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PERCEIVED STRESS, CAFFEINE CONSUMPTION, AND GPA OF UNDERGRADUATE STUDENTS AT A LARGE PUBLIC UNIVERSITY

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PERCEIVED STRESS, CAFFEINE CONSUMPTION, AND GPA OF UNDERGRADUATE STUDENTS AT A LARGE PUBLIC UNIVERSITY

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the College of Agriculture, Food, and Environment at the University of Kentucky

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ABSTRACT OF THESIS

PERCEIVED STRESS, CAFFEINE CONSUMPTION, AND GPA OF UNDERGRADUATE STUDENTS AT A LARGE PUBLIC UNIVERSITY

Evidence suggests that college students may increase caffeine consumption to cope with the stress and demands of college. The relationships between perceived stress, caffeine consumption, and GPA were examined in students at a large public university. Students were surveyed to determine perceived stress (Cohen's Perceived Stress Questionnaire), beliefs about caffeine, caffeine consumption, workload in and outside of the classroom, and GPA. Surveys were administered at the beginning of the semester and again at midterm. Based on Cohen's 40-point scale, average stress scores increased from 15.95 ± 6.34 at the beginning of the semester to 18.89 ± 6.94 at midterms. Additionally, 88% of students reported having consumed caffeine in the past week at the beginning of the semester; by midterms, this was 90%. Caffeine consumption increased from an average of 167.90 ± 159.08 mg/day to 197.59 ± 167.16 mg/day. Overall, there were not significant correlations between average perceived stress scores and average daily caffeine consumption, or by consumers, gender, or class. As well, there was not a significant association between average daily caffeine consumption and cumulative GPA. However, significant positive associations were found for the consumer group and within the senior consumer group.

KEYWORDS: perceived stress, caffeine consumption, college students, coping mechanism, exam period.

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11/3/2016

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College can be a stressful time for students; classes, homework, projects, quizzes, exams, work, and extracurricular activities may contribute to student's perceived stress. In order to cope with this stress and meet the demands of their classes, college students may turn to the use of stimulants, such as caffeine. Caffeine is a stimulant that acts on the central nervous system and may help to improve memory and alertness (Fulgoni, Keast, & Lieberman, 2015). Students may seek the benefits of caffeine in order to stay up late at night to study, complete assignments, stay awake in class, and/or for work. Their beliefs about caffeine prompt their use of caffeine as a study aid while stressed (McIlvain, Noland, and Bickel, 2011). However, it is unknown if caffeine is improving students' academic performance.

Problem

Strong and consistent evidence shows that consumption of coffee within the moderate range (3-5 cups/day or up to 400 mg/day of caffeine) is not associated with increased risk of major chronic diseases in healthy adults (USDA, 2015). However, many studies have found that college students are consuming, on average, higher amounts of caffeine than recommended. Excess caffeine consumption can lead to caffeine intoxication. Symptoms of caffeine intoxication include restlessness, sleep disorders, anxiety, and fast or irregular heartbeat (McIlvain et al, 2011).

Stress can also lead to adverse health effects; associations between psychological stress and disease have been established for depression, cardiovascular disease, and HIV/ AIDS (Cohen, Janiki-Deverts, and Miller, 2007). Additionally, new evidence is emerging that details the negative influence of stress on respiratory disease, viral infections,

autoimmune diseases, and wound healing. (Cohen et al, 2007). A greater understanding of caffeine consumption patterns in U.S. college students is needed to determine whether their caffeine consumption is beneficial or problematic in regards to stress and academic performance. Because of the potential negative health effects associated with excessive caffeine consumption and stress, students should be educated about caffeine and be provided with tools to better cope with stress.

Purpose

The purpose of this research was to assess the perceived stress and caffeine consumption of students enrolled in undergraduate-level courses at a large public university. This study compared perceived stress and caffeine consumption at the beginning of the semester and again at the midterm examination period. Perceived stress and caffeine consumption were also compared to students' cumulative GPAs. The objectives of this study were to determine the relationship between perceived stress and caffeine consumption and the relationship between caffeine consumption and cumulative GPA of undergraduate students.

Research Questions:

1. Do students who score higher on Cohen's Perceived Stress Scale (PSS) report higher caffeine consumption than students who score lower on the PSS?
2. Do students who report high levels of caffeine consumption have higher cumulative GPAs than students who report no caffeine consumption?

Hypotheses:

1. Students who score higher on the PSS consume more caffeine than students who score lower on the PSS.

2. Students with high caffeine consumption have higher cumulative GPAs than students who report no caffeine consumption.

Justification

Many students perceive college as a stressful time and turn to caffeine to cope with the stress. As well, much research supports that the majority of college students consume caffeine on a regular basis. Because of the potential negative health consequences associated with both stress and caffeine, more research is needed on the stress levels and caffeine consumption of college students. Conflicting evidence portrays a gap in understanding the relationship between stress and caffeine consumption and the effects on academic performance. There is also a lack of research done on college students in the United States. Information obtained from this survey should lead to a greater understanding of caffeine consumption patterns in U.S. college students and whether their caffeine consumption is beneficial or problematic in regards to stress and academic performance.

Section II: Literature Review

Introduction

To cope with the stress of college, students may turn to the use of caffeine. Research suggests that caffeine is the most frequently consumed central nervous system stimulant in the world (Fulgoni et al, 2015). According to NHANES data from 2001-2010, over 80% of individuals aged 19-30 years old consume caffeine. Fulgoni et al investigated a nationally representative population-based sample of 24,808 individuals to obtain an estimate of caffeine consumption in adults. The results showed that the amount of men and women who consume caffeine are equal, but that men tend to consume greater quantities of caffeine than women (Fulgoni et al, 2015). A limitation to this study includes the possible underreporting of intake and the lack of data on dietary supplements and medications which may also influence caffeine consumption (Fulgoni et al, 2015). Beverages were the predominant source of caffeine in the diet with approximately 64% of respondents reporting coffee consumption, 16% reporting tea, and 18% reporting soft drinks as predominant sources of intake (Fulgoni et al, 2015). Energy drinks provided less than 1% of intake, but their popularity increased dramatically from 2001 to 2010 (Fulgoni et al, 2015). Possible limitations of this study include inaccuracies associated with self-reported data as well as the complete lack of data on caffeine from other sources, such as supplements or medications."

Many studies have found that college students are consuming, on average, higher amounts of caffeine than recommended. Excess caffeine consumption can lead to restlessness, nervousness, or irregular heartbeat (Nawrot, Eastwood, Rostein, Hugenholtz,& Feeley, 2003). Due to the negative effects of both high caffeine

consumption and stress, the relationship between caffeine consumption and perceived stress needs to be investigated. However, there is conflicting research on whether or not perceived stress and caffeine consumption are related and if caffeine is enhancing academic performance.

Perceived Stress

College can be a stressful life transition as a result of increased exposure to stressors; subsequent behavioral reactions may be negative if stress is not managed (Robert, Harrington, & Storch, 2006). Behavioral changes occurring as adaptations or coping responses to stressors provide an important pathway through which stressors influence disease risk (Cohen et al, 2007). However, for an event or situation to be considered stressful, it must be perceived as stressful via perceptual processes (Robert et al, 2006). To address this concern, Cohen et al. (1983) developed the Perceived Stress Scale (PSS), which was based on Lazarus's theory of stress appraisal; that stress is a two way process of environmental stressors and an individual's response to these stressors. Versions include the Perceived Stress Scale 10-item Questionnaire (PSS-10), Perceived Stress Scale 14-item Questionnaire (PSS-14), and the Perceived Stress 20—item Questionnaire (PSS-20).

A study by Robert, Harrington, and Storch investigated the factorial findings, construct validity, and normative data of the 10-item Perceived Stress Scale (PSS-10) in college students. Data were collected from 285 undergraduate college students (225 women, 60 male) enrolled in one of three public universities in the southeast United States. Participants were solicited from introductory courses in various academic disciplines, participation was voluntary. Participants ranged in age from 17- 60 years with

a mean age of 23.8 years. There were no demographic differences found as a function of the academic institutions attended (Robert et al, 2006). However, the large proportion of Caucasians and women in the sample limits the generalizability. There were six instruments examined: the PSS-10, Sensation Seeking Scale Form (SSS-V), State-Trait Anxiety Inventory-Trait version (STAI-T), Multidimensional Health Locus of Control (MHLC Form A), Santa Clara Strengths of Religious Faith Questionnaire-Short Form (SCSRFQ-SF), and the Adult Aggression Scale (OA). The multivariate analysis revealed no differences between men and women on the factor scores on the different scales (Robert et al, 2006). Convergent validity was assessed with Pearson product moment correlations computed between the PSS-10 and the MHLC Form A and between the STAI-A and the STAI-D factors. Divergent validity was assessed with Pearson product moment correlations between the PSS-10 and the SSS-V, the SCSRFQ-SF, and the OA and the RA subscales (Robert et al, 2006). Robert et al found that the PSS-10 is a reliable and valid self-report measure of perceived stress within a nonclinical, multisite sample of U.S. college students. Based on these findings, the PSS-10 was used to determine perceived stress in the study described in this thesis.

Stress and Caffeine

There is conflicting research on the association of caffeine consumption and perceived stress. While several studies have found associations, others have found no association between consumption of caffeinated beverages and academic stress or load. More research is needed to definitively determine if there is a relationship between stress and caffeine consumption. There is also limited research on stress and caffeine in college populations in the United States.

A study by Zunhammer, Eichhammer, & Busch investigated how sleep quality, alcohol, caffeine, and nicotine consumption changed in a general academic student sample before, during, and after an academic exam period. A sample of 150 students from various academic disciplines at two public universities in Regensburg was recruited. The majority of students came from rural Eastern Bavaria, which limits the generalizability to other countries and other regions (Zunhammer et al, 2014). Analysis of the sample included 142 participants (71 male, 71 female). Participants were asked to complete online-questionnaires before (baseline), during (exam period), and after (post) an academic exam period. The pre- and post-surveys were scheduled 30 days before an exam period and 30 days after an exam period, respectively (Zunhammer et al, 2014). Students filled out the Regensburg Insomnia Scale, Perceived Stress Scale-20, and were surveyed on their alcohol, nicotine, and caffeine consumption. With questionnaires, response bias is a limitation. Perceived stress significantly increased from 33.68 ±17.62 before the exam period to 54.06 ± 19.34 during the exam period. Caffeine consumption did not differ significantly between the sexes and significantly increased from 4.76 ± 5.67 cups to 7.10 ± 9.51 cups per week. These findings supported a previous study, which indicated that caffeine intake increases during exam periods (Astill, Verhoeven, Vijzelaar, Van Someren, 2013).

