CAFFEINE INTAKE AMONG LAW ENFORCEMENT OFFICERS PARTICIPATING IN SHIFT WORK

ABSTRACT

Objective: To investigate caffeine consumption among law enforcement officers during day shifts (DAY) and night shifts (NIGHT); to assess the types of caffeine-containing products and the frequency of product intake during DAY and NIGHT; to identify relationships between caffeine products and selected demographic characteristics; to identify relationships between caffeine intake and job-related characteristics.; and to identify associative relationships between caffeine intake and perceived concentration level, caffeine side effects, and tobacco use.

Participants: Police officers (PO) and Sheriff Department Deputies (SDD) in a rural region in Eastern North Carolina. Useable sample of 75 (N = 75).

Methods: Anonymous, self-administered caffeine food-frequency questionnaires (FFQ; three for DAY, three for NIGHT) and demographic questionnaire. Nonparametric tests were used. The Wilcoxon signed rank test was used to compare related samples. Spearman's correlation was used to determine relationships between two samples. The Mann-Whitney U test was used to compare two independent samples. The Kruskal-Wallis test was used to compare more than two independent samples.

Results: Caffeine consumption was similar from DAY to NIGHT (225 $\pm$ 227mg DAY; 252 $\pm$ 232 mg NIGHT; p=0.891). Frequency of tea intake was greater during DAY (p=0.032). Greater caffeine consumption was found among (1) SDD versus PO; (2) expert officers (for night only); (3) lower concentration levels (for night only); (4) tobacco users; (5) those who experience caffeine side effects. In addition, younger officers consumed more energy drinks DAY and NIGHT.

Conclusions: It was found that certain job-related characteristics influence caffeine intake, but types of products used and frequency of intake tends to be the same regardless of shift or caffeine side effects. Energy drinks were found to be most popular among younger officers. Tobacco use and caffeine intake were found to have a correlate relationship. Caffeine may aid alertness, especially at night. Further research is needed to assess other areas of shiftwork, more caffeine-containing products, especially energy drinks, and psychological or behavioral aspects of caffeine intake and product choice among shift workers. Limitations, gaps in the literature and implications are discussed.

CAFFEINE INTAKE AMONG LAW ENFORCEMENT OFFICERS PARTICIPATING IN SHIFT WORK

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by

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CAFFEINE INTAKE AMONG LAW ENFORCEMENT OFFICERS PARTICIPATING IN SHIFT WORK

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I would like to give sincere gratitude to Dr. Bertrand and the members of my committee for their guidance and insight throughout the completion of this work.

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DAY	Day shifts
NIGHT	Night shifts
PO	Police Officers
SDD	Sheriff Department Deputies
SD	Sheriff Department
FFQ	Food Frequency Questionnaire

CHAPTER 1

LITERATURE REVIEW

Participation in shift work has been found to interfere with normal behaviors, including eating, exercise, and sleep patterns, potentially leading to adverse health effects. Atkinson, Fullick, Grindey and Maclaren (2008), reviewed the behavioral and biological disturbances associated with shift work. Shift work has been linked with increased BMI, prevalence of obesity, and other health complications (Atkinson, et. al., 2008). Total energy intake during shift work does not appear to be affected; however, there is a tendency toward decreased meal frequency and increased snacking during night shift work (Atkinson, et. al., 2008). It was concluded that a multidisciplinary approach to investigating health and energy balance of shift workers is needed as the biological and behavioral factors influencing energy expenditure and intake are not independent of each other (Atkinson, et. al., 2008).

Holmback and colleagues (2002) studied the postprandial reaction related to macronutrient composition when food is consumed at different points during a 24-hour period. It was hypothesized in this study that subjects would respond metabolically different when given identical meals in the morning compared to the evening, glucose tolerance would decrease from morning to midnight, and night time eating would increase low density lipoprotein to high density lipoprotein ratio (LDL:HDL; Holmback, et. al., 2002). The nocturnal hormonal pattern was thought to influence these results, as well as contribute to the prevalence of obesity and cardiovascular disease seen in shift workers (Holmback, et. al., 2002).

Results showed that participants' basal metabolic rate (BMR) tended to be higher after day 6 of a high fat diet. Fasting blood glucose, non-esterified fatty acids (NEFA), and glycerol concentrations did not differ when given a high fat versus high carbohydrate diet, but the triglyceride concentration was greater for the high carbohydrate diet (Holmback, et. al., 2002). It was determined that a high fat diet impacted metabolic responses differently than a high carbohydrate diet, and these responses may put shift workers at an increased risk for metabolic disturbances, including obesity, cardiovascular disease, and gastrointestinal problems (Holmback, et. al., 2002).

De Assis, Kupek, Nahas and Bellisle (2003) studied the association between nutritional-and health-related problems associated with shift workers, specifically garbage collectors of Florianopolis, Brazil. Because of the increase in shift work to about 20% of the work force in industrialized countries, it is important to understand the cause and effect of health issues related to shift work (De Assis, et. al., 2003). There were no to date studies showing the influence of shift time on food intake in workers with very high energy expenditure, thus, this study investigated energy and nutrient intake of garbage collectors (a high energy job) based on meal recording during a 24-hour period (De Assis, et. al., 2003). Three different shifts were examined: morning, afternoon, and night. The work tasks were the same for the three shifts. The 66 total participants (n = 22 per shift) were asked to answer questionnaires regarding their eating habits. Age, body weight and Body Mass Index (BMI) were similar for all three groups as well as daily energy expenditure. Multiple regression analysis was used to compare factors influencing energy and nutrient intake (De Assis, et. al., 2003).

It was found that energy intake did not differ among the three shifts, even with differences in food choices and ingestion times (De Assis, et. al., 2003). Factors that were found to have a significant impact on ingestion included hour of day, time since last meal, age, and BMI (De Assis, et. al., 2003). When looking at macronutrients, only carbohydrate intake significantly differed among the three shifts. Soda consumption was high among all shifts, with night workers consuming the greatest amount of soda compared to morning and afternoon workers (De Assis, et. al., 2003). This may be due to the caffeine or high sugar content of sodas, which would help combat fatigue during the night shift. The results confirm the influence of factors other than shift time on health and nutrition, including time of day, time since last meal, age, and BMI (De Assis, et. al., 2003).

Similarly, Reeves, Newling-Ward, and Gissane (2004) investigated how shift work changes food intake and eating patterns and the impact of these changes on health. It was found that night workers did not consume more than day workers, but that they did eat smaller meals and snacks over more time. Furthermore, night workers showed a more significant difference in their food intake patterns on work days and days off, while day workers did not (Reeves, et. al. 2004). Shift work impacts the timing of food consumption since there is typically less availability of food during the night shifts, which is thought to contribute to unhealthy eating patterns observed in shift workers (Reeves, et. al., 2004).

Fisher, Rutishauser and Read (1986) investigated how the specific type of job, work environment, and availability of food in the work place influence dietary habits among 25 oil refinery shift workers. Day, night and afternoon shifts were investigated using a 24-hour food intake record. Significant differences were found between the types and frequency of foods consumed during the different shifts (Fisher, et. al., 1986). These differences were thought to be related to change in type of meal consumed as well as the availability of food, with night shift workers being primarily influenced by the availability of food and time constraints, rather than by hunger (Fisher, et. al., 1986).

