IMPACT OF CAFFEINE AND SLEEP ON CALORIC INTAKE OF UNDERGRADUATE STUDENTS

by

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Abstract

This study sought to more clearly define the relationships between caffeine consumption, energy intake, and sleep quality while assessing for variables that may alter caloric intake, including: BMI, physical activity, eating meals with others, and stress. *Sample:* The data derived from 70 undergraduate students was used in the present study. Of these, 53 were female, 94% were of Caucasian race, and 65.7% were upperclassmen. *Procedures:* The caffeine intake (mg), energy consumption (kcals), and sleep quality of undergraduate students of Ashland Univeristy, a small, private, Christian-founded university located in the Midwestern United States, was assessed through a one-time completion of a researcher-generated questionnaire. These materials were distributed from Tuesday to Friday in the academic buildings of the university. *Materials:* The questionnaire contained a 24-hour dietary recall, Caffeine Assessment Questionnaire, and the Pittsburgh Sleep Quality Index (PSQI), along with a survey to assess population demographics, anthropometrics and the use of caffeine-containing over-the-counter (OTC) drugs. *Results:* The average participant consumed 51.6 $\pm$ 59.2 mg of caffeine from food and drink alone (FDC) and 25.7 $\pm$ 62.5 mg of caffeine from medication (MC) a day, with an average of 77.3 $\pm$ 89.1 mg of total caffeine a day. In addition, students consumed a daily average of 1,610 $\pm$ 746.2 kcals, comprised of 202.4 $\pm$ 92.5 grams (g) of carbohydrate, 63.3 $\pm$ 32.9 g of protein, and 61.6 $\pm$ 37.1 g of lipid. Total caffeine intake was positively associated with energy intake (p=0.05), but FDC and MC were not, indicating that a threshold for caffeine's alteration effect on eating behaviors may exist. Fat intake was also positively associated with total caffeine intake (p=0.023), indicating that fatty foods may be the greatest contributor to an individual's increased energy intake as a result of caffeine consumption. Lastly, a larger number of meals eaten with others was associated with an increased consumption of calories along with all macronutrients (calories: p=0.008; protein: p=0.022; carbohydrate: p=0.019; lipid: p=0.023). No significance was

exhibited between any dietary factors and sleep quality. MC and sleep quality were inversely correlated (p=0.02), but this may not be due to caffeine, but rather the presence of illness in which the caffeine-containing medications were administered as treatment. These findings suggest that increased attention should be given to the validation of a tool used to accurately assess caffeine intake in the undergraduate population. Development of such could test the hypothesis of a threshold level effect of caffeine on eating behaviors and quantify an amount if supported. In addition, tactics to improve mindfulness while eating should be encouraged among undergraduate students. Lastly, sleep quality does not seem to have an effect on the dietary choices of undergraduate college students.

Impact of Caffeine and Sleep on Caloric Intake of Undergraduate Students

Hypotheses

The main hypothesis of this research was that a greater consumption of caffeine (mg) will result in fewer Calories (kcals) consumed (Tremblay et al., 1988). However, this was refuted as the present study exhibited a significant positive correlation between kcal intake and total caffeine consumption (p=0.05). It was also hypothesized that females will consume a greater amount of caffeine from food and drink products (FDC) than males (Mahoney et al., 2018) and a greater amount of kcals would be consumed by males than females (Hand at al., 2013). In the present study, however, males consumed significantly more caffeine from food and drink sources than females (p=0.01) while also consuming a significantly greater amount of kcals (p=0.013). Other research points to the hypothesis that macronutrient intake will be impacted by the intake of caffeine so that carbohydrate, protein, and lipid intake will all decrease (Tremblay et al., 1988). However, the present research rejected all three of these hypotheses as no significant impact on carbohydrate or protein intake was shown while a significantly positive correlation was exhibited between lipid intake and total caffeine consumption (p=0.023).