Alternatively, a study done at the University of Puerto Rico Medical Sciences Campus (UPR-MSC) found that there was no association between the consumption of caffeinated beverages and academic stress or load (Ríos, Betancour, Pagán, Fabián, Cruz, González, & Palacios, 2013). This study examined the association between caffeinated beverage consumption, self-perceived academic load, and self-perceived stress levels in

first and second year students at UPR-MSC. A representative stratified sample of 275 students completed an anonymous self-administered questionnaire regarding socio-demographic characteristics, academic load, stress indicators, and caffeinated beverage consumption. Most participants were aged 21-30 (88%), women (68%), and had low annual household incomes (43%) (Ríos et al, 2013). Approximately 88% of the participants reported consuming caffeinated beverages; of those, 87% drank soft drinks, 83% drank coffee, 56% drank hot chocolate, 40% drank tea, and 29% drank energy drinks. Participants mainly used these to stay awake (Ríos et al, 2013). Soft drinks and coffee intake increased in periods of high stress, and many (49%) reported that these beverages were useful for coping with stress (Ríos et al, 2013). There was a significant difference in energy drink consumption between men and women, with men consuming more. However, none of these beverages were significantly associated with academic stress or load (Ríos et al, 2013). Based on the population, these findings limit the generalizability to men, those older than 30, higher income households, and populations outside of Puerto Rico.

A study by Pettit and DeBarr explored relationships regarding perceived stress, energy drink consumption, and academic performance among college students. A total of 136 undergraduates attending a large Southern Plains university were examined. Participants completed surveys including items from the Perceived Stress Scale-14 and items to describe energy drink consumption, academic performance, and demographics (Pettit & DeBarr, 2011). Students were 18-24 years of age and 61% of the sample was female. The majority, 79%, identified as Caucasian. About half of the participants were 19 years or younger (52%) and categorized as freshmen (48%). Positive correlations

existed between participants' perceived stress and energy drink consumption (Pettit & DeBarr, 2011). There was a negative correlation between energy drink consumption and academic performance. Freshmen (mean= 0.330 drinks) and sophomores (mean=0.408 drinks) reported consuming a lower number of energy drinks the previous day than juniors (mean= 1.000 drinks). Males reported higher mean intakes than females for selected energy drink consumption items (Pettit & DeBarr, 2011). Statistically significant interactions existed between gender and year in school for approximate number of energy drinks consumed on days when energy drinks were consumed during the past 30 days and largest number of energy drinks consumed on any occasion during the past 30 days (Pettit & DeBarr, 2011). Because they found an association between perceived stress and energy drink consumption, education regarding use of energy drinks in response to stress is needed. Results from this research represent an impetus for future research regarding perceived stress, energy drink consumption, and academic performance among college students (Pettit & DeBarr, 2011). Future research is needed to explore additional factors that potentially contribute to energy drink consumption among college students (Pettit & DeBarr, 2011). There were limitations to this study due to convenience sampling and bias associated with self-reported instruments.

Beliefs and Perceptions About Caffeine

Recent research has indicated that university students sometimes use caffeine pills during exam preparation for neuro-enhancement (NE), the non-medical use of psychoactive substances or technology to produce a subjective enhancement in psychological functioning and experience (Brand & Koch, 2016). German-speaking university students were invited to participate in an online survey. Of the 231

respondents, 75.8% were women, ages 18-35 years old (mean=23.5) and 23.8% were men ages 20-40 years old (mean=25.4). Participants were randomly assigned to one of three experimental groups. One group was told a fivefold overestimation of prevalence usage of caffeine pills amongst peers, a second group was told 50% underestimation of prevalence, and a third group was the control and given no information about peer prevalence. Researchers measured the resulting effects on the psychological predictors included in the Prototype-Willingness Model of risk behavior such as intention and willingness to use caffeine pills (Brand & Koch, 2016).

Structural equation modeling confirmed that the participants' willingness and intention to use caffeine pills in the next exam period could be explained by their past use of neuroenhancers, attitude toward NE and subjective norm about use of caffeine pills, while the image of the typical user was a much less important factor (Brand & Koch, 2016). Inaccurate information about prevalence reduced the predictive power of attitude, with respect to willingness, by 40-45%. Brand and Koch hypothesized that may be because receiving information about peer prevalence which does not fit with perception of the social norm causes people to question their attitude. The demographics of the sample population limit the generalizability to males and populations outside of Germany. Another limitation was the focus only on caffeine pills, not caffeinated beverages.

A study was conducted at Marshall University to determine the amount of caffeine consumed by freshman students, the beliefs of students regarding caffeine consumption, and the reported perceived benefits and adverse effects of caffeine consumption (McIlvain et al, 2011). There were 300 freshmen surveyed, including 118

men and 182 women ages 18-20 years old; the majority of participants were Caucasian (90%); this sample was generally reflective of the student body as a whole. Participants filled out an anonymous survey at the beginning of a regularly scheduled class period. They were asked about their reasons for consuming caffeine, caffeine consumption frequency, beliefs about caffeine, and perceived benefits or adverse effects. Students consumed an average of 849.86 mg of caffeine per day. Few (5.33%) students reported no caffeine intake for the previous two weeks. Beliefs of students regarding caffeine were inconsistent. Just over 72% of respondents did not believe caffeine would help them concentrate, while 76% believed caffeine would keep them awake, and 59% believed it would wake them up in the morning (McIlvain et al, 2011). Only 26.7% reported using caffeine to enhance mental performance and 76% reported using caffeine to stay awake. Moderate use of caffeine to produce alertness can be a benefit of caffeine and this may be an appropriate use of caffeine by college students (McIlvain et al, 2011). Students' beliefs about caffeine drive their use. These findings may not be generalizable to college populations with more ethnic diversity or to upperclassmen due to the sample population.

Another study was conducted at the University of New Hampshire to evaluate the perceptions of different caffeinated beverages among college students and determine the frequency and amount of caffeine intake (Olsen, 2013). Cues for consumption of caffeinated products were also examined. A survey was distributed to students enrolled at the University of New Hampshire Durham Campus via email and social media platforms and 342 students returned responses. Students were asked about their caffeine consumption, beliefs about caffeine, and cues for caffeine consumption. The majority (74.93%) of these students reported caffeine consumption; of these students, 26% were

male and 74% were female. The majority of participants, 66%, were between 18 and 21 years old. The highest percentage of respondents was seniors (33%), followed by juniors (25%), sophomores (19%), freshmen (13%), and graduate students (10%). The majority of participants consumed 1-3 caffeinated products per day and 7.57% reported no caffeine consumption. Of the caffeine consumers, 82.1% reported consuming caffeine to feel more awake. University of New Hampshire students who consume caffeine seemed to do so for school-related purposes, e.g. increased energy throughout the day (62.2%), to be more alert (60.6%), to be more productive (61.8%), to stay up late (47.4%), and to help with concentration (39.8%). Students indicated that they consumed caffeine while studying for an exam (65.7%), while doing homework (68.5%), and during class (59.8%) (Olsen, 2013). School was a major setting in which students consumed caffeine. The generalizability of the findings is limited by selection bias, response bias, and the large difference in response rate between genders.

Although studies have shown that energy drinks are not a predominant source of caffeine, consumption of energy drinks has continued to gain popularity. Despite the fact that energy drinks are targeted to young adult consumers, there has been little research regarding energy drink consumption patterns among college students in the United States (Malinauskas, Aeby, Overton, Carpenter-Aeby, & Barber-Heidal, 2007). The primary ingredient in energy drinks that has a cognitive effect is caffeine. A focus group was formed and comprised of 32 college students in a senior level course. They were asked open-ended questions regarding situations in which college students use energy drinks, the most common energy drinks college students were using, frequency patterns, and side effects from using energy drinks. Based on responses from the focus group, a 19-item

questionnaire was developed.

Participants were then recruited by 11 trained research assistants at a state university in the Central Atlantic region of the United States. There were 496 participants, aged 21.5 ± 3.7 years that completed the self-administered questionnaire. The majority (51%) of participants reported drinking greater than one energy drink per month in an average month for the current semester (Malinauskas et al, 2007). Although for the majority of situations assessed, users consumed one energy drink with a reported frequency of 1 - 4 days per month. This study found that female and male college students were using energy drinks in a similar fashion. The majority of users consumed energy drinks to increase their energy (65%) and 50% drank while studying or completing a major course project (Malinauskas et al, 2007). Consumption of energy drinks by college students is motivated by academic factors. Limitations to this study include self-reported data and the homogenous student body at the rural university (Malinauskas et al, 2007).

Energy drink consumption has become increasingly prevalent among U.S. college students, yet little is known about current rates of consumption and reasons for consumption among current energy drink users, particularly differences related to gender and race/ethnicity (Poulos & Pasch, 2015). A study was done at the University of Texas at Austin to examine energy drink consumption alone and mixed with alcohol among undergraduate students. All incoming first-year students who participated in an alcohol prevention curriculum were eligible for participation (Poulos & Pasch, 2015). Of these students, 2,971 students were randomly selected to participate and were invited via email; 603 students were recruited. The final sample was 585 participants after excluding those

under 18, second-, third-, or fourth-year students, or those who identify as transgender. The average participant age was 18.7 years old. In all, 47% of participants identified as non-Hispanic White and slightly over half were women (56%). This sample was similar to the first-year student class as a whole (51% non-Hispanic White; 53% women) (Poulos & Pasch, 2015). Participants were divided into two groups: those who reported using energy drinks at least once in the past year (n=330) and those who reported using energy drinks and alcohol at least once in the past year. There were no major demographic differences between the two groups. Over the past year, 64.9% of energy drink users consumed energy drinks in the past month and 38.5% consumed energy drinks in the past week. They found that men were more likely to have consumed energy drinks in the past week and month. Overall, the most common reasons for energy drink use included taste, mental alertness, studying for an exam, or completing a project (Poulos & Pasch, 2015). The survey was conducted at the end of the spring semester and spanned the final exam period. However, stress was not addressed in the survey, which is a limitation to this study. Generalizations from this study are limited because all participants reported at least one energy drink in the past year and consumption of other caffeinated beverages was not examined.

The frequency of energy drink consumption and associated factors were examined in a group of college students at Hacettepe University. A cross-sectional study was conducted on 439 students pursuing a career in medicine, sports, and arts in their fourth-year. Data were collected using a self-administered standard questionnaire. The questionnaire consisted of 35 questions on students' sociodemographic characteristics, personal habits, total fluid intake, energy-drink–related knowledge, and habits. Students

were asked whether they had ever consumed any energy drinks. Later, they were given a list of beverages available in the market, including energy drinks, sports drinks, and soft drinks. Many students who had tried an energy drink did so the first time because they wondered about its taste (Attila & Çakir, 2011). Of regular energy drink users, consumption reasons included obtaining getting energy, staying awake, and boosting performance while doing sports (Attila & Çakir, 2011). Most students could not correctly define the ingredients of energy drinks or the potential hazardous health effects, and they could not distinguish energy and sports drinks when they were requested to select them from a list of commercial drink names. Findings from this study cannot be generalized to underclassmen, those of other academic disciplines, and populations outside of Turkey.