Lennernas, Hambraeus, and Akerstedt (1995) explored how work hours impact eating behaviors and dietary choices among 96 male industrial workers on day work (work 40h/week between 0654 and 1530 hours), two-shift work (work 38h/week between 0530 and 1400 hours one week and between 1400 and 2230 hours the next week), and three-shift work (work 36h/week between 0530 and 1400 hours, 1400 and 2230 hours, and 2230 and 0530 hours). Due to a lack of research connecting shift work, eating behaviors, and disease as well as a gap in knowledge regarding shift workers and their specific food intake, the researchers chose to evaluate how shift work influences eating habits and nutritional parameters (Lennernas, et. al. 1995). Not only did the researchers compare energy and nutrient intake, but they also considered coffee and tea consumption for 8-hour work shifts (day, morning, afternoon, night), and for the 24-hour periods that included all four shifts. It was observed that the intake of coffee was significantly lower among three-shift workers on days off compared to work days (Lennernas, et. al. 1995). Among all three groups of workers, a difference in food and beverage intake, including coffee and alcohol, was found between work days and days off; however, no difference was reported among the 24-hour work periods with varying work shifts (Lennernas, et. al. 1995). Overall, energy intake and quality of food were not significantly influenced by shift work. Two- and three- shift work appeared to change circadian distribution of food and coffee intake, but not the overall 24-hour consumption (Lennernas, et. al. 1995).

Another aspect that has been shown to influence tolerance of shift work is aging, as studied by Smith and Mason (2001). The number of shift workers aged over 45 years is increasing. It was hypothesized that age is linked to decreased tolerance of shiftwork as it relates to aging, lifestyle, behavior, type of work and the shift worked (Smith & Mason, 2001). The participants in this study included 306 police officers working a new rotation for approximately six months. They were divided into three age groups for comparison (1=20-32.9, 2=33-39.9, 3=40+). A range of sleep-related variables, including fatigue, drowsiness, sleep quality, sleep duration, and caffeine consumption, were analyzed using multivariate analysis of covariance (Smith & Mason, 2001). Results showed that the three age groups differed significantly in terms of sleep needs (Smith & Mason, 2001). Younger officers tended to report better shift work attitudes, better adjustment to night shifts, higher job satisfaction and commitment to the work organization, less fatigue and longer sleep duration needs. Older officers reported significantly higher "morningness" (morning-oriented) and lower sleep needs (Smith & Mason, 2001). Concerning caffeine intake, older officers tended to consume more caffeine on all shifts worked (Smith & Mason, 2001). Older officers also tended to report less drowsiness on morning compared to night shifts. The results support the hypothesis that shiftwork tolerance is related to age; however, a link between the impacts of aging, lifestyle, behavior, type of work and the rotation worked has yet to be fully understood.

Caffeine has taken an important role in helping to maintain performance among shift workers as well as other sleep depriving situations. Snel and Lorist (2011) researched how caffeine can be used to alter mental state. While caffeine has been found to be useful for restoring low levels of wakefulness, it may result in detrimental effects on sleep, producing daytime fatigue (Snel & Lorist, 2011). During night shift work, where sleep deprivation is common, caffeine contributes to maintaining performance and wakefulness. However, the effects of caffeine may be due, in part, to caffeine expectancy and placebo effects (Snel & Lorist, 2011). Disturbances in the circadian rhythm, such as those seen with shift work, disrupt normal sleeping patterns and cognition, which may result in less than optimal work performance. According to Snel and Lorist (2011), it is necessary to combat circadian disturbances and restore cognitive performance, especially during work.

A series of double-blind studies was conducted by Killgore, Kahn-Greene, Grugle, Killgore, and Balkin (2009) to determine whether or not caffeine is a viable intervention to restore cognition. Fifty-four participants (18-36 years old) who had been sleep deprived for 45-50 hours were given either a 600 mg dose of caffeine, 400 mg modafinil (approved by FDA to manage fatigue, sleep apnea, and shift work sleep disorder), 20 mg dextroamphetamine, or a placebo prior to completing various cognitive tests designed to measure formation of abstract concepts (Killgore, et. al., 2009). Results showed that the three different stimulants (caffeine, modafinil, and dextroamphetamine) affected the outcome of the cognitive tests differently, with caffeine affecting cognitive processing most significantly (Killgore, et. al., 2009). Thus, it is suggested that performance is influenced by sleep deprivation and that this deprivation can be counteracted, in part, by caffeine (Killgore, et. al., 2009).

In another study, Kilpelaiinen, Huttunen, Lohi, and Lyytinen (2010) focused on perceived effects of caffeine on sleepiness, motivation, mood, and task performance. Military pilot students (23-24 years old) underwent a series of flight simulator tests after a 37-hour sleep deprivation period. It was predicted that sleep deprivation would decrease amount of correct answers and increase reaction time during testing. The subjects received either a placebo or 200 mg caffeine twice a day. Vigilance and learning were assessed during the test (Kilpelaiinen, et. al., 2010). As expected, sleep deprivation decreased the number of correct decisions as well as increased the reaction time for both placebo and caffeine groups. Interestingly, the perceived feeling of success remained stable across sustained wakefulness in the caffeine group (Kilpelaiinen, et. al., 2010). Similarly, it was observed by Ker, Edwards, Felix, Blackhall, and Roberts (2010) that caffeine has a significant impact on reducing the number of errors compared to a placebo.

Pecotic, Valic, Kardum, Seva, and Dogas (2008) further investigated the impact of caffeine on the adaptability of sleep habits by shift workers. The researchers predicted that sleep habits would be negatively affected by caffeine consumption. Medical students, physicians, specialists, and nurses participated in this study. The variables found to influence the amount of sleep needed were age, gender, work demands, and work schedule (Pecotic, et. al., 2008). Surprisingly, those participants who consumed caffeine reported greater difficulty staying awake during lectures and while driving a car. Based on these results, the researcher's hypothesis that caffeine intake impairs sleep habits and quality of sleep was supported.

Even in well-rested individuals, such as those examined in a study conducted by Michael, Johns, Owen, and Patterson (2008), caffeine can reduce drowsiness that persists for 3-4 hours. Different results between caffeine and placebo were only observed 30 minutes post administration of treatment. While this supports the prediction that caffeine can beneficially impact alertness and work performance, the benefits may be short-lived (Michael, et. al., 2008). Furthermore, the findings from Snel and Lorist (2011) show that caffeine can alter mental state in terms of cognitive processing and alertness as caffeine has been shown to restore wakefulness and performance. This is an important conclusion and may help explain the use of caffeine during shift work as a means to counteract fatigue and cognitive dysfunction.

CHAPTER 2

MANUSCRIPT

CAFFEINE INTAKE AMONG LAW ENFORCEMENT OFFICERS PARTICIPATING IN SHIFT WORK

Abstract

Objective: To investigate caffeine consumption among law enforcement officers during day shifts (DAY) and night shifts (NIGHT); to assess the types of caffeine-containing products and the frequency of product intake during DAY and NIGHT; to identify relationships between caffeine products and selected demographic characteristics; to identify relationships between caffeine intake and job-related characteristics.; and to identify associative relationships between caffeine intake and perceived concentration level, caffeine side effects, and tobacco use.

Participants: Police officers (PO) and Sheriff Department Deputies (SDD) in a rural region in Eastern North Carolina. Useable sample of 75 (N = 75).

Methods: Anonymous, self-administered caffeine food-frequency questionnaires (FFQ; three for DAY, three for NIGHT) and demographic questionnaire. Nonparametric tests were used. The Wilcoxon signed rank test was used to compare related samples (caffeine intake DAY to NIGHT, types of products used DAY to NIGHT, and frequency of product use DAY to NIGHT). Spearman’s correlation was used to determine relationships between two samples. The Mann-Whitney U test was used to compare two independent samples. The Kruskal-Wallis test was used to compare more than two independent samples.

Results: Caffeine consumption was similar from DAY to NIGHT (225 $\pm$ 227mg DAY; 252 $\pm$ 232 mg NIGHT; p=0.891). Frequency of tea intake was greater during DAY (p=0.032). Greater caffeine consumption was found among (1) SDD versus PO; (2) expert officers (for night only); (3) lower concentration levels (for night only); (4) tobacco users; (5) those who experience caffeine side effects. In addition, younger officers consumed more energy drinks DAY and NIGHT.