Studies show a negatively correlated relationship between total caloric intake and sleep quality (Spiegel et al., 2004), but the present study found no significant relationship between the two factors. Other research shows a significant impact of caffeine consumption on sleep quality, such that greater caffeine consumption results in a poorer score on the Pittsburgh Sleep Quality Index (PSQI) (Watson et al., 2016). No statistical significance was seen between PSQI scores and total caffeine or caffeine from food or drink alone. However, data analysis resulted in a significant correlation between increased caffeine from medication and poorer sleep quality (p=0.02).

Body mass index (BMI) also played a role in this research. It was hypothesized that a greater BMI would be associated with poorer sleep quality (Vargas at al., 2014) as well as reduced carbohydrate intake (Merchant et al., 2009) and caffeine consumption (Greenberg et al., 2005). This study accepted that BMI is associated with poorer sleep quality (p=0.039), but rejected the association of a greater BMI with reduced intake of total caffeine, as the opposite was shown (p=0.002). Results also showed that greater BMI was associated with greater carbohydrate intake (p=0.014), rejecting the earlier hypothesis.

Lastly, it was hypothesized that physical activity and the number of meals eaten with others would have a significant impact on caloric intake, such that physical activity would decrease Calories consumed (King et al., 2011) and meals eaten with others would increase the amount of Calories consumed, along with an increase in carbohydrate and fat consumption (Hetherington et al., 2006). No significant association was seen between physical activity and caloric intake in any direction, while the number of meals eaten with others increased intake of kcals, carbohydrate, fat, and protein (p=0.008, p=0.019, p=0.023, p=0.022, respectively).

Methods

Participants

Individuals were eligible to participate in the present study if they were an undergraduate student (Norton et al., 2011) at Ashland University (AU) and were at least 18 years of age. This criterion resulted in an initial sample of n=78. However, questionnaires from four subjects were returned incomplete and another individual proved to be graduate student, leading to exclusion from the sample. Participants were also excluded if they reported consuming less than 500 kcals/day or more than 5,000 kcals/day (Frankenfeld et al., 2012), excluding 3 additional

participants and leaving the final population size for the present study at n=70 (53 females; 94% Caucasian; 65.7% upperclassmen; height (mean ± standard deviation), 66.3 ± 3.9 in.; weight, 167.0 ± 50.3 lbs.; body mass index (BMI), 26.6 ± 6.9 kg m^{-2}).

Materials

The present research used three separate validated tools in order to quantify and assess caffeine, caloric and macronutrient intake along with sleep quality. A Caffeine Intake Assessment (Bühler et al., 2013), a researcher-generated 24-hour dietary recall (Frankenfeld et al., 2012), and the Pittsburgh Sleep Quality Index (Buysse et al., 1989) were used to quantify subject data in this research. These tools were combined into a single questionnaire that included a researcher-generated short survey to assess the participants' demographics and anthropometrics. This questionnaire allowed for the amount of energy (kcals) and caffeine (mg) consumed by an individual to be quantified while also accounting for variables that could independently influence the amount of food and drink consumed. These variables include: sleep quality (Spiegel et al., 2004), gender (Hand et al., 2013), tobacco use (Romero et al., 2018), BMI, stress (Oliver et al., 1999; Pettit et al., 2011), physical activity (King et al., 2011), the desire to lose weight (Kruger et al., 2004), and consumption of meals in the presence of others (Hetherington et al., 2006). In addition, this questionnaire included a list of over-the-counter (OTC) caffeine-containing medications (Carrillo & Benitez, 2000) and asked participants to indicate the amount they had taken the previous day, if any. This list of medications was derived from the website of the Cleveland Clinic, with the caffeine amounts listed on this site used to assess total caffeine consumption. A copy of the full questionnaire is available in Appendix A, in which this question and others can be viewed. ESHA's Food Processor® Nutrition Analysis

software was used to analyze daily dietary consumption and IBM'S Statistical Package for Social Sciences (SPSS) program was used to analyze the resulting data and its exhibited relationships.

Procedures

All participants provided written, informed consent. After providing this consent, participants were asked to complete the questionnaire explained above. The surveying process used a convenience sample and was conducted in a pen and paper format, taking place in various communal locations throughout the academic buildings of Ashland University. Surveys were administered Tuesday-Friday during normal classroom hours (Ruopeng, 2016), and each questionnaire was completed once by each participant. There was no further contact explored beyond the point of survey completion except with the single winner of the gift card raffle used to incentivize participation. The experimental design was approved by the Ashland University Human Subjects Review Board.