Cognitive Effects of Caffeine

People may seek caffeine because their beliefs and expectations about caffeine (Berg, 2011). A study by Berg examined how the expectancies people hold about caffeine relate to the effects they experience after consuming it. This study examined how expectancies affect participants' cognitive functioning when they are not actually caffeinated, but believe that they are. Participants were recruited through introductory and upper level psychology courses based on previous eligibility questionnaires. Out of 327 students, 43 enrolled in the study. Students were categorized as high (>500 mg/week) or low (<250 mg/week) caffeine consumers and categorized based on level of expectancy of caffeine. The high expectancy group averaged >3 on the seven items reflecting the more typical positive effects of caffeine and <2 on the six items reflecting the less typical effects of caffeine (Berg, 2011). Students were then divided into four groups based on their caffeine use and expectancy: (1) high caffeine consumption, high

expectancy, (2) high caffeine consumption, low expectancy, (3) low caffeine consumption, high expectancy, and (4) low caffeine consumption, low expectancy. Students were told that they were randomly assigned to teams and were competing for the highest scores on memory and attention tasks. They then got to select one of three labeled drinks: 0 mg, 35 mg, or 80 mg caffeine. Students did not get to consume their chosen drink; they were "randomly" assigned to consume a certain drink (Berg, 2011). However, all three drinks were caffeine free. Participants had to wait 30 minutes before the tasks so they believed they were waiting for caffeine to kick in (Berg, 2011). Tasks performed were the Rey Auditory Verbal Learning Test, Digit Span, Spatial Span, and Paced Auditory Serial Addition Task. Results did not support the hypothesis that caffeine expectancies would interact with students' beliefs about how much caffeine they had consumed to impact performance on cognitive tests (Berg, 2011). The four expectancy/caffeine groups performed similarly on tests of memory. On tests of attention, group differences emerged. Results indicate that expectancies alone (without the presence of caffeine) are not sufficient to influence cognition. Expectancies may only impact cognitive processes when they interact with the actual effects of caffeine (Berg, 2011). However, this study did not control for caffeine before participants arrived for the study; actual caffeine consumption is not known. Also, this study had a low response rate.

The effects of caffeine and glucose on cognition, mood and self-judgment were examined in Germany (Ullrich, de Vries, Kühn, Repanti, Dresler, & Ohla, 2015). A total of 17 healthy men ages 19-40 years, with heterogeneous caffeine and glucose consumption patterns were studied. Participants were allowed their regular intake of caffeine and glucose up to 2 hours prior to testing to avoid withdrawal symptoms (Ullrich

et al, 2015). This was a double blind, placebo-controlled study that examined multi-task performance. Logical thinking, processing speed, numeric and verbal memory, attention and the ability to concentrate, and mood were examined; these were measured over a two-hour period (Ullrich et al, 2015)**.** Caffeine and glucose were administered in common beverages with appropriate placebo controls allowing the assessment of psychological effects of expectancy (Ullrich et al, 2015). This study found that neither caffeine nor glucose significantly influenced cognitive performance when compared with placebo, water, or no treatment controls in a multi-task setting (Ullrich et al, 2015). Yet, caffeine and, by trend, placebo improve dispositions such that participants perceived preserved mental energy throughout the test procedure (Ullrich et al, 2015). These subjective effects were stronger after 24-hour caffeine abstinence. Limitations to this study are the exclusion of females. The large age range of the sample population also limits generalizability to traditional college-aged students.

Energy drink use among college students to improve academic performance has skyrocketed (Trunzo, Samter, Morse, McClure, Kohn, Volkman, & O'Brien, 2014). A growing body of literature indicates that the risks associated with energy drink use may outweigh the perceived benefits. A total of 574 students were surveyed- from Bryant University (84.8%), LaSalle University (12.8%) in Philadelphia, PA, and the University of the Pacific (2.5%) in Stockton, CA (Trunzo et al, 2014). After accounting for incomplete data, there were 486 completed surveys. The students were surveyed on their general substance and energy drink usage, Social Problem-Solving (SPS) ability, and academic performance (Trunzo et al, 2014). The average GPA was 2.93, and the average caffeinated non-energy drink use was 3.14, while mean energy drink use was 2.52. A

linear multiple regressions for AP were conducted, with predictor variables entered in the following order: total drug use, non-energy drink caffeine use, SPS, and ED use. The overall model was significant and accounted for approximately 7% of the variance in academic performance (Trunzo et al, 2014). It was found that energy drink use might be related to decreased academic performance, SPS ability may be related to increased academic performance, or that students with poor academic performance and less effective SPS skills are more likely to use energy drinks (Trunzo et al, 2014).

Energy drinks containing caffeine, taurine, and glucose may improve mood and cognitive performance (Giles, Mahoney, Brunyé, Gardony, Taylor, & Kanarek, 2012). However, no published research studies could be found that assess the individual and interactive effects of these ingredients. The effects of caffeine, taurine, and glucose alone and in combination on cognitive performance and mood in 24-hour caffeine-abstained habitual caffeine consumers were examined at Tufts University. The participants included 48 undergraduate students with a mean age of 20.08 years. All participants were healthy individuals who were moderate to high habitual caffeine consumers (at least 200 mg/day, mean consumption 527.59 mg/day) and non-nicotine users. There were 18 males and 30 females. This study was a double-blind, mixed factor, repeated measures design with caffeine and taurine treatment as within participants factors and glucose treatment as a between participants factor (Giles et al, 2012). Participants were evaluated using multiple measures of caffeine withdrawal symptoms, mood, and cognitive performance. They filled out typical consumption, profile of mood states, and withdrawal questionnaires. Participants then performed three tasks: Attention Network Test (ANT), N-back Task (NB), and Reaction Time Task (RTT). Results from the cognitive tasks

showed that caffeine reduced reaction time on the simple and choice reaction time tasks and verbal N-Back Task, particularly at the highest (3-Back) load (Giles et al, 2012). This study found that caffeine had the most consistent effects on cognitive performance. Generalizations from this study are limited due to the small sample size and the uneven distribution of genders. Another limitation is the degree that 200 mg of caffeine will affect those who already consume more than 500 mg/day.

Summary

Numerous studies have shown that the majority of college students consume caffeine. Student's beliefs and expectations of caffeine prompt their use of caffeine as a study aid. They may seek the benefits of caffeine in order to stay awake or to help them study (McIlvain et al, 2011). Strong and consistent evidence shows that consumption of coffee within the moderate range (up to 400 mg/d of caffeine) is not associated with increased risk of major chronic diseases in healthy adults (USDA, 2015). However, many studies have found that college students are consuming, on average, higher amounts of caffeine than recommended. There is conflicting evidence on the association of stress and caffeine consumption and the effect on academic performance and a lack of studies on populations in the United States. A greater understanding of caffeine consumption patterns of U.S. college students is needed to see if their caffeine consumption is beneficial or problematic in regards to stress and academic performance. Because of potential negative health effects associated with excessive caffeine consumption and stress, students should be educated about caffeine and provided with tools to better cope with stress.

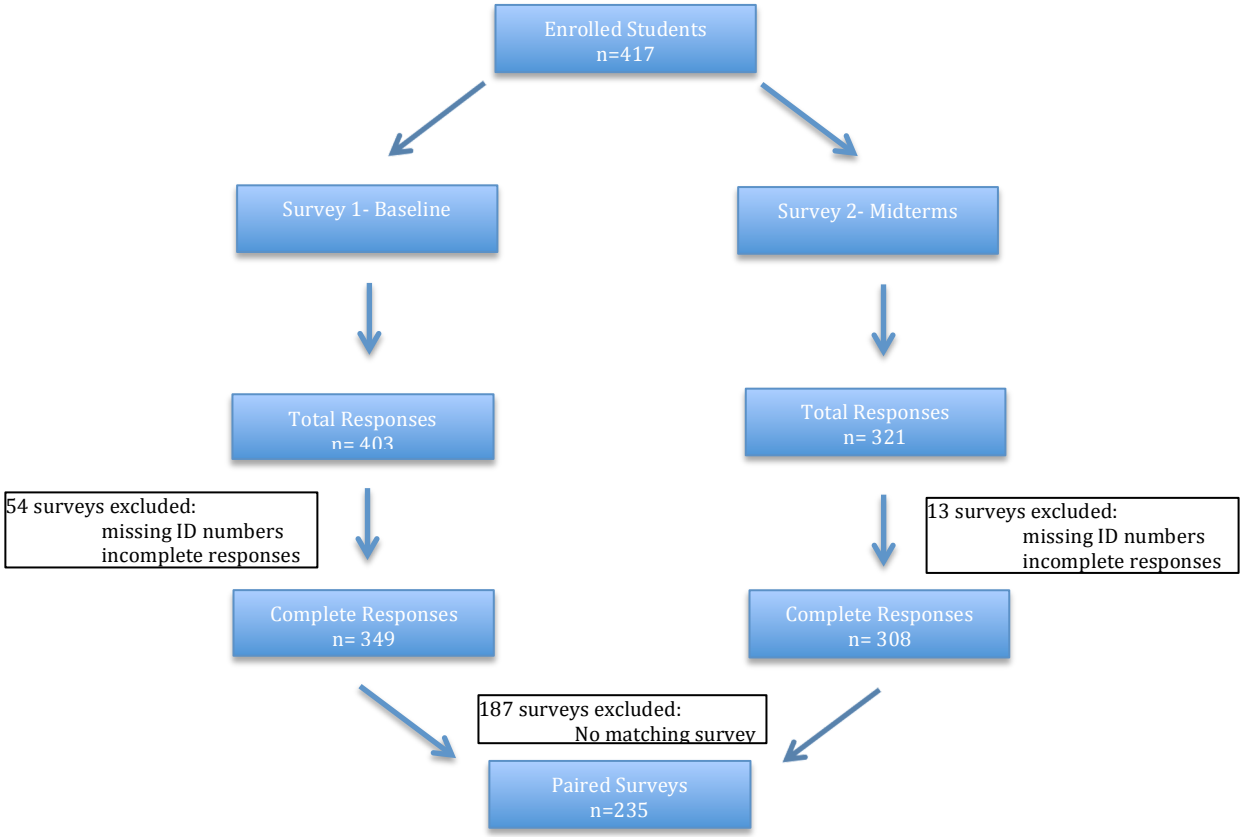
Section III: Methods

This panel survey design study was conducted within the Department of Dietetics and Human Nutrition (DHN) at the University of Kentucky. After obtaining approval from the University of Kentucky Non-medical Institutional Review Board, a self-reported survey was administered to students during the Fall 2015 semester. Data were collected twice- once at the beginning of the semester and again after midterm exams. Participants were recruited through an in-class announcement. While the course professors approved the research to be conducted in their classrooms, the graduate student PI for the project was in charge of recruiting and conducting the research. Before participating, all students were read a letter explaining the purpose of the study and their rights as a participant. A hard copy of this letter was also distributed with the first survey. Students were given class time to complete the surveys and participation was voluntary. All responses were anonymous, but the last four digits of student ID numbers were used for survey pairing purposes. The data from paired sets of surveys were examined.