Conclusions: It was found that certain job-related characteristics influence caffeine intake, but types of products used and frequency of intake tends to be the same regardless of shift or caffeine side effects. Energy drinks were found to be most popular among younger officers. Tobacco use and caffeine intake were found to have a correlate relationship. Caffeine may aid alertness, especially at night. Further research is needed to assess other areas of shiftwork, more caffeine-containing products, especially energy drinks, and psychological or behavioral aspects of caffeine intake and product choice among shift workers. Limitations, gaps in the literature and implications are discussed.

CAFFEINE INTAKE AMONG LAW ENFORCEMENT OFFICERS PARTICIPATING IN SHIFT WORK

Introduction

Participation in shift work has been found to interfere with normal behaviors, including eating, exercise, and regular sleep patterns. Disruption in these normal behaviors can lead to adverse health effects. Shift work is associated with increased BMI and prevalence of obesity, cardiovascular disease, peptic ulcers, and gastrointestinal dysfunction (Atkinson, 2008; Holmback, 2002). De Assis and colleagues (2003) observed that night shift workers are more likely to consume energy-dense foods and beverages during shift work compared to morning and afternoon workers (2003). Fisher and colleagues (1986) reported that the types and frequency of foods consumed during the night shift are influenced by the availability of food and time constraints, rather than by hunger.

Disturbances in sleep patterns and normal circadian rhythms may contribute to food and beverage choices among shift workers (Atkinson, et al., 2008). According to Snel and Lorist (2011), caffeine is commonly used to offset fatigue and sleepiness and to assist with maintaining work performance. Lennernas and colleagues (1995) studied the impact of work hours on eating behaviors and dietary choices among male industrial workers on day work (work 40h/week between 0654 and 1530 hours), two-shift work (work 38h/week between 0530 and 1400 hours one week and between 1400 and 2230 hours the next week), and three-shift work (work 36h/week between 0530 and 1400 hours, 1400 and 2230 hours, and 2230 and 0530 hours). The findings indicated that intake of coffee was significantly higher among three-shift workers on work days compared to days off. Among all groups, differences in food and beverage intake, including coffee and alcohol, were found between work days and days off (Lennernas, Hambraeus, & Akerstedt, 1995).

According to Schardt (2012), over 80 percent of American adults regularly consume caffeine. Burke (2008) states that 90 percent of adults worldwide consume caffeine daily. Some of the most common caffeine-containing beverages include coffee, tea, and soda, as assessed by Barone and Roberts

(1996). Both American adults and adolescents consume caffeine, but caffeine intake has been shown to be nearly three times greater among the adult population (Barone & Roberts, 1996). Energy drinks have been declared the second most popular supplement behind multi-vitamins, specifically among adolescents and young adults (Hoffman, 2010). In addition, caffeine-containing products are commonly used among athletes due the perceived effects on performance and endurance (Hoffman, 2010; Desbrow & Leveritt 2006; Burke, 2008). Athletes that competed in the 2005 Ironman triathlon chose sodas, caffeinated gels, coffee, energy drinks, and NoDoz tablets most often (Desbrow & Leveritt, 2006).

Caffeine effects people differently, with reported side effects ranging from jittery, nervous, and restless to energetic or insomniatic (Monroe, 1998). Use of caffeine can result in dependence, defined as craving caffeine regularly, and tolerance, defined as the body requiring more and more caffeine to obtain the same effect (Monroe, 1998). Along with dependence comes withdrawal, which often results in increased negative mood (Monroe, 1998; Smith, 2002). Caffeine side effects are more common among heavy daily caffeine users and include insomnia, restlessness, depression, rapid heartbeat, anxiety, stomach pain or heartburn, headaches, muscle gain, shaking, and ringing in the ears (Monroe, 1998). Some of the more positive side effects are enhanced wakefulness and alertness, which have attracted shift workers, truck drivers, military officers, athletes, and others who aim to combat fatigue (Burke, 2008).

While the majority of adults both worldwide and within the United States regularly use caffeine, it has been found to be most popular among certain populations, including athletes (Hoffman, 2010; Desbrow & Leveritt 2006; Burke, 2008) and night workers (Smith, 2002). Studies have shown caffeine intake to be common among various workers participating in night shifts, including industrial workers, electronic workers, steel and railway workers, and medical staff, including nurses (Glazner, 1991). Lieberman and colleagues (2012) assessed intake among US army soldiers, where coffee was the most popular product used overall, and energy drinks was most commonly used among young adult males. Literature is lacking on caffeine intake among law enforcement officers participating in shift work as well as among shift workers serving as their own control to compare day versus night shifts.

The purpose of this study was to evaluate caffeine intake from caffeinated beverages and energy boosting supplements among law enforcement officers while working day shifts (DAY) and night shifts (NIGHT). The specific research aims for this study were: 1) Assess the amount of caffeine consumed, the types of caffeine products used, and the frequency of caffeine products used between DAY and NIGHT; 2) Identify relationships between caffeine products used and demographic characteristics; 3) Identify relationships between caffeine intake and job-related characteristics; and 4) Identify associative relationships between caffeine intake and perceived concentration level, caffeine side effects, and tobacco use.

Methods

This was a quantitative prospective study design. Participants were Police Officers (PO) and Sheriff Department Deputies (SDD) of a rural city in the eastern region of North Carolina who worked rotating DAY and NIGHT. The county served was 652 square miles large with a population of 172,554 (United States Census Bureau, 2012). The city served accounted for 5% of the county (34.6 sq. mi.) and over half of the county population (population 87,242), making the target city the largest, most populated area of the county (United States Census Bureau, 2012). In 2012, the county index crime rate was 3,986.5 per 100,000 persons, which was slightly higher than the state index crime rate of 3,767.2 per 100,000 persons (State Bureau of Investigation, 2013).

Caffeine Food Frequency Questionnaire (FFQ)

A quantitative self-administered caffeine food frequency questionnaire (FFQ) was used to assess 24-hour caffeine intake from beverages and supplements for each of three DAY and NIGHT shifts worked. An initial FFQ with five drink categories was designed from the literature (Neuhours et al, 2009; Heckman et al, 2010; McCusker et al, 2003; Chin et al, 2008; USDA, 2011; McCusker et al, 2006; Chou et al, 2007; McCusker 2006; Consumer Reports 2011; (Starbucks Drinks., 2012; McDonald’s Beverages, 2012). Additional drink categories and an energy-boosting supplement category were added following field research by a Registered Dietitian of area convenient stores, pharmacies, coffee shops, and grocery stores. The final FFQ had seven drink and four energy boosting supplement categories. Drink categories included coffee, coffee drinks, espresso, caffeinated sodas, energy drinks, tea, and caffeinated water. The energy boosting supplements included energy shots, caffeine supplements, energy chewing gum, and energy strips. Participants indicated each drink and supplement that they consumed for the given shift, in addition to serving size and number of servings consumed for each item. A reference serving size was provided for each item. For example, eight ounces (8 oz.) for coffee (standard coffee mug size) and 12 oz. for soda (regular can of soda). Job-related information for that shift was also reported, including the shift worked (day or night), the number of hours worked, and how busy was the shift (not busy, slightly busy but less than normal, normal workload, slightly more busy than normal, or very busy).

The FFQ was content validated by two Registered Dietitians, the SD Captain, and a Health Educator. Revisions were made to drink categories and serving sizes from feedback provided. A pilot test was next conducted among five university fitness center employees, aged 22 to 40 years (two males and three females). Reference serving sizes for each drink were added and modifications to heading titles and instructions for completing the questionnaire were made from feedback provided. Table 1 presents the mean caffeine content (mg) of products assessed on the FFQ. A serving size reference sheet was developed from field research of area restaurants. The sheet listed standard serving sizes for each drink and supplement.