Results

Participants of this research study had a mean PSQI score of 6.2 $\pm$ 2.5 with a mean sleep duration of 6.9 hours $\pm$ 1.1. In addition, participants exhibited a BMI of 26.6 $\pm$ 7.0, with a mean of 26.4 for females and 27.3 for males, exhibiting that the average undergraduate student attending this university is overweight. The average participant consumed 51.6 $\pm$ 59.2 mg of caffeine from food and drink alone and 25.7 $\pm$ 62.5 mg of caffeine from medication a day, with an average daily total caffeine intake (from food, drink, and medication) of 77.3 $\pm$ 89.1 mg. In addition, students consumed a daily average of 1,610 $\pm$ 746.2 kcals, comprised of 202.4 $\pm$ 92.5

grams (g) of carbohydrate, 63.3 ± 32.9 g of protein, and 61.6 ± 37.1 g of lipid. The average self-reported stress score was 4.8 (out of 7) with a standard deviation (SD) of 1.3.

Total caloric intake was significantly tied to the number of meals eaten with others (p=0.008, correlation of 0.318); BMI (p=0.012, correlation of 0.299); and gender (p=0.013), with males consuming greater amounts of kcals than females. A significantly positive correlation (p=0.05) was also found between caloric intake and total caffeine consumption. This positive correlation remained when controlled for gender (p=0.022), meals eaten with others (p=0.05), PSQI score (p=0.023), and race (p=0.039). This is a probable result of a significant increase in fat intake as total caffeine intake increased (p=0.023). No significant correlation was found between caloric intake and caffeine from medication (MC) or caffeine from food and drink sources (FDC). No significance was found between caloric intake and physical activity, PSQI score, PSQI category, sleep duration, sleep latency, number of meals eaten in the school cafeteria, the following of a specific diet, tobacco usage, stress, or the desire to lose weight. Eating meals with others was the largest variable tied to caloric intake, and was additionally resulting in a significant increase in consumption of all macronutrients (protein: p=0.022; carbohydrate: p=0.019; lipid: p=0.023). Additionally, an increase in carbohydrate intake was significantly correlated to an increase in BMI (p=0.014), despite hypothesizing differently.

Contrary to this study's hypotheses, male students consumed significantly more caffeine from food and drink than females (p=0.01). Total caffeine and MC were both positively correlated to BMI (p=0.002 and p=0.004, respectively), but FDC was not. In addition, significantly higher total caffeine and MC intake was seen on non-typical days (p=0.007 and $p<0.01$, respectively).

PSQI score and gender were not tied significantly, nor was PSQI score significantly correlated to total caffeine consumption or FDC, despite this study's hypotheses. However, PSQI score and MC were significantly correlated (p=0.02), so that a higher PSQI (indicating poorer sleep quality) was associated with greater MC. This difference could be tied to sleep latency, as a longer sleep latency period was significantly correlated to increased MC (p=0.023, correlation of 0.271) and not significantly tied to total caffeine or FDC. PSQI was also positively correlated to self-reported stress (p=0.001), indicating that poorer sleep quality and a increase in stress and were coupled together. This is most likely due to a difference in sleep duration, as a significant correlation (p=0.028) was seen between an increase in stress and a decrease in sleep duration. Lastly, PSQI score was also significantly correlated to BMI (p=0.039), in that a higher BMI was accompanied by poorer sleep quality.