Participants

Male and female students of all ages were recruited for this study. Participants were recruited from four course levels within the department. These courses included students from Dietetics, Human Nutrition, and Nursing majors. No students were excluded; data includes responses from graduate students and nontraditional students. There were 22 students enrolled in the 100-level course, 175 in the 200-level course, 138 in the 300-level course, and 82 in the 500-level course. There were 417 total students enrolled in the four courses. The final sample consisted of 235 paired surveys (Figure 1).

Figure 1: Participant Flow Diagram



Instruments

Survey data was collected twice during the semester; both surveys can be found in the appendices. The first survey collected demographic information, workload in and outside of the classroom, and cumulative self-reported grade point average. Participants were given two frequency tables, both of which included popular caffeinated beverages and standard serving sizes. The first table examined the average number of days on which they consumed caffeine; the second examined the average number of servings the students had consumed in the previous week. The milligrams of caffeine consumed were calculated from the serving frequency table. A popular reference beverage was selected for general items, such as coffee and soda, in order to determine the approximate caffeine consumption (Table 1).

Table 1: Caffeine Content of Beverages for Calculations

Caffeine Content of Beverages for Calculations		
Product	Reference Serving Size	Caffeine Content
Red Bull	8.4 oz. can	80 mg
Full Throttle	16 oz. can	160 mg
Rockstar	16 oz. can	160 mg
Monster	16 oz. can	160 mg
Starbucks Doubleshot Espresso	6.5 oz. can	125 mg
5-hour Energy	1.93 oz. bottle	200 mg
Caffeinated Coffee*	12 oz.	330 mg
Caffeinated Regular or Diet Soda**	12 oz. can	46 mg
Caffeine Pills	one 200 mg pill	200 mg

*Based off of caffeine content of Starbucks Grande medium roast
**Based off of caffeine content of Diet Coke

The midpoint of each frequency range was used to calculate caffeine consumption. For example, if a student selected "1-2" servings, 1.5 was used for the calculation. Students were asked about their beliefs about caffeine and caffeine consumption patterns; questions were adapted and adopted from a survey by McIlvain et al that investigated the caffeine consumption patterns and beliefs of college freshmen. The original survey was adapted/adopted from previously published research that produced valid and reliable results (McIlvain et al, 2011). Validity and reliability of measurements include the use of Hollingshead's Two Factor Index of Social position, Cronbach's Alpha, assessing face validity of consumption pattern questions, and pilot testing the completed instrument with 30 university students who were not included in the final sample. The Perceived Stress Scale 10-item Questionnaire (PSS-10) was used to determine perceived stress in this study. A study by Robert et al found that the PSS-10 is a reliable and valid self-report measure of perceived stress within a nonclinical, multisite sample of U.S. college students. Each item was rated on a 5-point Likert scale ranging from never (0) to almost always (4), indicating how often they have felt or thought a certain way within the past month (Robert et al, 2006). Summing across all 10 items, with the four positive items reverse scored, possible scores range from 0-40 and were categorized as low (0-12), moderate (13-26), or high stress (27-40). According to the

PSS-10 norm table developed by Harris, the mean score for ages 18-29 years old is 14.2 (SD= 6.2). The mean score for males is 12.1 (SD=5.9) and for women 13.7 (SD=6.6).

The second survey collected information on workload in and outside of the classroom for the previous week. Caffeine consumption (mg) was determined using the same serving's frequency table as administered in the baseline survey. The PSS-10 was administered again to determine perceived stress at the midterm period.

Statistical Analysis

Surveys were entered into Research Electronic Data Capture (REDCap) and coded. Statistical Analysis System (SAS) University Edition was used to analyze the data. Descriptive statistics were used to summarize demographic information, situational caffeine use, and perceptions about caffeine. Perceived stress, caffeine consumption, GPA, work hours, study hours, and credit hours were examined as continuous variables. Because it was their first semester of college, freshmen had no GPA and were excluded in GPA calculations. Gender, caffeine consumption, and class status were examined as discrete variables. Linear regression was used to determine correlations between perceived stress, caffeine consumption, and GPA. T-tests were used to compare differences in gender for caffeine consumption and perceived stress. T-tests were also used to examine perceived stress and GPA in caffeine consumers vs. non-consumers. One-way ANOVA was conducted to evaluate the effects of year in school on perceived stress and on caffeine consumption. To determine differences in perceived stress and caffeine consumption from the beginning of the semester to the midterm period, paired t-tests were performed. Significance was determined by a p-value of 0.05 or below.

Section IV: Results

From the 417 potential participants, there were 235 total pairs of surveys collected. Non-traditional students and graduate students were not excluded from participation. Only incomplete or unmatched surveys were excluded. There were 402 responses to the first survey; 54 surveys were excluded due to missing ID numbers or incomplete responses. There were a total of 349 completed responses to the first survey and 308 completed responses to second survey. Of these, 187 surveys were unpaired and therefore excluded from the final sample used for data analysis.

Demographics

Out of the final sample of 235 students, there were 205 females and 30 males surveyed (Table 2). Gender was examined as an interaction variable in this research. The students ranged in age from 18-50 years old, with an average age of 20.9 years and median of 20 years. The majority of participants identified as White/Caucasian (87.66%). In the remaining categories, <1% identified as American Indian/Native American, 5.11% as Asian, 7.66% as Black/African American, 3.83% as Hispanic/Latino, <1% Pacific Islander, and <1% identified as “Other”.

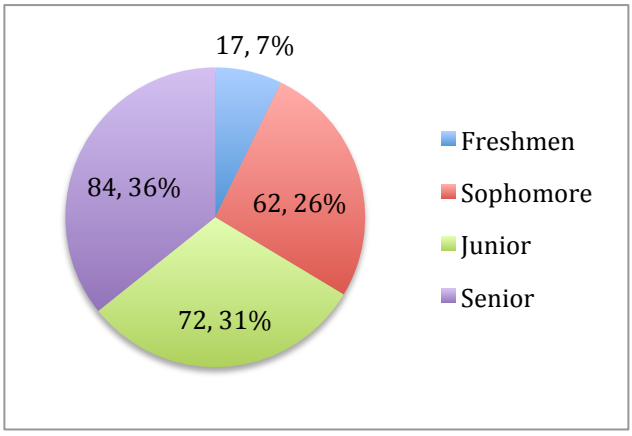
Table 2: Demographics of Study Participants

Gender	N	%
Male	30	12.77%
Female	205	87.23%
Age (in years)		
Average		20.9
Range		18-50
Median		20
Race/Ethnicity	N	%
American Indian/Native American		1%
Asian	12	5%
Black/African American	18	7%
Hispanic/Latino	9	4%
White/Caucasian	206	83%
Pacific Islander	1	0%
Other	1	0%

Baseline Survey

The first survey was administered at the beginning of the Fall 2015 Semester. Of the 235 participants surveyed 17 were Freshmen (7.23%), 62 were Sophomores (26.38%), 72 were Juniors (30.64%), and 84 were Seniors (35.75%) (Figure 3). Class status was an interaction variable examined in this research. Class status was an interaction variable examined in this research.

Figure 3: Class Status of Study Participants

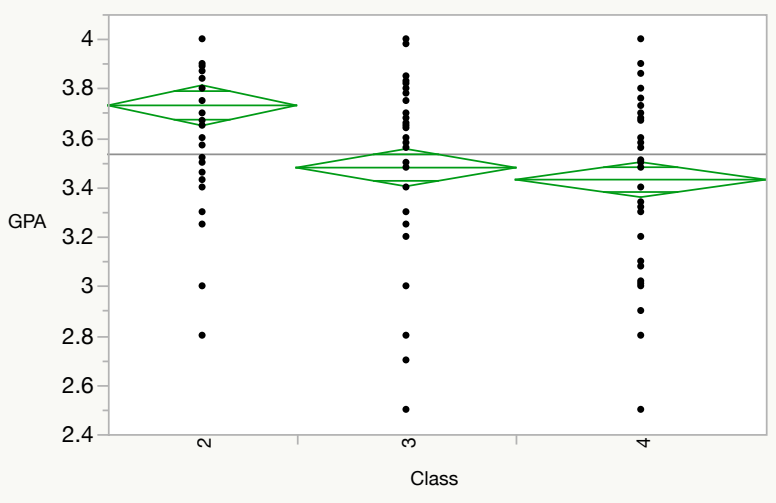


Students were asked to report their cumulative GPA; since it was their first semester of college, any Freshmen data for cumulative GPA were excluded in all GPA calculations and analysis. Sophomores had an average cumulative GPA of 3.73 ± 0.27, Juniors 3.48 ± 0.35, and Seniors 3.43 ± 0.34; overall, the average cumulative GPA was 3.536 ± 0.35 (Table 3). As shown in Figure 4, a one-way ANOVA was conducted on the cumulative GPA of study participants by class status. There was a significant difference between group means ($p<0.0001$).

Table 3: Cumulative GPA

Cumulative GPA					
Freshmen			Excluded		
Sophomore			3.73 ± 0.27		
Junior			3.48 ± 0.35		
Senior			3.43 ± 0.34		
Overall			3.54 ± 0.35		
	df	Sum of Squares	Mean Square	F Ratio	p-value
Class	2	3.448	1.724	16.426	<0.0001
Error	210	22.039	0.105		
Total	212	25.487			

*Figure 4: One-way ANOVA of Cumulative GPA by Class**



*Freshmen Excluded
2- Sophomore; 3- Junior; 4- Senior

Students were asked about their workload outside of the classroom (Table 4). The majority of students (76.17%) said they work or volunteer. On average, students reported that they typically work 18.21 hours per week. Freshmen had the lowest average work/volunteer hours (7.65 hours/week), Sophomores averaged 8.6 hours/week, Juniors averaged 13.29 hours/week, and Seniors reported the highest average hours (19.3 hours/week). Students were also asked about their course load for the semester. Credit hours ranged from 3-23 credit hours for that semester with an average of 15.73 credit hours and a median of 16 credit hours. A course load of 12 credit hours or more is considered full time for undergraduate students at the University of Kentucky.