Demographic and Caffeine Effects Questionnaire

The Demographic and Caffeine Effects Questionnaire assessed demographic information and characteristics of shift work for the past two weeks. As part of this questionnaire, a 7-point Likert scale was used to assess perceived level of energy and concentration while participating in shift work (1 = extremely low, 7 = extremely high; Laerhoven, et al, 2004). The questionnaire also assessed side effects experienced from consuming caffeine. This questionnaire was reviewed for content validity by the SD Captain, a Health Educator, and the City Human Resources Safety and Risk Manager. Three additional job-related and two demographic questions were added from their feedback. Further, the phrasing of the

Likert scale question was modified. The study was approved by the university's Institutional Review Board, the SD Captain, the Chief of Police, and the City Human Resources Safety and Risk Manager. All participants provided written informed consent prior to study participation. Data collection took place from April to June 2012.

Procedures

Each participant received a 9-page packet. Page 1 included a description of each item in the packet, deadline for completion, and researcher contact information. Page 2 was the Demographic and Caffeine Effects Questionnaire. Pages 3-8 were color-coded FFQs (pages 3-5 were yellow for DAY; pages 6-8 were purple for NIGHT). Page 9 was the Serving Size Reference Sheet, which included a graphic outline of a 16-ounce cup for gauging drink size. To maintain participant anonymity, each page was ID-coded with the same randomly assigned three-digit number.

Initially, the researcher attended roll call for each patrol unit of the SD. The researcher used a script to describe the packet content and time frame for completing the study, instruct recruits that participation was voluntary and recorded anonymous, and to obtain informed consent. Participants returned the packets to an assigned deputy; these were then given to the Captain and returned to the researcher. The same protocol was used for recruiting PO, with the exception that an assigned PO distributed and collected the packets, which were then returned by the PO to the researcher. By telephone and email, the researcher was in contact with the SDD and PO bi-monthly throughout data collection. Neither questions nor concerns were reported throughout the data collection period.

Statistical Analysis

Because data were not normally distributed, nonparametric tests were used for analyses. The Wilcoxon Signed Rank Test for related samples was used to compare mean caffeine intake and frequency of product intake for DAY and NIGHT in order to assess mean population difference (Wilcoxon, 1945). Spearman's correlation was used to assess the significance of the relationship between two quantitative variables (Page, 1963). The Kruskal-Wallis test was used when comparing more than two independent samples (Kruskal, Wallis, 1952), and The Mann-Whitney U Test for independent samples was used (Lund Research Limited, 2013) (Page, 1963) for comparisons between two non-related samples.

Results

There were 187 PO who serviced the city area. The PO operated 12-hour shifts and rotated from DAY to NIGHT (and vice versa) every three weeks. There were 199 SDD who serviced the county beyond police jurisdiction (City of Greenville, 2007; Pitt County Development Commission, 2007-2012). SDD also had 12-hour shifts, but rotated shifts every four weeks. SDD followed a Dupont schedule; officers worked two days during the week, then had two days off, and worked every other weekend (Friday, Saturday, and Sunday) for a total of seven 12-hour shifts during a 2-week period. There were 111 packets distributed between the PO and SDD. The response rate was 76% and 9 were excluded, resulting in a 68% useable response rate. Those who returned only one FFQ for DAY or NIGHT were excluded.

Participant demographic characteristics are reported in Tables 2 and 3. Mean participant age was 36 years, and ranged from 23 to 58 years (24% aged 20-29 years, 39% were 30-39 years, 30% were 40-49 years, and 7% were 50-58 years). The majority was male, married, non-Hispanic white, and did not use tobacco. On average, participants were in their current position for the past six years and in shift work for the past 10 years. The majority changed shift each three weeks (PO) and worked overtime 2 to 6 of the past 14 days.

Assessment of Caffeine Consumption

Overall, daily caffeine intake and types of caffeine products used were similar between DAY and NIGHT (255±227 milligrams per day (mg/d) (*M*±*SD*), *Mdn* 180 mg/d, 95% CI [202, 308] mg/d DAY; 252±232, 164, [198, 306] NIGHT; p=0.891), as assessed using the Wilcoxon Signed Rank Test. Frequency of product consumption was similar between DAY and NIGHT for all products except tea, which had greater frequency during DAY (p=0.032). The number of days and mean frequency of product intake for 3-day shift periods are reported in Tables 4 and 5. Of the four supplements assessed, energy shots was the only one that was used by participants. The other products assessed included NoDoz, energy gum and energy strips.

Caffeine Product Use and Demographic Characteristics

Demographic characteristics tested in this study included tobacco use, age, sex, marital status, and race. Energy drinks was the only product that differed with age. Only eight of the 75 participants used energy drinks; their ages ranged from 24 to 40 years. Those with the highest intake of energy drinks (average one per shift) were younger for both DAY and NIGHT. Table 6 presents the mean distribution of ages for energy drink consumption during DAY and NIGHT. Mean caffeine intake and product consumption were similar across categories of sex, marital status, and race (data not shown).

Further looking at demographic characteristics between departments, SDD were, on average, five years older than PO (34±8 years (*M*±*SD*), *Mdn* 33 years, 95% CI [32, 37] years for PO; 39±7 years, 39 years, [36, 41] years for SDD; p=0.016) using the Kruskal-Wallis Test. Gender, marital status and race, were similar between departments (data not shown).

Caffeine Intake and Job Related Characteristics

Job-related characteristics assessed included shifts worked (8-10 hour night or day versus 12 hour night or day), length of time participating in current position and in shift work overall, how often the shift changed from day to night, perceived energy and concentration levels during shift work, caffeine side effects, overtime, and department. As illustrated in Table 7, mean caffeine intake was nearly twice as much for SDD versus PO for both DAY (p=0.001) and NIGHT (p=0.001). However, within each department, caffeine intake was similar between DAY and NIGHT (p=0.206 SD; p=0.258 PO). Those who worked more years of shift work (>10 years = "expert"; N= 29; Marsal, 2013) consumed more caffeine during NIGHT (p=0.029) regardless of department, as illustrated in Figure 1. Intake was similar based on years of shift work for DAY (p=0.077). In addition, caffeine intake was similar despite years worked at current job, overtime, how busy the current shift was, or the reported hours worked for that shift (data not shown).

Associative Relationship between Caffeine Intake, Perceived Concentration Level, Caffeine Side Effects and Tobacco Use

Associative relationships between caffeine intake and tobacco use, side effects from caffeine ingestion, and perceived level of concentration during shift work are reported in Table 8. Tobacco users consumed about 190 mg/d more caffeine for DAY and NIGHT as compared to those who did not use tobacco. Further, those who had caffeine side effects consumed about 130 mg/d more caffeine during NIGHT and 80 mg/d more during DAY as compared to those without side effects. As displayed in Figures 2 and 3, for both DAY and NIGHT the majority of participants who reported no caffeine side effects consumed less caffeine (between 0-200 mg) and a weak negative trend between caffeine intake and age was found; thus, as caffeine intake increased, age decreased. In contrast, among participants who did report caffeine side effects, caffeine intake was widely distributed and a weak positive correlation between caffeine intake and age was seen; thus, as caffeine intake increased, age also increased. Concentration level approached statistical significance for NIGHT only ($p=0.056$), with a greater mean caffeine intake observed for lower concentration. Intake was similar for DAY and NIGHT across reported energy levels (data not shown).

Discussion

Among a survey of law enforcement officers, the results of this study indicate that certain job-related factors influence caffeine consumption, including department (SDD versus PO), perceived concentration level and the number of years participating in shift work. Nearly double the intake of caffeine was found among SDD versus PO, regardless of shift. Whereas caffeine consumption and frequency of caffeine product use were similar between DAY and NIGHT, those who consumed more caffeine reported caffeine side effects, including headaches, stomach aches, heart palpitations, heart burn, and “jolt and crash” episodes.