Discussion

An increase in total caffeine consumption was attributed to an increase in total kcals consumed and remained significant when controlling for gender and the number of meals consumed with others. These results indicate that the largest variables related to caloric intake and caffeine consumption in this study did not have an effect on the significance of the positive correlation, despite literature oppositions. A study conducted by Schubert et al. compared differences in gastric emptying and appetite between groups consuming caffeinated and decaffeinated coffee, and found no significant differences in energy intake between the two groups (2014). A positive correlation was also found between kcals consumed and both FDC and MC, though they were not significant. This suggests that a threshold may exist for daily caffeine consumption, in which the alteration of eating behaviors begins once that measure has

been passed. While the research presented in the current article is highly observational in nature, the researchers behind the forespoken research were able to assess for biochemical markers related to hormonal regulation. This aspect of the study is a definitive strength over the present research, but the design of Schubert et al.'s work did not allow for a wide range of caffeine consumption, thus possibly prohibiting them from discovering a threshold level effect. In addition, the positive correlation between total caffeine consumption and fat intake indicates that the stimulated appetite may be accompanied with an increased affinity for fatty foods, thus resulting in altered caloric and macronutrient intakes. This correlation may also put caffeine consumers at a greater risk for cardiovascular disease if addition fat sources are those containing saturated fatty acids, rather than unsaturated or polyunsaturated fatty acids, though this was not directly assessed.

Total caffeine consumption and MC were positively correlated to BMI, but FDC was not. This may be due to an increase in illness in those with a higher BMI (Martí et al., 2000), in which caffeine-containing medications are used as treatment. This is entirely possible as previous research has linked both poor sleep (Bollinger et al., 2010) and higher BMI (Martí et al., 2000) to decreased immunity. MC (associated with illness) was also found to have a significant positive correlation to sleep latency (p=0.023), which makes up a portion of the PSQI scoring system and results in an inverse relationship to sleep quality (p=0.02). Because the present study also coupled BMI with poorer sleep quality, a semi-cyclical relationship between BMI, sleep quality, and immune function can be proposed. These findings suggest that a decrease in sleep quality may result in a subsequent decrease in immune function and an increase in BMI, or that any one of these factors may implicitly effect another. In addition, Spiegel et al. concluded that a restriction in sleep is associated with increased carbohydrate intake (2004), with

the present research supporting the relationship between higher BMI and greater consumption of carbohydrates, thus adding a piece to the puzzle. This association was not significant for protein intake nor lipid consumption, so it can be hypothesized that an increase in BMI is typically maintained and/or gained through the consumption of a greater amount of carbohydrate-containing foods in this population. In addition, physical activity did not play a significant role in caloric intake of the population involved, but this may be due to the lack of care given by the researcher to differentiate between chronic and acute physical activity (Horner et al., 2011; Goto et al., 2013).

No significant associations were present between any aspect of dietary intake and an individual's PSQI score, including carbohydrates and kcals. Though this study hypothesized that sleep quality and caloric intake would be inversely related (Spiegel et al., 2004), this result was not seen. This hypothesis, however, is under scrutiny as other research has found the relationship between sleep quality and caloric intake to be positive (Halson, 2014). However, the results of the current study remain non-significant in either direction. Carbohydrate intake also proved to have no significance with sleep in the current study, though Lindseth et al. found promising relationships between the two (2013). This may be due to a difference in meal timing, as the current study did not consider timing of meals and differing compositions thereof of any particular importance, and therefore failed to consider them as a variable to be assessed.

Self-reported stress played a part in individual PSQI scores, as a larger amount of stress was associated with decreased sleep duration and poorer sleep quality (p=0.028; p=0.001). These results are not all that surprising as previous research has also linked poor sleep to increased stress (Jehan et al., 2017). The results of this study indicate that the average undergraduate student at Ashland University has a moderate amount of stress and sleep of good

quality, though sleep duration falls below the recommendation of 8 hours. Mathematically, this higher quality sleep can still be obtained if all other components are of high quality, such as: short sleep latency, few sleep disturbances, and students subjectively ranking their sleep as of good quality. What students lack in quantity of sleep, they may make up for in quality.

Based on the measurements provided by the Caffeine Intake Assessment tool (Bühler et al., 2013), it can be understood that students of Ashland University consume a wide range of caffeine each day, with none particularly at risk for caffeine overconsumption or adverse caffeine toxicity effects (Nawrot et al., 2003). On the other hand, this widespread consumption may put undergraduate students at greater risk for all potential effects of caffeine usage, including: cardiac arrhythmia, temporarily high blood pressure, and feelings of anxiety (Nawrot et al., 2003). Because this population is largely considered to experience higher levels of stress and anxiety (Iqbal et al., 2015), it may become increasingly important for some individuals to find alternative behaviors to habitual caffeine consumption.