Table 4: Workload of Study Participants

Do you have a job or volunteer?	N	%
Yes	179	76.17%
No	56	23.83%
How many hours do you work or volunteer per week?		
Overall	18.21	
Freshmen	7.65	
Sophomore	8.6	
Junior	13.29	
Seniors	19.3	
Credit Hours		
Average	15.73 ± 2.61	
Range	3 - 23	
Median	16	

Next, the students were asked general questions about their caffeine consumption (Table 5). The majority of students, 88.10%, indicated that they consume caffeine (Table 5). Reasons for caffeine consumption were also examined; both academic and nonacademic reasons were examined. Students were able to select multiple answers and

there were a total of 617 responses. The two most popular reasons were to wake up (22.7%) and taste (22.37%). Other popular reasons included studying for exams (13.94%), to stay awake (13.94%), and for homework/projects (12.32%). Morning (41.67%) was the most popular time that students tended to consume caffeine while 35.12% tended to consume caffeine in the afternoon, 19.35% in the evening, and 3.86% at nighttime.

Table 5: Caffeine Consumption Patterns

Do you consume caffeine?	N	%
Yes	207	88.10%
No	28	11.90%
Reasons for Caffeine Consumption	N	%
To Wake Up	140	22.70%
Stay Awake	86	13.94%
Study for Exams	86	13.94%
Exercise	30	4.86%
Homework/Projects	76	12.32%
Work/Volunteer	52	8.43%
Taste	138	22.37%
Other	9	1.44%
When do you tend to Consume Caffeine? (Select all that apply)	N	%
Morning	140	41.67%
Afternoon	118	35.12%
Evening	65	19.35%
Night	13	3.86%

Due to variance in the caffeine content of brewed beverages, caffeinated coffee was investigated further. Of those who identified as caffeine consumers, 81.64% said that they consume caffeinated coffee (Table 6). Students were asked to identify the types of coffee that they consume most often. Both off-campus sources and on-campus sources were examined. Home-brewed, gas stations, fast food, and nearby coffee shops were off-

campus sources. On-campus sources of caffeinated coffee included campus dining establishments (8 locations), Starbucks (3 locations), and Einstein Brothers. The most popular types were home-brewed (44.55%) and Starbucks (33.33%).

Table 6: Responses to Coffee Questions

Do you drink caffeinated coffee?	N	%
Yes	169	81.64%
No	38	18.36%
What type of coffee do you drink most often? (Select all that apply)		
Home-brewed	143	44.55%
Gas station	7	2.18%
Fast food	12	3.74%
Campus Dining	9	2.80%
Coffea	17	5.30%
Starbucks	107	33.33%
Einstein Brothers	19	5.92%
Other	7	2.18%

N=321

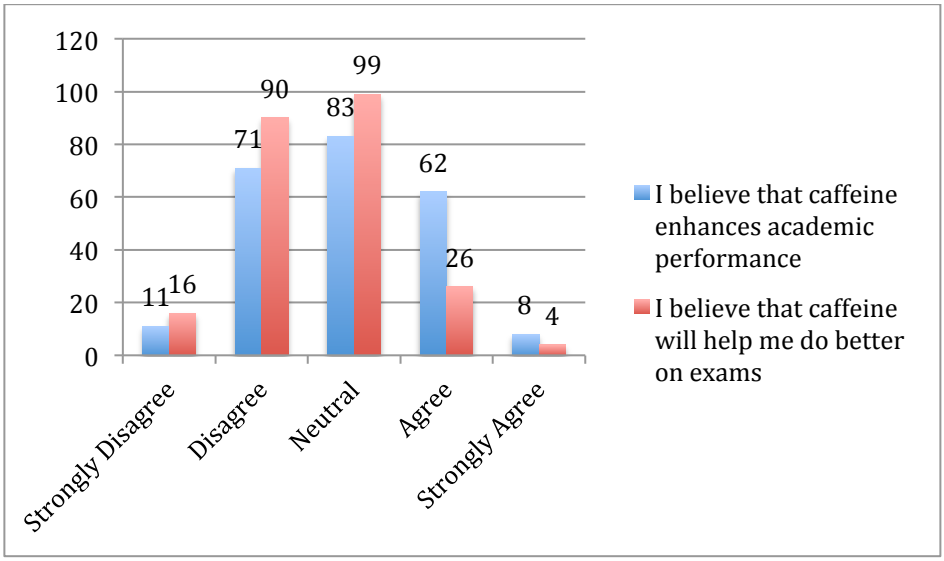
Students filled out a caffeine frequency table; examining the number of servings of popular caffeinated beverages consumed over the past week. Students were given standard serving sizes of each product as a reference and had set ranges of servings to choose from. The milligrams of caffeine consumed were calculated from the serving frequency table (Table 7). At the beginning of the semester, students consumed an average of 167.90 mg per day. On average, students are not exceeding the recommended limit of 400 mg caffeine/day. Caffeine consumption ranged from 0-4,317.5 mg in the previous week with a median value of 814mg. Average daily caffeine consumption by class was investigated. Seniors had the highest average daily caffeine consumption of 188.60 mg ±165.99.

Table 7: Caffeine Consumption at the Beginning of the Semester

Caffeine Consumption- Baseline	
Average	1,175.33 mg/week 167.90 mg/day
Standard Deviation	1113.59 mg
Range	0-4,317.5 mg
Median	814 mg
Caffeine Consumption by Class- Baseline	
Freshmen	169.79 mg ± 175.88
Sophomores	154.59 mg ± 154.76
Juniors	154.91 mg ± 151.05
Seniors	188.60 mg ± 165.99

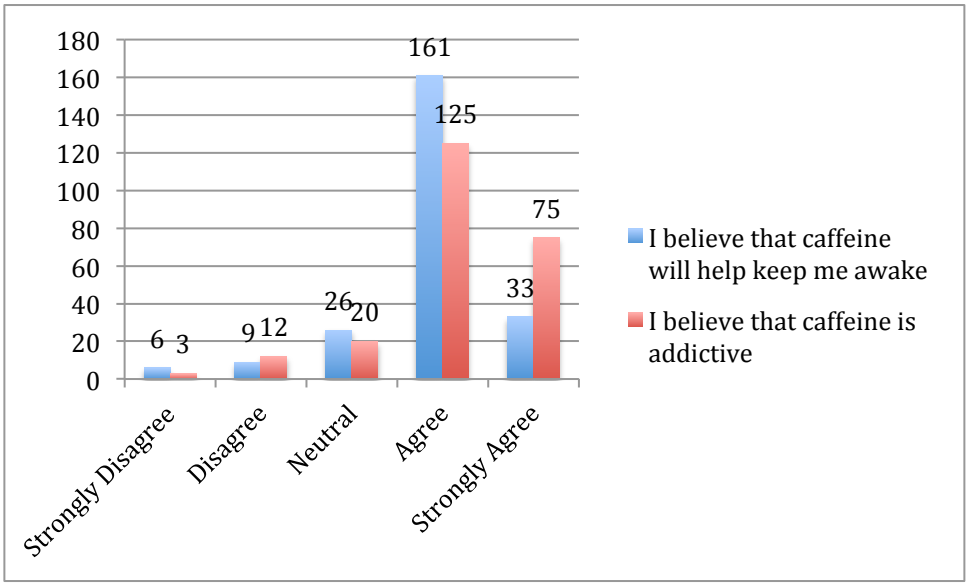
The students were asked a series of questions regarding their beliefs about caffeine using a Likert-type scale. Questions 8 and 13 asked students about their beliefs about caffeine and academic performance (Figure 5). Opinions on the statement, "I believe that caffeine enhances academic performance" were split; 34.89% disagreed, 35.32% were neutral, and 29.79% agreed. Most students disagreed with (45.11%) or were neutral (42.13%) towards the statement, "I believe that caffeine will help me do better on exams".

Figure 5: Questions Regarding Beliefs about Caffeine and Academic Performance



Questions 9 and 11 examined the actions of caffeine (Figure 6). The majority of students agreed with the statement, "I believe that caffeine will help keep me awake" (82.55%) and "I believe that caffeine is addictive" (85.11%).

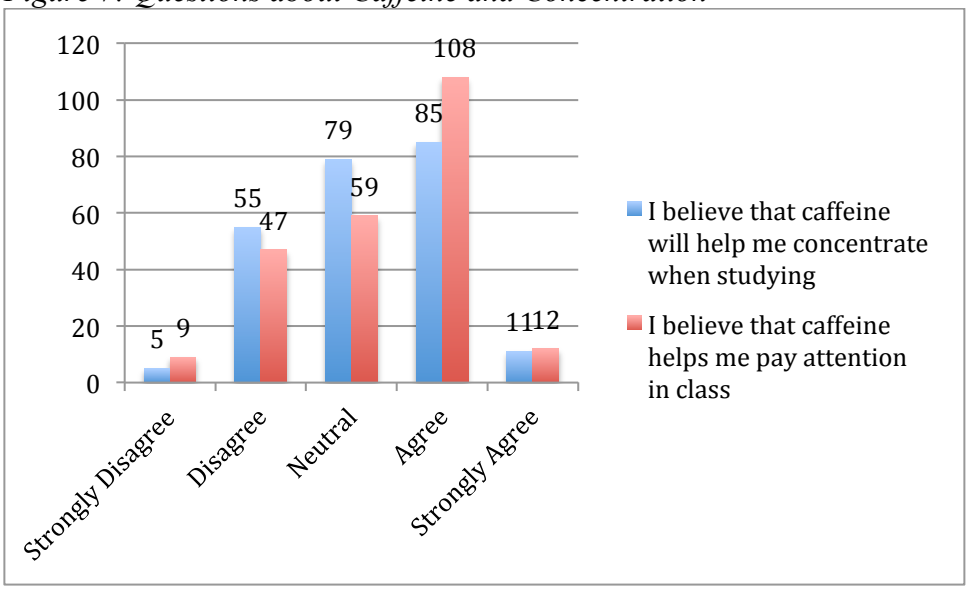
Figure 6: Questions Regarding Beliefs about the Actions of Caffeine



Questions 10 and 12 examined the use of caffeine in regards to concentration (Figure 7). Most students were neutral (33.62%) or agreed (40.85%)with the statement, "I

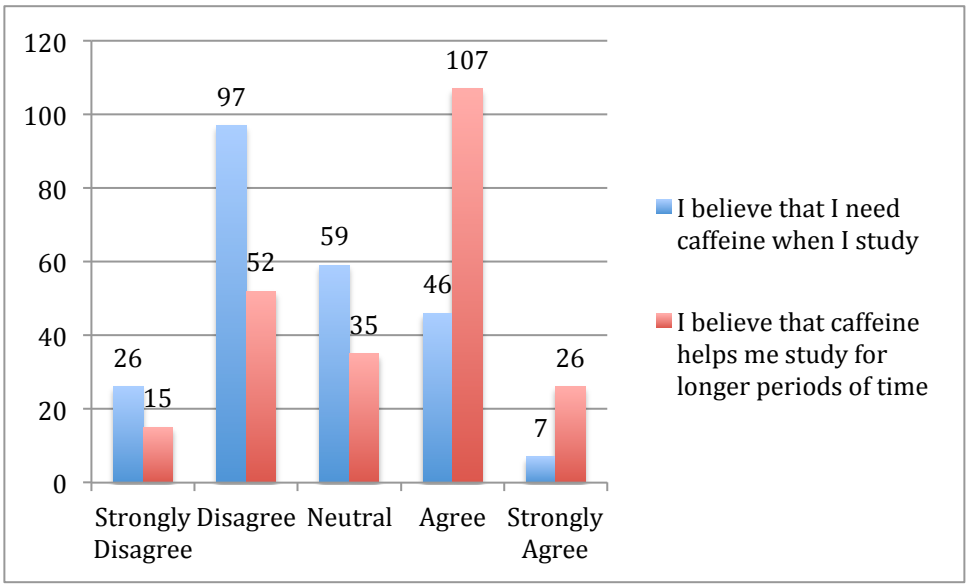
believe that caffeine will help me concentrate when studying". The majority (51.06%) agreed that, "I believe that caffeine helps me pay attention in class"

Figure 7: Questions about Caffeine and Concentration



Question 14 and Question 15 investigated beliefs about caffeine regarding studying (Figure 8). The majority of students (52.34%) disagreed with the statement, "I believe that I need caffeine when I study", but (56.60%) agreed with the statement, "I believe that caffeine helps me study for longer periods of time.