These results suggest that habits play a large role in caffeine consumption regardless of shift. Regular caffeine use has been recognized as habit-forming and strongly addictive, as well as being associated with withdrawal symptoms (Smith, 1987; Olekalns & Bardsley, 1996). Tobacco use is also habit-forming (Stolerman & Jarvis, 1995), which may explain why many who use tobacco also consume more caffeine. Since the majority of participants consumed the same amount of caffeine and caffeine-containing products for DAY and NIGHT, availability does not seem to be a factor. All of the products assessed are readily available at convenience stores, grocery stores and fast food restaurants; many of these establishments are open 24-hours per day or have extended hours of operation.

Higher caffeine intake for NIGHT was associated with reported lower concentration level. Working night shifts disrupts the normal circadian rhythm (Van Reeth, 1998). Even after years of shift work, it has been reported that circadian rhythm does not adjust to working nighttime hours (Van Reeth, 1998). The wide use of caffeine to combat sleepiness and circadian disturbances (Roehrs & Roth, 2008) may explain why a greater caffeine intake was reported at night among those with lower concentration levels and for those who participated in shift work for more years. There may be other contributing factors that impact caffeine intake and the choice of products that contain caffeine that were not assessed in the current study, such as co-worker influence, stress of the job, down time, location of patrol work (i.e., in city limits versus rural areas), and availability of products within the workplace.

Previous studies have found that food choices and frequency of intake are influenced more by habit and time availability rather than by hunger (Waterhouse, Buckley, Edwards, & Reilly, 2003). Waterhouse and colleagues (2003) found a higher intake of snacks and lower intake of large hot meals among night workers compared to day workers. Multiple researchers have reported that total energy intake for shift workers does not differ despite the shift worked (Debry, et al, 1967; Reinberg, et al, 1979; Pasqua & Moreno, 2004; Lennernas, et al, 1994), which is consistent with our findings that caffeine consumption was similar between DAY and NIGHT. Lowden and colleagues (2010), however, found that eating behaviors are influenced by night shift work. Psychological disruptions in eating habits, including meal times of shift workers compared to culturally normal meal times, have been associated with increased snacking among night shift workers (Lowden, et al, 2010). Thus, further research should investigate timing of caffeine and caffeine-product intake among shift workers.

In contrast to the present study, Reeves and colleagues found that female night-shift workers consumed more cups of coffee and tea compared to female and male day-shift workers. These investigators also found that night workers smoked more cigarettes than day workers (Reeves, et al, 2004). Both caffeine and nicotine likely aid alertness and are habit-forming (Smith, 1987; Olekalns & Bardsley, 1996; Stolerman & Jarvis, 1995; Roehrs & Roth, 2008), which may explain why night shift workers consumed more of both. Similar to our findings, a strong relationship between tobacco use, namely cigarette smoking, and caffeine consumption has been reported (Friedman, et al, 1974; Dawber et al, 1974; Prineas, et al, 1980; Kannas, 1981; Thomas, 1973; Conway, et al, 1981). Roehrs and Roth (2008) reported that caffeine is a widely used substance among those with sleep deprivation, restriction, or circadian rhythm reversal to combat sleepiness because it enhances alertness and performance. The present study found that a lower reported concentration level was associated with greater caffeine intake at night, which may be explained by caffeine's ability to offset fatigue and restore performance. Weis and Laties (1962) concluded that caffeine restored numerous performance tasks while Smith (2002) further reported that caffeine improved attention and psychomotor functions as opposed to complex intellectual tasks.

Although age did not influence overall caffeine intake, it does seem to be a determinant toward chosen caffeine products. Our findings suggest that energy drinks are more popular among younger officers in their early-to-mid-twenties. Energy drinks have become a popular product in recent years, especially among teens and young adults (Torpy & Livingston, 2013; Rath, 2012; Hoffman, 2010). Energy drinks are considered the second most popular supplement, after multi-vitamins, among American adolescents and young adults. Caffeine is the primary active ingredient in energy drinks (Hoffman, 2010). In addition, many energy drinks combine caffeine with other stimulatory ingredients (Hoffman, 2010). Young adult males are the targeted market for energy drinks due to the reported ability of energy drinks to enhance performance, increase attention, and prolong endurance (Reissig, et al, 2008). These performance effects might be considered beneficial among young male shift workers.

A limitation of the current study was that intake of caffeine-containing products was self-reported. The researchers did not control the products consumed, and were not able to determine whether or not reported sizes were consistent with the sizes provided on the FFQ. It has been commonly found that self-reported food intake underestimates actual intake (Gibson, 2005). Similarly, participants may have underestimated the size of a product consumed. Although the FFQ included many caffeine-containing beverages and supplements, it is possible that more products were available. In addition, most of the participants were male, limiting the researchers to distinguish between sex differences with regard to caffeine intake.

Future research should compare the present study’s findings with other areas of shift work as well as other regions of the country and urban areas of residency. Future studies may better determine whether the length of time during a shift as well as how often one rotates from day to night shifts influences caffeine intake, since both participating departments in the present study worked 12-hour shifts and rotated from day to night in relatively the same amount of time (every three versus four weeks). Caffeine-containing products offered on the market today will change as new products become available and grow in popularity; therefore, it is important for future research to identify the variety of caffeine-containing products on the market. Energy drinks are one such product that continues to gain popularity for its perceived energy-boosting and performance-enhancing properties (Rath, 2012; Hoffman, 2010; Reissig, et al, 2008). Future research with a greater focus on energy drink consumption among shift workers is needed. Psychological aspects seem to play a significant role in determining food choices (Lowden, et al, 2010); however, there is a lack of research investigating the relationship between caffeine consumption and psychological factors among shift workers. Additional research aiming to explore this relationship is indicated to better understand caffeine intake among shift workers from a behavioral standpoint. Finally, there may be other factors that influence caffeine consumption among shift workers, such as number of children in the participants’ household and children’s ages, health status of the participant, and how the participant perceives caffeine with relation to health or nutritional value.

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Table 1. Mean caffeine content (mg) per serving of caffeine-containing products assessed on the food frequency questionnaire (FFQ) as reported by various sources.

Product	**Mean caffeine content**	**Serving size**
Coffee	148 mg	8 fl. oz.
Coffee drinks	138 mg	16 fl. oz.
Espresso	58 mg	1 fl. oz.
Caffeinated sodas	37 mg	12 fl. oz.
Energy drinks	64 mg	8 fl. oz.
Tea	38 mg	8 fl. oz.
Caffeinated water	45 mg	16.9 fl. oz. of Avitae regular
	90 mg	16.9 fl. oz. of Avitae 90
Energy shots	207 mg	2 fl. oz.

Note. Caffeine content not included for NoDoz, energy gum and energy strips; these were included on the FFQ, but were not used by participants. (Anonymous, 2011; Center for Science in the Public Interest, 2011; Chin, et al., 2008; Chou, et al., 2007; McCusker, et al., 2003; McCusker, et al., 2006; Avitae Caffeinated Water, 2012)

Table 2. Age and job-related characteristics of Police and Sheriff officers (N=75)

Characteristic	*M (±SD)*	*Mdn*	95% CI
Age (years)	36 (±8.0)	36	[34.3, 38.0]
Years at current job	6 (±4.8)	5	[5.0, 7.2]
Years shift work	10 (±6.6)	9	[8.3, 11.3]
Overtime (days)	2 (±1.7)	1	[1.1, 1.9]

Note. *M* = mean; *SD = standard deviation; Mdn* = median; CI = confidence interval.