The average BMI of both male and female undergraduate students of this university fall into the range considered to be overweight. Though BMI fails to account for lean body mass (LBM), the majority of this population reported engaging in physical activity for 30 minutes or less, allowing for the interpretation that most additional weight is due to an increase in adipose tissue rather than that of muscle or bone (Hérvas et al., 2018). Additionally, this average BMI is higher than other studies (Burnette et al., 2018), indicated a potential difference in habit and/or culture of Ashland University students as compared to other universities. Based on the research of Panek-Shirley et al., it was originally hypothesized that this difference may be caused by the dining options available on AU's campus (2018), where the main cafeteria is buffet-style and boasts in its award-winning services. However, a significant relationship was found between the

consumption of meals in the school cafeteria and BMI (p=0.003), such that students consuming meals the cafeteria center had a consistently lower BMI, therefore rejecting this thought. At the same time, consuming meals with others showed an increase in caloric intake (p=0.008) as well as intake of all macronutrients (p=0.019, carbohydrates; p=0.022, protein; p=0.023), indicating that social interaction during meals could be the main contributor to the increase of BMI rather than the dietary options itself. The consumption of meals in the presence of others was the strongest variable attributed to caloric intake in this study and is of increased interest. The findings associated with social meals could be due to decreased mindfulness and/or increased distraction while eating (Hetherington et al., 2006). This hypothesis points towards the importance of mindful eating habits and their potential effect upon adiposity and BMI. Lastly, Gavrieli et al. found that significant differences in energy intake as a result of caffeine intervention were more pronounced in the overweight and obese populations, suggesting that the results of the present study could be swayed by an over-inclusion of overweight and obese individuals (2013).

Conclusion

In opposition to previous research (Belza et al., 2009; Tremblay et al., 1988), greater total caffeine consumption was associated with an increase in caloric intake. However, this association did not remain significant when testing for MC and FDC alone, indicating that a threshold of caffeine consumption may exist in which passing of this measure results in altered appetite regulation and fatty food cravings. In order to combat the prevalence of obesity and overweight individuals in the undergraduate population, focus should be given to the encouragement of mindful eating practices within university culture.

Limitations

This research had several limitations. First, the study was limited to a small, private, Christian-founded university located in the Midwestern United States. Additionally, all data was self-reported, allowing for personal bias and/or perception to sway statistical results. Specifically, the 24-hour recall provided in the questionnaire was self-proctored, allowing for significant user error and potential inaccuracy of macronutrient and caloric intake values. ESHA's Food Processor® Nutrition Analysis software failed to include all food, drink, and supplements listed on 24-hour recalls, leaving the accuracy of caloric and macronutrient intake numbers up to researcher decision. The present research also did not specify between caffeine-containing products and their specific associations with caloric intake and sleep quality (ex. energy drinks versus coffee, supplements, tea, etc.). The Caffeine Intake Assessment tool used in the present research was developed in Germany, however, this study was conducted in the United States. Therefore, the caffeine content of products listed may differ, leaving the correlation of caffeine (mg) to certain variables accurate, but limiting the validity of exact caffeine measurements and recommendations for measured caffeine intake. Lastly, the researcher-generated questionnaire did not account for instances of pregnancy and prescription drug usage, both of which are present in undergraduate populations and have the opportunity to alter eating behaviors and caffeine intake.

Future Research

Future research should seek to assess undergraduate caffeine usage and its effects on dietary habits and sleep while specifying the products consumed, as statistical associations could change from one product to the next. Secondly, researchers should aim to better understand the

relationship between medicinal caffeine consumption, BMI, and sleep quality and assessing whether this association can be attributed to additional caffeine intake or the presence of illness. Care should be given to the understanding of a potential mechanism in which caffeine and/or the consumption of specific caffeinated products alter eating behaviors. Efforts should also be made to validate a tool for the U.S. undergraduate population that accurately quantifies daily caffeine intake. Finally, efforts should be made to further assess mindful eating behaviors in the undergraduate population and the variables that may add or detract from such practices.