Figure 8: Questions Regarding Caffeine and Studying



Finally, students were given the PSS-10 to complete. Students scored on average a 15.95 ± 6.38 on the PSS at the beginning of the semester; this is on the lower end of the moderate stress category (scores 13-26). Scores ranged from 2-33 with a median score of 16 (Table 8). The majority of students fell within the moderate range.

Table 8: Perceived Stress Scores at Beginning of the Semester

Perceived Stress Score- Baseline	
Average	15.95
Standard Deviation	6.38
Range	2-33
Median	16
Perceived Stress Score Levels- Baseline	N
Low Stress (0-12)	87
Moderate Stress (13-26)	137
High Stress (27-40)	11

Midterm Survey

The second survey was administered during the Fall 2015 Midterm examination period. Students were given the same servings of caffeine frequency table as the beginning of the semester. Students consumed an average of 1,383.15 mg (SD= 1,170.13 mg) of caffeine in the previous week, averaging 197.59 mg per day (Table 9). Caffeine consumption ranged from 0-4,278.5 mg in the previous week with a median value of 1,224 mg. Average daily caffeine consumption was investigated by class again. At the midterm period Seniors still had the highest average daily caffeine consumption at 232.63 mg ± 180.70.

Table 9: Caffeine Consumption at the Midterm Period

Caffeine Consumption- Midterms	
Average	1,383.15 mg/week 197.59 mg/day
Standard Deviation	1,170.13 mg
Range	0 to 4,278.5 mg
Median	1,224 mg
Caffeine Consumption by Class- Midterms	
Freshmen	194.53 mg ± 145.85
Sophomores	170.49 mg ± 160.42
Juniors	180.80 mg ± 156.96
Seniors	232.63 mg ± 180.70

Next, students were asked about their workload outside and inside of the classroom over the past week (Table 10). Students reported an average of 21.49 hours (SD= 14.65) spent studying or completing assignments over the previous week. Responses ranged from 2 to 100 hours with a median of 19 hours. Since it was the midterm period, the number of exams was examined (Table 19). On average, students had 2.13 tests over the past week (SD=0.97). Some students reported having no exams,

while others reported up to 7 exams over the past week with a median of 2 exams. However, each class was surveyed one or two class days after an exam, so all students had at least one exam in the previous week. Students were also asked if they had a higher than normal number of assignments due over the past week. The majority (58.30%) agreed with that statement. Students reported working or volunteering an average of 15.39 hours (SD= 10.95) over the past week. Work and volunteer hours ranged from 1-45 hours with a median value of 13 hours. Students, on average, worked less during the midterm period than at the beginning of the semester.

Table 10: Workload at the Midterm Period

How many hours did you spend studying or completing homework, projects, and/or papers OVER THE PAST WEEK?		
Average	21.49 hours	
Standard Deviation	14.65 hours	
Range	2-100 hours	
Median	19 hours	
How many tests have you had over the past week?		
Average	2.13 tests	
Standard Deviation	0.97 tests	
Range	0-7 tests	
Median	2 tests	
Have you had a higher than normal number of assignments (lab reports, homework, projects, papers) due over the past week?	N	%
Yes	137	58.30%
No	98	41.70%
How many hours have you worked/volunteered over the past week?		
Average	15.39 hours	
Standard Deviation	10.95 hours	
Range	1-45 hours	
Median	13 hours	

Finally, the students were given the PSS-10 again. On average, students scored an 18.89 (SD= 6.95) on the PSS at the midterm of the semester (Table 11). This average

falls within the moderate category (scores 13-26). Scores ranged from 2-36 with a median score of 19. The majority of students fell into the moderate range for stress scores.

Table 11: Perceived Stress Scores at the Midterm Period

Perceived Stress Score- Midterms	
Average	18.89
Standard Deviation	6.95
Range	2 - 36
Median	19
Perceived Stress Score Levels- Midterm	N
Low Stress (0-12)	55
Moderate Stress (13-26)	148
High Stress (27-40)	35

Comparison of Baseline vs. Midterm Period

From the beginning of the semester to the midterm period, both average daily caffeine consumption and perceived stress increased (Table 12). Daily caffeine consumption increased from 167.90 mg/day at the beginning of the semester to 197.59 mg/day at the midterm period. There was an average difference in caffeine consumption of 29.69 mg/day. Perceived stress scores increased from an average of 15.95 at the beginning of the semester to an average of 18.89 at the midterm period. The average difference in perceived stress scores was 2.94.

Table 12: Changes from Beginning of Semester to the Midterm Period

	Baseline	Midterms	Average Difference
Average Daily Caffeine Consumption	167.90 mg/day	197.59 mg/day	29.69 mg/day
Average Perceived Stress Score	15.95	18.89	2.94

A paired t-test was performed for caffeine consumption (Table 13). This was significant (p=0.00004).

Table 13: Paired T-test for Average Daily Caffeine Consumption

Variable	N	Mean	Std Error	
Caffeine (mg)	235	29.69	8.27	
t-value	df	p-value	95% CI of the mean	
3.59	234	0.00004	13.39	45.99

Gender was examined further (Table 14). It was not statistically significant for males (p=0.1740), but statistically significant for females (p=0.0009).

Table 14: Paired T-test for Caffeine Consumption by Gender

Variable-Males	N	Mean Difference	Std Error	
Caffeine (mg)	30	19.63	14.09	
t-value	df	p-value	95% CI of the mean	
1.39	29	0.174	-9.18	48.09
Variable-Females	N	Mean Difference	Std Error	
Caffeine (mg)	205	31.16	9.26	
t-value	df	p-value	95% CI of the mean	
3.36	204	0.0009	12.9	49.42

Changes from the beginning of the semester to the midterm period were further examined by class status (Table 15). No significance was found for Freshman (p=0.51), Sophomores (p=0.22), and Juniors (p=0.92). This was significant for Seniors (p=0.0042). Senior, on average, consumed the highest amount at both the beginning of the semester and the midterm period. A one-way ANOVA was performed on average caffeine consumption by class status; there was not a significant (p=0.1938) difference in average caffeine consumption between the classes.

Table 15: Comparison of Changes in Daily Caffeine Consumption by Class

	Baseline	Midterms	p-value
Freshmen	169.79 mg ± 175.88	194.53 mg ± 145.85	0.51
Sophomores	154.59 mg ± 154.76	170.49 mg ± 160.42	0.22
Juniors	154.91 mg ± 151.05	180.80 mg ± 156.96	0.92
Seniors	188.60 mg ± 165.99	232.63 mg ± 180.70	0.0042

A paired t-test was performed for perceived stress scores from the beginning of the semester to the midterm period (Table 16). This was significant ($p<0.0001$).

Table 16: Paired T-test for Perceived Stress Score

Variable	N	Mean Difference	Std Error	
PSS Score	235	2.94	0.42	
t-value	df	p-value	95% CI of the mean	
7.09	234	<0.0001	2.13	3.76

Gender was examined further (Table 17). This was significant for both males ($p= 0.0087$) and females ($p <0.0001$).

Table 17: Paired T-test for Perceived Stress Score by Gender

Variable-Males	N	Mean Difference	Std Error	
PSS Score	30	3.57	1.29	
t-value	df	p-value	95% CI of the mean	
2.81	29	0.0087	0.97	6.16
Variable - Females	N	Mean Difference	Std Error	
PSS Score	205	2.85	0.44	
t-value	df	p-value	95% CI of the mean	
6.5	204	<0.0001	1.99	3.72

Changes from the beginning of the semester to the midterm period were further examined by class status (Table 18). No significance was found for Freshman (p=0.4971). This was significant for Sophomores (p <0.0001), Juniors (p=0.0003), and Seniors (p=0.0006). A one-way ANOVA was performed on average PSS score by class status (Figure 9). This was significant (p=0.0011) at α= 0.05 (Table 33). On average, Freshmen and Sophomores had the highest PSS scores at the beginning of the semester and at midterms. Seniors consistently had the lowest PSS scores.

Table 18: Comparison of Changes in PSS Scores by Class

	Baseline		Midterms		p-value
Freshmen	18.82 ± 6.76		19.76 ± 6.38		0.4971
Sophomores	17.16 ± 6.31		21.81 ± 6.94		<0.0001
Juniors	15.83 ± 6.20		18.19 ± 6.12		0.0003
Seniors	14.57 ± 6.26		17.17 ± 7.15		0.0006
	Df	Sum of Squares	Mean Square	F Ratio	p-value
Class	3	537.735	179.245	5.509	0.0011
Error	231	7515.559	32.535		
Total	234	8053.294			

Figure 9: One-way ANOVA of Average PSS Score by Class
1- Freshman; 2- Sophomore; 3- Junior; 4- Senior

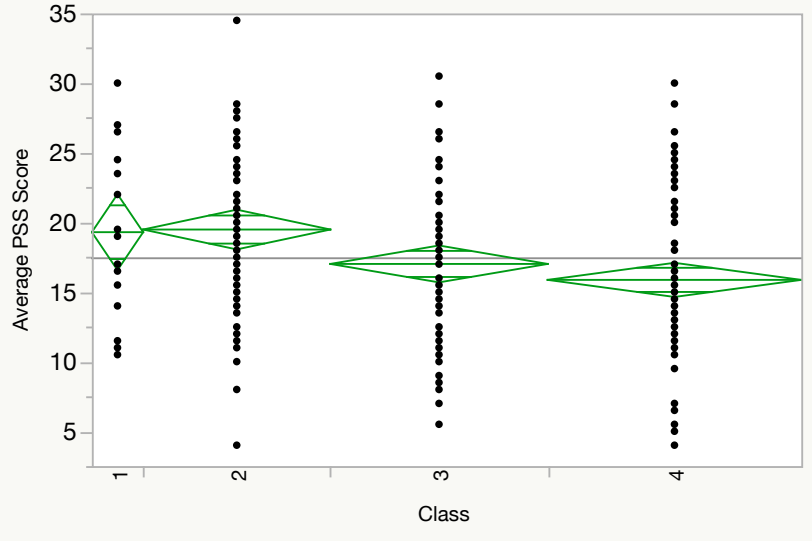


Table 33: One-way ANOVA of Average PSS Score by Class

	Df	Sum of Squares	Mean Square	F Ratio	p-value
Class	3	537.735	179.245	5.509	0.0011
Error	231	7515.559	32.535		
Total	234	8053.294			

Research Question 1: Do students who score higher on Cohen's Perceived Stress Scale (PSS) report higher caffeine consumption than students who score lower on the PSS?