Table 3. Demographic characteristics of Police and Sheriff officers (N=75)

Characteristic	Total (n)	Distribution (%)
Sex		
Male	66	88
Female	8	11
Missing	1	1
Marital status		
Single	13	17
Married	56	75
Divorced	4	5
Missing	2	3
Race		
Non-Hispanic White	59	79
Asian American	1	1
Hispanic/Latino	3	4
African American	9	12
Other	1	1
Missing	2	3
Shift change		
Each three weeks (Police)	44	59
Each four weeks (Sheriff)	29	38
Missing	2	3

Division		
Patrol	73	98
Sheriff	1	1
Missing	1	1
Tobacco use		
Yes	20	27
No	54	72
Missing	1	1

Table 4. Number of days or nights during a 3-day shift that caffeine-containing products were consumed among Police and Sheriff officers as reported by food frequency questionnaire (FFQ) (n = 64)

	3-day shift period						
	Number of days			Number of nights			
	M (+SD)	*Mdn*	95% CI	*M (+SD)*	*Mdn*	95% CI	P-value
Product							
Coffee	1.2 (+1.4)	0.0	[0.8, 1.5]	1.2 (+1.4)	0.0	[0.8, 1.5]	0.904
Coffee drinks	0.1 (+0.3)	0.0	[0.0, 0.1]	0.1 (+0.2)	0.0	[0.0, 0.1]	0.655
Espresso	0.1 (+0.3)	0.0	[0.0, 0.1]	0.1 (+0.4)	0.0	[0.0, 0.2]	0.414
Soda	1.4 (+1.3)	1.0	[1.0, 1.7]	1.3 (+1.4)	1.0	[1.0, 1.7]	0.623
Energy drinks	0.2 (+0.6)	0.0	[0.0, 0.3]	0.2 (+0.7)	0.0	[0.0, 0.4]	0.180
Tea	0.8 (+1.2)	0.0	[0.5, 1.1]	0.7 (+1.0)	0.0	[0.4, 0.9]	0.110
Water	0.1 (+0.5)	0.0	[0.0, 0.2]	0.1 (+0.3)	0.0	[0.0, 0.1]	0.655
Energy shots	0.1 (+0.3)	0.0	[0.0, 0.1]	0.0 (+0.2)	0.0	[0.0, 0.1]	0.414

Note. *M* = mean; *SD = standard deviation; Mdn* = median; CI = confidence interval. The *sample size* accounts for elimination of participants who completed less than three FFQs for DAY or NIGHT. The Wilcoxon Signed Rank Test was used to determine the p-values.

Table 5. Mean caffeine-containing product frequency during day and night shifts among Police and Sheriff officers as reported by food frequency questionnaire (FFQ) (n = 64)

	Frequency per 3-day shift period						
	Day			Night			
	M (±SD)	*Mdn*	95% CI	*M (±SD)*	*Mdn*	95% CI	P-value
Product							
Coffee	0.6 (±0.9)	0.0	[0.4, 0.8]	0.6 (±0.8)	0.0	[0.4, 0.8]	0.974
Coffee drinks	0.0 (±0.2)	0.0	[0.0, 0.1]	0.0 (±0.1)	0.0	[0.0, 0.1]	0.705
Espresso	0.0 (±0.1)	0.0	[0.0, 0.1]	0.0 (±0.1)	0.0	[0.0, 0.1]	0.414
Soda	0.9 (±1.5)	0.3	[0.6, 1.3]	1.0 (±1.7)	0.3	[0.6, 1.4]	0.585
Energy drinks	0.1 (±0.2)	0.0	[0.0, 0.1]	0.1 (±0.2)	0.0	[0.0, 0.1]	0.317
Tea	0.4 (±0.7)	0.0	[0.2, 0.6]	0.3 (±0.7)	0.0	[0.2, 0.5]	0.032
Water	0.0 (±0.3)	0.0	[0.0, 0.1]	0.0 (±0.1)	0.0	[0.0, 0.0]	0.655
Energy shots	0.0 (±0.1)	0.0	[0.0, 0.0]	0.0 (±0.1)	0.0	[0.0, 0.0]	0.414

Note. *M* = mean; *SD = standard deviation; Mdn* = median; CI = confidence interval. The *sample size* accounts for elimination of participants who completed less than three FFQs for DAY or NIGHT. The Wilcoxon Signed Rank Test was used to determine the p-values.

Table 6. Mean distribution of ages for energy drink consumption during day and night shifts (N=75)

		Age (years)							
		Day				Night			
	N	*M (+SD)*	*Mdn*	95% CI	P-value	*M (+SD)*	*Mdn*	95% CI	P-value
Mean number of energy drinks									
0.00	67	36.7 (+7.8)	36.0	[34.8, 38.6]		37.0 (+7.8)	37.0	[35.1, 38.9]	
0.33	4	39.0 (+1.4)	39.0	[26.3, 51.7]	0.03	32.3 (+6.9)	32.0	[21.2, 43.3]	0.003
1.00	4	24.3 (+1.5)	24.0	[20.5, 28.1]		25.0 (+1.8)	25.0	[22.1, 27.9]	

Note. *M* = mean; *SD = standard deviation; Mdn* = median; CI = confidence interval. Spearman's Correlation was used to determine the p-values.

Table 7. Caffeine intake between Police and Sheriff departments for 3-day period of day and night shifts as reported by food frequency questionnaire (FFQ) (N=75)

	Mean daily caffeine intake for 3-day shift (mg/d)							
	Day				Night			
	M (±SD)	*Mdn*	95% CI	P-value	*M (±SD)*	*Mdn*	95% CI	P-value
Department								
Police	176 (±62)	135	126, 225	0.001	184 (±184)	137	128, 240	0.001
Sheriff	381 (±259)	319	282, 479		361 (±260)	341	262, 460	

Note. *M* = mean; *SDI = standard deviation; Mdn* = median; CI = confidence interval. The Kruskal-Wallis Test was used to determine the p-values.

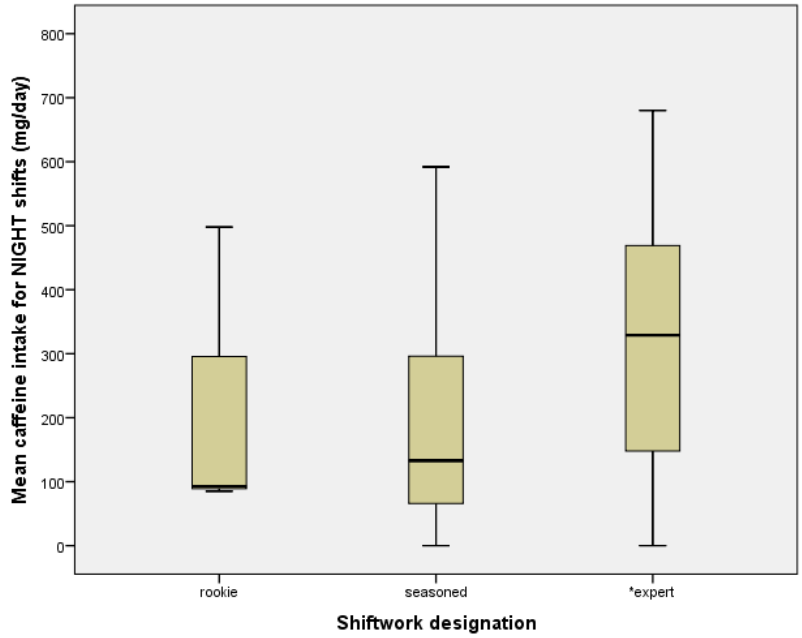
Table 8. Associative relationships between caffeine intake and tobacco use, caffeine side effects, and perceived concentration level among Police and Sheriff officers (N=75)

		Caffeine intake (mg/day)							
		Day				Night			
	N	*M (+SD)*	*Mdn*	95% CI	P-value	*M (+SD)*	*Mdn*	95% CI	P-value
Characteristic									
Tobacco									
Use	20	397 (+198)	338	304, 489	0.000	388 (+227)	353	282, 494	0.001
Do not use	54	208 (+217)	139	149, 267		206 (+214)	137	147, 264	
Caffeine side effects									
Yes	17	318 (+161)	319	235, 401	0.024	352 (+209)	305	245, 460	0.009
No	58	239 (+240)	139	176, 302		223 (+230)	141	163, 284	
Perceived concentration level									
3	3	300 (+260)	169	-346, 945		426 (+467)	173	-733, 1586	
4	35	293 (+224)	261	216, 370		301 (+239)	283	219, 383	
5	18	226 (+233)	136	110, 342	0.160	202 (+196)	126	105, 300	0.055*
6	12	275 (+252)	218	115, 434		235 (+198)	183	109, 361	
7	4	133 (+143)	114	-94, 360		124 (+148)	100	-122, 360	

Note. *M* = mean; *SD = standard deviation; Mdn* = median; CI = confidence interval. Side effects from caffeine ingestion included headaches, jolt and crash episodes, heart palpitations, stomach ache and heart burn (Malinauskas, et al, 2007); a 7-point Likert scale was used to evaluate perceived concentration level (1 = extremely low concentration, 4 = normal level of concentration, 7 = extremely high level concentration) (Laerhoven, et al, 2004). Spearman's correlation, the Kruskal-Wallis test and Mann-Whitney U Test were used to determine the p-values.