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Appendix A

INSTRUCTIONS: The following questions relate to your usual sleep habits during the *past month* only. Your answers should indicate the most accurate reply for the majority of the days and nights in the *past month*. Please answer all questions.

1. During the past month, when have you usually gone to bed at night?
   USUAL BED TIME:_____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
   NUMBER OF MINUTES:_____

3. During the past month, when have you usually gotten up in the morning?
   USUAL GETTING UP TIME:_____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)
   HOURS OF SLEEP PER NIGHT:_____

INSTRUCTIONS: For each of the following questions, circle the number the represents the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you…

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
(a) …cannot get to sleep within 30 minutes	0	1	2	3
(b) …wake up in the middle of the night or early morning	0	1	2	3
(c) …have to get up to use the bathroom	0	1	2	3
(d) …cannot breathe comfortably	0	1	2	3
(e) …cough or snore loudly	0	1	2	3
(f) …feel too cold	0	1	2	3

(g) …feel too hot	0	1	2	3
(h) …had bad dreams	0	1	2	3
(i) …have pain	0	1	2	3
(j) Other reason(s), please describe _____ _____				
How often during the past month have you had trouble sleeping because of this?	0	1	2	3

INSTRUCTIONS: For questions 6 through 9, check the box corresponding to the best answer.

6. During the past month, how would you rate your sleep quality overall?

- ☐ Very good
- ☐ Fairly good
- ☐ Fairly bad
- ☐ Very bad

7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?

- ☐ Not during the past month
- ☐ Less than once a week
- ☐ Once or twice a week
- ☐ Three or more times a week

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

- ☐ Not during the past month
- ☐ Less than once a week
- ☐ Once or twice a week
- ☐ Three or more times a week

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- ☐ No problem at all
- ☐ Only a very slight problem
- ☐ Somewhat of a problem
- ☐ A very big problem

10. Please fill the following chart with all *food*, *drinks*, and *supplements* you consumed yesterday. Be as comprehensive and specific as possible.

Time	Food/Beverage/Supplement Consumed	Quantity/ Amount Consumed	Brand Name	Where did you eat/drink this?	Did you eat/drink this with others?

11. What is today's date?

__ __ / __ __ / __ __

Month Day Year

12. Which day of the week does the chart in question 10 record? *Please tick one:*

Sun ☐ Mon ☐ Tues ☐ Wed ☐ Thurs ☐ Fri ☐ Sat ☐

13. Does the above record represent a typical day? *Please tick one:* Yes ☐ No ☐

14.

We would like to know how much caffeine you consume

Indicate in the table, how much you drank yesterday.
Put a line in the box for every cup/glass.
If you didn't drink the item, leave the box empty.

Portion sizes:

Small cup 150 mL	Large cup 250 mL	Small glass 150 mL	Large glass 250 mL	Energy Drink Dose 250 mL	Energy drink Dose 500 mL	Energy shot Dose 60 mL	Espresso cup 60 mL	Chocolate bar 20g

For example, like this:

	Coffee		Cola, fizzy, soft drink		Chocolate
Breakfast	II			I	I

	Coffee		Decaffeinated coffee		Espresso	Black-, green, white, mate tea		Cocoa drink		Iced tea, drinks with tea extract		Cola, mixed cola beverages (but not orangeade and lemonade)		Energy drink		Energy shot	Alcopops with energy drink, cola or coffee		Chocolate
Breakfast																			
Between breakfast and lunch																			
lunch																			
Between lunch and dinner																			
Dinner																			
After dinner																			

15. Are you actively following a specific diet? *Please circle one answer.*

Yes 1 No 0

If yes, please explain below.

16. Are you actively trying to lose weight? *Please circle one answer.*

Yes 1 No 0

17. On a scale of 1 to 7, with 7 being the most stressed, 1 being the least, and 4 being average, how stressed have you been in the past week?