The association between average PSS score and average daily caffeine consumption for all students, both consumers and non-consumers, was examined. There was no correlation (R^2= 0.02837) and was not statistically significant (p=0.4164). The association between average PSS score and average daily caffeine consumption was examined in just students who identified as caffeine consumers. No association (R^2= 0.000139) or statistical significance (p=0.8663) was found between average PSS score and average daily caffeine consumption in consumers.

The relationship between average PSS score and average caffeine consumption was examined by gender. There was no correlation (R^2= 0.109783) and no statistical significance (p=0.1057) for male consumers. There was no association (R^2= 0.001295) or statistical significance (p=0.6296) between average PSS and average caffeine consumption in female consumers.

The relationship between average PSS score and average caffeine consumption was by class status. There was no correlation (R^2= 0.139396) and was not statistically significant (p=0.1543) for freshmen consumers. Next, the relationship between average PSS score and average caffeine consumption was examined in sophomore consumers; there was no correlation (R^2= 0.024302) and was not statistically significant (p=0.263). There was a no correlation (R^2= 0.010758) and was not statistically significant

(p=0.4147) for Junior consumers. Finally, the relationship between average PSS score and average caffeine consumption was examined in senior consumers. There was no correlation (R^2= 0.006381) or statistical significance (p=0.5017).

Research Question 2: Do students who report high levels of caffeine consumption have higher cumulative GPAs than students who report no caffeine consumption?

The association between average daily caffeine consumption and cumulative GPA for all students, both consumers and non-consumers, was examined. There was no correlation (R^2= 0.014693) and the relationship was not statistically significant (p=0.0775). Next, the association between average daily caffeine consumption and cumulative GPA was examined in just consumers. There was no association (R^2= 0.023378) but was a statistically significant relationship (p=0.0372) for the consumer group.

Within the consumer group, the relationship between average daily caffeine consumption and cumulative GPA was examined by gender. There was no correlation (R^2= 0.166456) and was not statistically significant (p=0.0533) for male consumers. There was no association (R^2= 0.011463) or statistical significance (p=0.1737) between average daily caffeine consumption and cumulative GPA in female consumers.

The relationship between average daily caffeine consumption and cumulative GPA was examined by class status. There was no association (R^2= 9.634e-5) and no statistical significance (p=0.9444) for sophomore consumers. For Juniors, there was no correlation (R^2= 0.052638) and was not statistically significant (p=0.0705). Finally, the relationship between average daily caffeine consumption and cumulative GPA was examined in senior consumers. There was no association (R^2= 0.111657) but was statistically significant (p=0.0047).

Section V: Discussion

The purpose of this research was to assess the perceived stress and caffeine consumption of students enrolled in undergraduate-level DHN courses. This study compared perceived stress and caffeine consumption at the beginning of the semester and again at the midterm examination period. The objectives of this study were to determine the relationship between perceived stress and caffeine consumption and the relationship between caffeine consumption and cumulative GPA.

Perceived stress scores increased significantly from the beginning of the semester to the midterm period. Although the average perceived stress scores remained in the moderate range at both the beginning of the semester and midterms, the number of students who scored in the moderate and high stress ranges increased from baseline. As expected, the majority of students believed that there was a higher workload than usual at the midterm period. This supports findings from previous that showed perceived stress increased at an examination period (Zunhammer et al, 2014).

The literature has also shown that caffeine consumption can be used as a coping mechanism in response to periods of increased stress, such as examinations (Rios et al, 2013). In this study, caffeine consumption increased significantly from the beginning of the semester to the midterm period. This supports findings from previous literature that found an increase in caffeine consumption during an examination period (Zunhammer et al, 2014). For this study, school-related uses were included in questions about reasons for caffeine consumption. As expected, popular motivations for students to consume caffeine were taste, to wake up/stay awake, complete homework/projects, or to study. The use of caffeine to stay awake or wake up has consistently been a popular reason for

caffeine consumption in the literature. While students did report academic reasons as motivations for caffeine use, they did not believe caffeine would benefit them in those situations. Although seemingly contradictory, these conflicting beliefs about caffeine are consistent with findings in the literature.

Results from this study reaffirm that the majority of college students consume caffeine. Excess caffeine consumption may put students at increased risk for adverse effects. Previous studies have shown that, on average, students are consuming higher amounts of caffeine than recommended from caffeinated beverages (McIlvain et al, 2011). However, results from this study oppose these results. On average, students in this study reported drinking below the moderate range of up to 400 mg of caffeine per day, both at the beginning of the semester and at the midterm period. The Senior class consistently reported the highest average daily caffeine consumption. This was expected as students may establish habits or become more physically dependent on caffeine over the years.

Although the students in this study appear to consume less than the recommended daily limit for caffeine, both perceived stress and caffeine consumption did significantly increase during the midterm exam period; failing to cope with this added stress or increased caffeine consumption could put these students at increased risk for adverse effects.

1. Do students who score higher on Cohen's Perceived Stress Scale (PSS) report higher caffeine consumption than students who score lower on the PSS?

Results from this study disprove the hypothesis that students who score higher on the PSS consume more caffeine than students who score lower on the PSS. Students who

scored higher on the PSS did not report higher caffeine consumption than those who scored lower on the PSS. Overall, no significant positive relationship was found between the average perceived stress scores and average daily caffeine consumption. This supports a previous study that found no association between the consumption of caffeinated beverages and academic stress or load (Ríos et al, 2013). Findings from this research negate a previous study that found positive correlations existed between the participants' perceived stress level and caffeine consumption (Pettit & Debarr, 2011). However, unlike previous studies, this study did not find a significant difference in consumption between men and women, with men consuming higher amounts (Rios et al, 2013. Pettit & Debarr, 2011). This study found that, on average, females were actually consuming higher amounts of caffeine than males at both the beginning of the semester and the midterm period. This may be due to the uneven sample size between the genders in this study. Results also show that class status was not a significant interaction variable; year in school did not impact whether or not there was a relationship between perceived stress scores and caffeine consumption. However, there was an uneven distribution of participants between each of the classes. Previous research did not further investigate the association between perceived stress and caffeine consumption by class status.

2. Do students who report high levels of caffeine consumption have higher cumulative GPAs than students who report no caffeine consumption?

The hypothesis that students with high caffeine consumption have higher cumulative GPAs than students who report no caffeine consumption was disproved. Students with high levels of caffeine consumption did not have higher cumulative GPAs than students who did not report caffeine consumption. Overall, there was no significant

positive association between average daily caffeine consumption and cumulative GPA. This contradicts previous research that found there was a negative correlation between energy drink consumption and academic performance (Pettit & DeBarr, 2011). However, statistical significance was found between average daily caffeine consumption and cumulative GPA for the consumer group and then by class status for Seniors within the consumer group; although, there was no correlation. No previous studies had further investigated class status as an interaction variable in the relationship between caffeine consumption and GPA.

Limitations

Major limitations of this study include the lack of generalizability and bias. Only one department within the university was surveyed; this did not provide a randomized sample so we are unable to predict stress and caffeine consumption for the general college student population. The courses surveyed included nursing, dietetics, and human nutrition majors; these health-related majors are competitive and students have an average GPA higher than the university wide average. There were also graduate students and non-traditional students included in this study; these students may perceive stress differently and have different caffeine consumption patterns than traditional students. Next, the sample was not representative of the University population; there were a higher percentage of female participants (87%) than male participants (13%). Additionally, the majority of participants were Caucasian (88%) and the majority of participants were also caffeine consumers, making comparisons between consumers and non-consumers challenging. The composition of the sample limits the generalizability of the findings of this research to the general college student population.

The accuracy of the reported caffeine consumption is another limitation to this study. The caffeine frequency tables collected data based on frequency of consumption of caffeinated beverages or pills over the previous seven days; caffeine from food sources or other supplements were not examined. The table included popular caffeinated beverages and was not all inclusive- students may not be aware that the caffeinated beverages that they consumed contained caffeine or may not have reported consuming a caffeinated beverage under "other" if it was not listed in the table. Another consideration is the variance in caffeine content of brewed items, such as coffee or tea. Additionally, some beverages listed in the table were not brand or type specific- there is variance in caffeine content within a category, such as different soda products, that was not accounted for.

Bias is an issue in survey sampling and limits the generalizability of the results from this study. Due to the voluntary nature of the survey, there is voluntary response bias. Nonresponse bias is also a limitation since students may have missed class when data were collected due to issues related to stress or their caffeine consumption. Another limitation is recall bias- students had to remember their caffeine consumption over the previous 7 days and reflect on how they felt over the past 30 days for the PSS.

Further research should be done on a representative sample of the university population in order to make generalizations about the student population. In addition, all sources of caffeine should be examined when determining caffeine consumption, not just popular beverages and caffeine pills. The symptoms associated with caffeine intoxication and symptoms associated with high stress should also be examined. Identification of symptoms would help determine if students' caffeine consumption or stress is problematic to their health.

Section VI: Conclusion

From the results found in this study, it is clear that the majority of college students consume caffeine. In addition, this study found that, on average, college students who consume caffeine seem to be consuming less than 400mg a day, the safe limit for most healthy adults (USDA, 2015). However, some college students (13.5%) are consuming more than this amount. Finally, this study found that both caffeine consumption and perceived stress significantly increased during the midterm exam period, suggesting that students may be consuming more than the recommended amount in periods of stress. There is limited evidence to ascertain the safety of high caffeine intake in adults. Students would benefit from learning about the health risks associated with increased caffeine consumption and healthy ways to manage and cope with stress. Education may help students reduce their risk of experiencing negative effects from both caffeine consumption and unmanaged stress. Results from this study provide a basis for further research in the areas of perceived stress and caffeine consumption as it is related to college students.