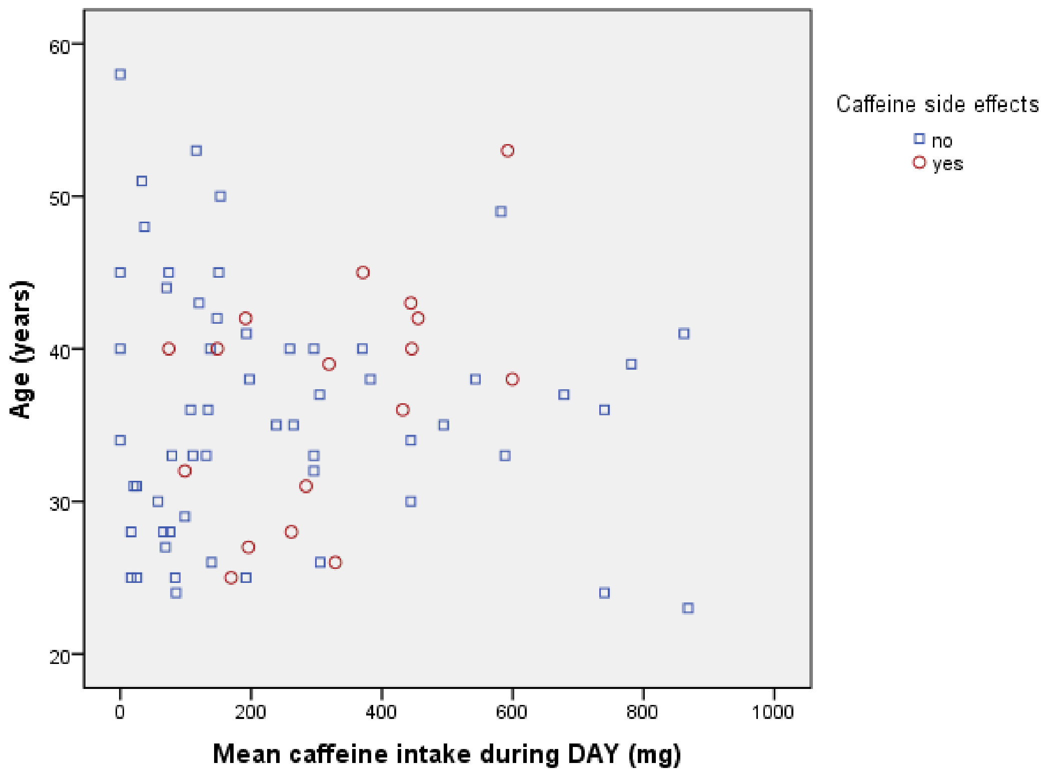
*For perceived concentration level and caffeine intake during night, using Spearman's Correlation, p=0.055, using Pearson Correlation, p=0.047, and using the Kruskal-Wallis Test, p=0.283. Spearman's Correlation was kept due to data was not normally distributed.

Figure 1. Caffeine intake during a 3-night shift period among “rookie,” “seasoned,” and “expert” Police and Sheriff officers (N=75)



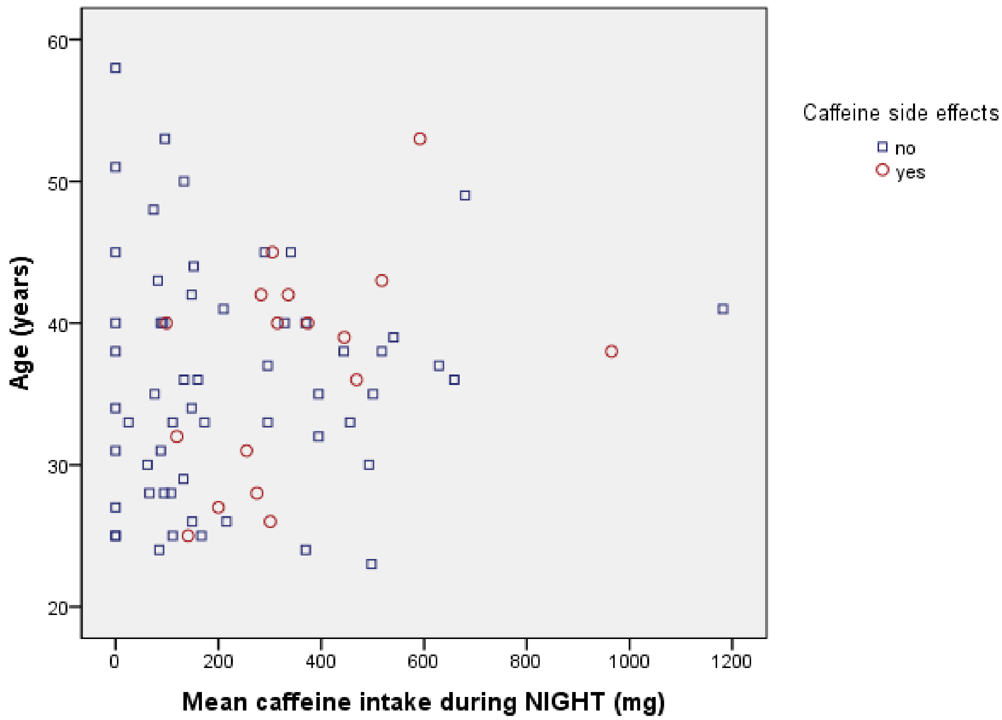
Note. Rookie: < 1 year service (N=3); seasoned: 1-10 years (N=41); expert: > 10 years (N=29); (J. Marsal, personal communication, April 16, 2013). *p=0.029. The Kruskal-Wallis Test was used to determine the p-value.

Figure 2. Association of age and caffeine intake for those with caffeine side effects vs. those without side effects for day shifts among Police and Sheriff officers (n=75)



Note. Mean caffeine intake from food frequency record for three day shifts.

Figure 3. Association of age and caffeine intake for those with caffeine side effects vs. those without side effects for night shifts among Police and Sheriff officers (n=75)



Note. Mean caffeine intake from food frequency record for three night shifts.

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APPENDIX A

IRB APPROVAL LETTER

Notification of Exempt Certification

From: Social/Behavioral IRB
To: Maddison Greaves
CC: Brenda Bertrand
Date: 2/16/2012
Re: UMCIRB 11-001291
Caffeine Intake among Shift Workers

I am pleased to inform you that your research submission has been certified as exempt on 2/15/2012. This study is eligible for Exempt Certification under category #2.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The UMCIRB office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption Certification request at least 30 days before the end of the five year period.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B

PERMISSION LETTERS

Statement of Informed Consent

Included in this packet:

- 6 Caffeine Surveys:
  - Complete 3 while on three separate day shifts (yellow paper).
  - Complete 3 while on three separate night shifts (blue paper).
- 1 Demographic Survey (pink paper)
- 1 Drink size reference sheet

Please complete all six caffeine surveys and demographic survey within **four weeks** of receiving this packet.