1 2 3 4 5 6 7

18. Please mark next to any medications used yesterday.

- ☐ Anacin Maximum Strength
- ☐ Anacin Tablets and Caplets
- ☐ Aspirin-Free Excedrin Caplets
- ☐ Excedrin Extra Strength Caplets and Tablets
- ☐ Excedrin Migraine
- ☐ Goody's Extra Strength Tablets
- ☐ Goody's Extra Strength Headache Powder
- ☐ Goody's Cool Orange Powder
- ☐ Midol Menstrual Maximum Strength Caplets
- ☐ NoDoz Maximum Strength
- ☐ Pain Reliever Plus Tablets
- ☐ Vanquish Caplets
- ☐ Vivarin
- ☐ I did not take any of these medications (skip to question 19)

19. How much of the marked medication did you use yesterday?

_____

20. Yesterday, how much time did you spend undergoing physical activity?

_____

21. Rank the following as 1, 2, 3, 4, 5, or 6 from the most common reason you consume caffeine to the least, with 1 being the most common and 6 the least common reason. *Use every number only once.*

__ Out of habit	__ To improve athletic performance
__ Taste of product	__ For social reasons
__ To stay awake	__ To stay focused

INSTRUCTIONS: For questions 22-23 circle the best answer.

22. What is your class level?

Freshman 1 Sophomore 2 Junior 3 Senior 4

23. What is your biological sex?

Female 0 Male 1

INSTRUCTIONS: For questions 24 and 25, check the box corresponding with the best answer.

24. How would you describe yourself?

- ☐ American Indian/Alaskan Native
- ☐ Asian
- ☐ African American
- ☐ Native Hawaiian/Pacific Islander
- ☐ Caucasian

25. Do you use tobacco products? (Including cigarettes, cigars, smokeless tobacco, e-cigarettes, JUULs, etc.)

- ☐ No 0
- ☐ Yes 1

26. If yes, what product do you typically use and how much?

_____

27. What is your height (*in inches)*?

_____ in.

28. What is your weight (*in pounds)*?

_____ lbs.

29. What is your AU email? (This is used in the event that you win the Amazon gift card raffle)

Thank you for completing this survey!

Please check survey for completion and return to survey administrator.

Author Biography

Grace Stockert grew up in Canal Fulton, Ohio on her family's dairy farm. She graduated from Northwest High School in 2015 and continued her studies at Ashland University as a Dietetics major. Throughout her time at AU, Grace has been extremely involved on campus, serving on the leadership teams of many student organization and becoming connected to the greater Ashland community through Park Street Brethren Church. This involvement, however, has not distracted Grace from her studies, but rather proved to supplement them well as she has gain status on the Dean's List for each of the last 7 semesters.

Upon graduation, Grace will be traveling to South Africa with a missions team from AU and interning with a Brethren Church in Virginia. When August arrives, Grace will continue her studies at Messiah College through their Dietetic Internship Program.

HUMAN SUBJECTS REVIEW BOARD

PART I

APPLICATION FOR APPROVAL TO USE HUMAN SUBJECTS IN RESEARCH

Return the original typewritten application including Parts II and III to:
Director of the Graduate School
119 Andrews Hall
OR

PRINCIPAL INVESTIGATOR Grace Stockert (typed name) DEPARTMENT Health Sciences

ADDRESS Box 1375 401 College Ave EMAIL gstocker@ashland.edu

CITY Ashland STATE Ohio ZIP 44805 PHONE (330) 936-7125

CO-INVESTIGATOR(S) _____ (typed name) _____ (signature)

_____ (typed name) _____ (signature)

PROJECT TITLE The Impact of Caffeine on Total Caloric Intake of Undergraduate Students

BEGINNING DATE OF RESEARCH (MONTH/YEAR) Upon HSRB Approval

ANTICIPATED ENDING DATE OF RESEARCH (MONTH/YEAR) 12/20/18

IS THIS RESEARCH RELATED TO A GRANT? Y/N N IF YES, GRANT NUMBER: __

****

TYPE OF PROJECT

☐ **FACULTY RESEARCH:**
EXTERNALLY FUNDED YES _____ AGENCY _____
NO _____

☒ **STUDENT DIRECTED RESEARCH:**
ADVISOR Dr. David Vanata
THESIS X DISSERTATION _____ COURSE REQUIREMENT Y
COURSE # HS 360 PRACTICUM _____ OTHER (Please Specify) Towards Honors

