful effects of caffeine may have

caused some of these student volunteers to choose not to consume caffeine even before the study was conducted.

Given the body's physical reaction to caffeine alone, even for this small sample, the literature shows that caffeine consumption increases stress. The participants who consumed caffeine regularly may not have perceived that they had increased stress.

My literature review initially focused on the known effects of caffeine. As I was focusing on available research on caffeine use in college-aged young people, repeatedly I found energy drinks especially associated with this age group. Due to the dangers associated with high doses of caffeine, and especially when it is mixed with alcohol, this report would have been incomplete without that information. There was an abundance of information available in the literature on the dangers of caffeine consumed in high doses as in energy drinks.

Evaluation

It is easy to understand that insufficient rest and the multi-system physical stressors caused by caffeine intake would cause a person to be psychologically stressed as well. What is not clear is whether young adults consume caffeine because they are stressed or whether the consumption of caffeine increases their stress level. The results of the literature review indicate some of both. An area for further study would be to determine if college students consume caffeine because they are stressed or if it adds to their stress. Caffeine is consumed by the student population in effort to increase alertness and cognition. According to current literature, there is indication that caffeine may have this effect in low doses. However in higher doses, caffeine actually decreases blood flow to the brain, stresses the body as well as the mind, and decreases academic performance.

Studies assessed from Iceland, Turkey, and across the US all have similar findings regarding the growing caffeine consumption among youth, as well as trends of mixing energy

drinks with alcohol. In the US, when the American Dietetic Association evaluated pre-mixed drinks of alcohol and energy drinks, they were concerned regarding the dangers of this practice. As a result, they required manufacturers to remove caffeine from alcohol-based products. Still the habit of mixing one's own drinks continues and widespread ignorance remains of the potential for caffeine to exacerbate the risks of alcohol (Miller, 2012). With both ingredients having the capability to produce dependence, and the appearance of this quality being enhanced by mixing the two, much educating of the public, young people in particular, needs to take place.

More studies are needed to determine the effects of high caffeine dosages on the developing brain. The majority of mental health issues first become apparent in adolescence and young adult age groups as well. Additional research is also needed in energy drink use and psychological adjustment (Stacio et al., 2011).

Educators as well as all medical providers would do well to educate the general public, especially young people, on the dangers of caffeine intake and the evidence that high doses of caffeine during exercise have proven lethal in young adults and adolescents. In addition, education of the general public needs to include that energy drinks are not sports drinks, and using them as such is extremely dangerous. The public needs to become aware of the ingredients in energy drinks and their harmful effects. Evidenced–based health information should include energy drink consumption and targeted interventions to combat myths and preconceptions of energy drinks. Motivational interviewing regarding mixed drinks and alcoholic beverages would be especially helpful for school counselors as well as for nurse practitioners (Spierer et al., 2014). Health promotion programs should encourage alternative ways to increase energy levels such as healthy diet, getting adequate sleep, and participating in regular exercise (Trapp et al., 2014; Petit & DeBarr, 2011).

As a nurse practitioner, I intend to assess caffeine intake on each new patient and at each visit. I plan to educate all my patients on the harmful effects of caffeine, especially on children and young people. The areas of the brain that regulate emotion are some of the last structures to mature, not being fully developed until the mid-twenties. Substance abuse during adolescence and young adulthood appears to put emotional development and regulation at risk. College-aged young people in particular need to be educated that caffeine consumption could increase their stress and decrease their grades. Athletes also need to be educated to understand that using energy drinks as sports drinks can be lethal. Additionally, people need to be warned about the dangers of energy drinks and how they impact one's health.

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