This survey is **anonymous**, so please do not write your name. Your participation in this research is **voluntary**. You may choose not to answer any or all questions, and you may stop at any time. There is **no penalty for not taking part in or withdrawing** from this research study at any point. If you have any questions please feel free to contact me, Maddie Greaves, at 619-980-3355, or the Office for Human Research Integrity (OHRI) at 252-744-2914 for questions about your rights as a research participant.

This is acknowledging that the Greenville Police Department has agreed to participate in the research study, Caffeine Consumption among Shift Workers, being conducted by Maddison Greaves, graduate student at East Carolina University.

J A Bartlett
Signature

2/7/12
Date

J. A. Bartlett
Print name

Interim Chief of Police
Title

This is acknowledging that the Pitt County Sheriff Department has agreed to participate in the research study, Caffeine Consumption among Shift Workers, being conducted by Maddison Greaves, graduate student at East Carolina University.

Neil Elks
Signature

2/13/12
Date

Neil Elks
Print name

Sheriff
Title

APPENDIX C

CAFFEINE FOOD FREQUENCY QUESTIONNAIRE

Caffeine Survey Date: ___________

Which shift did you just work?	How many regular work hours did you log this shift?	Tell me how busy this shift was:
☐ 8-10 hour day ☐ 12 hour day ☐ 8-10 hour night ☐ 12 hour night	_______ hours	☐ Not busy ☐ Slightly busier than normal ☐ Light workload ☐ Very busy ☐ Normal workload

Check all you had this shift.	What's your size and amount? (For each drink checked, indicate the size(s) and how many you had.)		
Drinks (all flavors, regular or diet, not decaffeinated)		**Your Size**	**How many?**
☐ Coffee	Regular coffee mug = 8oz	X-small (8oz) Small (12oz) Medium (16oz) Large (20oz) X-large (24oz)	O ____ O ____ O ____ O ____ O ____
☐ Coffee drinks (Frappuccinos, etc.)	Starbuck's "Tall" = 12oz	X-small (9.5oz) Small (12oz) Medium (16oz) Large (20oz) X-large (24oz)	O ____ O ____ O ____ O ____ O ____
☐ Espresso (Latte, mocha, espresso shot, etc.)	Small mocha = 1 shot	Small (1 shot) Medium (2 shots) Large (3 shots)	O ____ O ____ O ____
☐ Caffeinated sodas (colas, root beer, Mountain dew)	Regular can soda = 12oz	X-small (12oz) Small (16oz) Medium (20oz) Large (24oz) X-large (32oz)	O ____ O ____ O ____ O ____ O ____
☐ Energy drinks (Red Bull, Rockstar, Monster Starbucks Double Shot, etc.)	Regular can Red Bull = 8oz	Small (8oz) Medium (12oz) Large (16oz) X-large (24oz)	O ____ O ____ O ____ O ____
☐ Tea (Green, black, sweet tea)	Small McDonald's sweet tea = 16oz	X-small (12oz) Small (16oz) Medium (21oz) Large (32oz)	O ____ O ____ O ____ O ____
☐ Caffeinated water (Avitae)	1 bottle = 16.9oz	Avitae (16.9oz) Avitae 90 (16.9oz)	O ____ O ____
Energy Boosting Supplements (all flavors, regular or diet, not decaffeinated)		**Standard Serving Size**	**How many?**
☐ Energy shots (5-hour Energy, 6 Hour Power, etc.)		1 bottle	____
☐ Caffeine supplements (NoDoz)		1 capsule	____
☐ Energy chewing gum (Jolt Caffeine Energy Gum)		2 pieces	____
☐ Sheets Energy Strips		2 strips	____

APPENDIX D

DEMOGRAPHIC AND CAFFEINE EFFECTS QUESTIONNAIRE

Demographic Survey

1. <u>In the past two weeks</u>, which shifts did you work (mark all that apply), **& how many of each shift did you work?**

<u>Shift</u>	<u>How many</u>
☐ 8-10 hour night	______
☐ 8-10 hour day	______
☐ 12 hour night	______
☐ 12 hour day	______

2. How long have you been at your current position?

____

3. How many years have you participated in shift work?

____

4. How often do you switch from one shift to another? (Example: every 4 weeks.)

____

5. For each statement listed below, circle the number that best represents how you feel.

	Extremely low		→	Normal		→	Extremely high
What is your energy level when participating in shift work?	1	2	3	4	5	6	7
What is your concentration level while participating in shift work?	1	2	3	4	5	6	7

6. <u>In the past two weeks</u>, did you experience any of the following side effects related to caffeine intake? (Mark all that apply.)

- ☐ Headaches
- ☐ "Jolt and crash" episodes
- ☐ Heart palpitations
- ☐ Stomach ache
- ☐ Heart burn
- ☐ Don't have any of the side effects listed.

7. <u>In the past two weeks</u>, how many days did you work overtime?

______ days

8. What is your department / division?

- ☐ Patrol
- ☐ Investigation
- ☐ Sheriff's
- ☐ Dispatch

9. Do you currently use tobacco?

- ☐ Yes
- ☐ No

10. Age:

_______ years

11. Gender:

- ☐ Male
- ☐ Female

12. Marital Status:

- ☐ Single
- ☐ Married
- ☐ Divorced
- ☐ Widowed

13. Race:

- ☐ Non-Hispanic White
- ☐ Asian American
- ☐ Hispanic or Latino
- ☐ Black or African American
- ☐ American Indian or Alaskan Native
- ☐ Hawaiian or other Pacific Islander
- ☐ Other. Specify: _______________

APPENDIX E

SERVING SIZE REFERENCE SHEET

Drink Sizes

Drink	Sizes & Examples
Coffee	X-small (8oz)..................Small coffee mug; Starbucks *short* Small (12oz)...................Starbucks *tall*; Sheetz small Medium (16oz)...............Starbucks *grande*; Sheetz medium; regular size travel mug Large (20oz)...................Starbucks *venti*; Sheetz large X-large (24oz)...............Sheetz X-large
Coffee drinks	X-small (9.5oz)..............Bottled Starbucks Frappuccino Small (12oz)...................Starbucks *tall*; Sheetz small Medium (16oz)...............Starbucks *grande*; Sheetz medium Large (20oz)...................Starbucks *venti*; Sheetz large X-large (24oz)...............Sheetz X-large
Espresso / Espresso drinks	Small (1oz)......................1 shot espresso; small/medium latte Medium (2oz)................2 shots espresso; large latte Large (3oz)......................3 shots espresso; large latte with added shot espresso
Sodas	X-small (12oz)...............Regular soda can Small (16oz)...................16oz soda bottle; McDonald's/ Bojangles small Medium (20oz)..............McDonald's medium; Bojangles regular Large (24oz)...................24oz bottle X-large (32oz)...............McDonald's/ Bojangles large
Energy drinks	Small (8oz)......................Smallest can Red Bull, Rockstar, & Monster Energy Medium (12oz)..............Medium size can Red Bull Large (16oz)...................Largest can Red Bull; medium can Rockstar & Monster Energy X-large (24oz)...............Largest can Rockstar & Monster Energy
Tea	X-small (12oz)...............McDonald's *child* size tea Small (16oz)...................McDonald's & Bojangles small tea Medium (21oz)..............McDonald's medium tea; Bojangles regular tea Large (32oz)...................McDonald's & Bojangles large tea

Miscellaneous examples:

Small coffee mug = 8-10 oz
Larger coffee mugs = 16-20 oz
Standard travel mug/tumbler = 16oz
Sheetz and other gas station cup sizes = 12oz, 16oz, 20oz, 24oz
***Big gulp* or large soda/tea from McDonald's or Bojangles**= 32oz
Starbucks cup sizes = *short* 8oz, *tall* 12oz, *grande* 16oz, *venti* 20oz, *venti iced* 24oz

Use the image below to gage the size drink you had. This is