Appendices

Survey 1 Last 4 digits of student ID#: _____

Demographic Information:

Age: _____

Gender: Male Female

High School: _____

City: _____ State: _____

Race/Ethnicity (Circle all that apply):

American Indian/Native American Asian Black/African American

Hispanic/Latino White/Caucasian Pacific Islander

Other (please specify): _____

Class Status (Circle):

Freshman Sophomore Junior Senior

Cumulative GPA: _____

Do you have a job or volunteer?

Yes No

If "yes", how many hours do you work or volunteer per week? _____

How many credit hours are you taking this semester? _____

1. Do you consume caffeine?

   Yes No

   If you responded "no" to question 1, please skip ahead to question 8.
   If you responded "yes" to question 1, please answer the following questions.

2. When do you tend to consume caffeine? (Circle all that apply)

   Morning Afternoon Evening Middle of night

3. Why do you tend to consume caffeine? (Circle all that apply)

   To wake up Stay awake during class Study for exams

   Enhance exercise Complete homework/projects Work/volunteer

   Like the Taste Other: _____

4. Do you drink caffeinated coffee?

   Yes No

   If you responded "no" to question 4, please skip to question 6.

5. What type of coffee do you drink most often? (Circle all that apply)

   Home-brewed Gas station Fast food Campus dining

   Coffea Starbucks Einstein Brothers

   Other: _____

6. On average, how often do you consume the following caffeinated products each WEEK? Please mark an "x" in the appropriate box.

Product	Frequency				
	Never	1-2 days/week	3-4 days/week	5-6 days/week	Daily
Red Bull					
Full Throttle					
Rockstar					
Monster					
Starbucks Doubleshot Espresso					
5-hour Energy					
Caffeinated Coffee					
Caffeinated Regular or Diet Soda					
Caffeine Pills					
Other: _____					

7. How many servings of the following caffeinated products did you consume TOTAL in the PAST WEEK? Please mark an "x" in the appropriate box.

Product	Frequency							
	Serving size	None	1-2 servings	3-4 servings	5-6 servings	7-8 servings	9-10 servings	11 or more servings
Red Bull	8.4 oz. can							
Full Throttle	16 oz. can							
Rockstar	16 oz. can							
Monster	16 oz. can							
Starbucks Doubleshot Espresso	6.5 oz. can							
5-hour Energy	1.93 oz. bottle							
Caffeinated Coffee	12 oz.							
Caffeinated Regular or Diet Soda	12 oz. can							
Caffeine Pills	200 mg							
Other: _____								

Please select the answer that best reflects how you feel about the following statements:

8. I believe that caffeine enhances academic performance

Strongly Disagree Disagree Neutral Agree Strongly Agree

9. I believe that caffeine will help keep me awake

Strongly Disagree Disagree Neutral Agree Strongly Agree

10. I believe that caffeine will help me concentrate when studying

Strongly Disagree Disagree Neutral Agree Strongly Agree

11. I believe that caffeine is addictive

Strongly Disagree Disagree Neutral Agree Strongly Agree

12. I believe that caffeine helps me pay attention in class

Strongly Disagree Disagree Neutral Agree Strongly Agree

13. I believe that caffeine will help me do better on exams

Strongly Disagree Disagree Neutral Agree Strongly Agree

14. I believe that I need caffeine when I study

Strongly Disagree Disagree Neutral Agree Strongly Agree

15. I believe that caffeine helps me study for longer periods of time

Strongly Disagree Disagree Neutral Agree Strongly Agree

The following questions ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

0=Never 1=Almost Never 2=Sometimes 3=Fairly Often 4=Very Often

16. In the last month, how often have you been upset because of something that happened unexpectedly?

    0 1 2 3 4

17. In the last month, how often have you felt that you were unable to control the important things in your life?

    0 1 2 3 4

18. In the last month, how often have you felt nervous and "stressed"?

    0 1 2 3 4

19. In the last month, how often have you felt confident about your ability to handle your personal problems?

    0 1 2 3 4

20. In the last month, how often have you felt that things were going your way?

    0 1 2 3 4

21. In the last month, how often have you found that you could not cope with all the things you had to do?

    0 1 2 3 4

22. In the last month, how often have you been able to control irritations in your life?

    0 1 2 3 4

23. In the last month, how often have you felt that you were on top of things?

    0 1 2 3 4

24. In the last month, how often have you been angered because of things that were outside your control?

    0 1 2 3 4

25. In the last month, how often have you felt difficulties were piling up?

    0 1 2 3 4

Survey 2

Last 4 digits of student ID#: _____

1. How many servings of the following caffeinated products did you consume TOTAL in the PAST WEEK? Please mark an "x" in the appropriate box.

Product	Frequency							
	Serving size	None	1-2 servings	3-4 servings	5-6 servings	7-8 servings	9-10 servings	11 or more servings
Red Bull	8.4 oz. can							
Full Throttle	16 oz. can							
Rockstar	16 oz. can							
Monster	16 oz. can							
Starbucks Doubleshot Espresso	6.5 oz. can							
5-hour Energy	1.93 oz. bottle							
Caffeinated Coffee	12 oz.							
Caffeinated Regular or Diet Soda	12 oz. can							
Caffeine Pills	200 mg							
Other: _____								

2. How many hours did you spend studying or completing homework, projects, and/or papers OVER THE PAST WEEK? _____

3. How many tests have you had over the past week? _____

4. Have you had a higher than normal number of assignments (lab reports, homework, projects, papers) due over the past week?

   Yes No

5. How many hours have you worked/volunteered over the past week? _____

The following questions ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

0=Never 1=Almost Never 2=Sometimes 3=Fairly Often 4=Very Often

6. In the last month, how often have you been upset because of something that happened unexpectedly?

   0 1 2 3 4

7. In the last month, how often have you felt that you were unable to control the important things in your life?

   0 1 2 3 4

8. In the last month, how often have you felt nervous and "stressed"?

   0 1 2 3 4

9. In the last month, how often have you felt confident about your ability to handle your personal problems?

   0 1 2 3 4

10. In the last month, how often have you felt that things were going your way?

    0 1 2 3 4

11. In the last month, how often have you found that you could not cope with all the things you had to do?

    0 1 2 3 4

12. In the last month, how often have you been able to control irritations in your life?

    0 1 2 3 4

13. In the last month, how often have you felt that you were on top of things?

    0 1 2 3 4

14. In the last month, how often have you been angered because of things that were outside your control?

    0 1 2 3 4

15. In the last month, how often have you felt difficulties were piling up?

    0 1 2 3 4

REFERENCES:

Astill RG, Verhoeven D, Vijzelaar RL, Van Someren EJW (2013) Chronic stress undermines the compensatory sleep efficiency increase in response to sleep restriction in adolescents. J Sleep Res 22: 373–379. doi:10.1111/jsr.12032.

Attila, S., & Çakir, B. (2011). Energy-drink consumption in college students and associated factors. *Nutrition*, *27*(3), 316-322.

Berg, K. A. (2011). What Do You Expect?: An Investigation of How Caffeine Expectancies Affect College Students' Cognitive Performances.

Brand, R., & Koch, H. (2016). Using Caffeine Pills for Performance Enhancement. An Experimental Study on University Students' Willingness and Their Intention to Try Neuroenhancements. *Frontiers in psychology*, *7*.

Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *Jama*, *298*(14), 1685-1687.

Enrollment data for Winter 2014-Spring 2015 school year: http://www.forbes.com/colleges/university-of-kentucky/

Fulgoni, V. L., Keast, D. R., & Lieberman, H. R. (2015). Trends in intake and sources of caffeine in the diets of US adults: 2001–2010. *The American journal of clinical nutrition*, *101*(5), 1081-1087.

Giles, G. E., Mahoney, C. R., Brunyé, T. T., Gardony, A. L., Taylor, H. A., & Kanarek, R. B. (2012). Differential cognitive effects of energy drink ingredients: caffeine, taurine, and glucose. *Pharmacology Biochemistry and Behavior*, *102*(4), 569-577.

Malinauskas, B. M., Aeby, V. G., Overton, R. F., Carpenter-Aeby, T., & Barber-Heidal, K. (2007). A survey of energy drink consumption patterns among college students. *Nutrition journal*, *6*(1), 1.

McIlvain, G. E., Noland, M. P., & Bickel, R. (2011). Caffeine consumption patterns and beliefs of college freshmen. *American Journal of Health Education*, *42*(4), 235-244.

Nawrot, P., Jordan, S., Eastwood, J., Rotstein, J., Hugenholtz, A., & Feeley, M. (2003). Effects of caffeine on human health. *Food Additives & Contaminants*, *20*(1), 1-30.

Olsen, N. L. (2013). Caffeine Consumption Habits and Perceptions among University of New Hampshire Students.

Paul A. Harris, Robert Taylor, Robert Thielke, Jonathon Payne, Nathaniel Gonzalez, Jose G. Conde, Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support, J Biomed Inform. 2009 Apr;42(2):377-81.Pettit, M. L., & DeBarr, K. A. (2011). Perceived stress, energy drink consumption, and academic performance among college students. *Journal of American College Health*, *59*(5), 335-341.

Pettit, M. L., & DeBarr, K. A. (2011). Perceived stress, energy drink consumption, and academic performance among college students. *Journal of American College Health*, *59*(5), 335-341.

Poulos, N. S., & Pasch, K. E. (2015). Socio-demographic differences in energy drink consumption and reasons for consumption among US college students. *Health Education Journal*, 0017896915578299.

Ríos, J. L., Betancourt, J., Pagán, I., Fabián, C., Cruz, S. Y., González, A. M., ... & Palacios, C. (2013). Caffeinated-beverage consumption and its association with socio-demographic characteristics and selfperceived academic stress in first and second year students at the University of Puerto Rico Medical Sciences Campus (UPR-MSC). *Puerto Rico health sciences journal*, *32*(2).

Roberti, J. W., Harrington, L. N., & Storch, E. A. (2006). Further psychometric support for the 10-item version of the perceived stress scale. *Journal of College Counseling*, *9*(2), 135-147.

Trunzo, J. J., Samter, W., Morse, C., McClure, K., Kohn, C., Volkman, J. E., & O'Brien, K. (2014). College students' use of energy drinks, social problem-solving, and academic performance. *Journal of psychoactive drugs*, *46*(5), 396-401.

Ullrich, S., de Vries, Y. C., Kühn, S., Repantis, D., Dresler, M., & Ohla, K. (2015). Feeling smart: Effects of caffeine and glucose on cognition, mood and self-judgment. *Physiology & behavior*, *151*, 629-637.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

Zunhammer, M., Eichhammer, P., & Busch, V. (2014). Sleep quality during exam stress: the role of alcohol, caffeine and nicotine. *PloS one*, *9*(10), e109490.

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