I agree to follow the procedures outlined in this summary description and any attachments to ensure that the rights and welfare of human subjects in my project are properly protected. ***I understand that no contact may be initiated with subjects until I have received approval of these procedures from the HSRB and complied with any required modifications in connection with that approval.***

_____ Date _____
(Signature of Principal Investigator)

APPROVAL OF FACULTY ADVISOR: ***Required for all students***

_____ Date _____
(Signature of Advisor)

PRINTED NAME OF ADVISOR Dr. David Vanata
ADDRESS/AFFILIATION Health Sciences 240
CITY Ashland STATE OH ZIP 44805
PHONE (419) 289-5292 E-MAIL dvanata@ashland.edu FAX (_____)_____

(PLEASE TYPE OR WORD-PROCESS)

A-2

HUMAN SUBJECTS REVIEW BOARD
PART II: RESEARCH PROTOCOL

TYPE OF REVIEW REQUESTED *(Choose One)*

NOTE: Regardless of type of review, all of Part II and Part III must be completed and submitted to the HSRB. Research may begin only after written approval of HSRB is obtained.

_____ EXEMPTED

I (We) believe the current project is **EXEMPTED**. It meets category(ies) _____ from the list of six categories on pages 4-6 of the Guidelines.

In the space below, explain why you feel your research project meets the **EXEMPTED** provisions. Briefly detail all the categories that apply to your research. (Refer to the six categories that define exempt status).

__X__ EXPEDITED

I (We) believe the current project meets the **EXPEDITED** classification. It meets category __2__ from the list of thirteen categories on pages 6-8 of the Guidelines.

This research applies to category 2 as I will simply be assessing behavior that the research subjects have already exhibited. I will not be treating the subjects or interfering with their normal daily functions in any way.

_____ FULL BOARD

I (We) believe that this project exceeds the requirements for the **EXEMPTED** and **EXPEDITED** classifications, and therefore, must be reviewed by the **FULL BOARD** of the HSRB.

HUMAN SUBJECTS REVIEW BOARD
PART II: RESEARCH PROTOCOL

YES NO		
___X___ _____	A.	Human subjects in the proposed research are involved in activities that exceed those described as exempt categories.
_____ ___X___ ⇨ ⇨ ⇨ ⇨ (please circle appropriate classes of subjects)	B.	The proposed research activity will involve a special class of subjects. Examples would include: children, prisoners, pregnant women, mentally disabled persons, or economically or educationally disadvantaged persons. Further examples may include: individuals with psychiatric, cognitive, or developmental disorders, substance abuses, and any other special category of individual who may not have the capacity to make a reasoned decision about participation.
_____ ___X____	C.	The proposed research activity will involve an element of deception.
_____ ___X____	D.	The proposed research activity will expose subjects to discomfort or harassment beyond levels encountered in daily life.
_____ ___X____	E.	The subjects will be identifiable to anyone other than the researchers through records, responses or identifiers linked to the subjects.
_____ ___X____	F.	The subjects could be at risk of criminal or civil liability, damage to employability or to financial standing, or undue embarrassment, if responses became known outside this research project.
___X___ _____	G.	The research deals with sensitive aspects of subjects' behavior, such as illegal conduct, drug use, sexual behavior, or use of alcohol. *(asking about past day's dietary intake that may include alcohol, asked about tobacco use)*
_____ ___X____	H.	The research involves the collection or study of existing data from sources not publicly available. (Existing data can be documents, records, pathological specimens or diagnostic specimens).
_____ ___X____	I.	The subjects will be video/audio taped.
___X___ _____	J.	The subjects are free to withdraw at any time without penalty.
_____ _____ ____X___ N/A	K.	The research activities outlined in Part III have the written approval of the authorized official(s) in the school district and/or other agencies involved with this research (if applicable). (Attach copy).
___X___ _____	L.	All required forms and safeguards are included with Part III: Summary of Proposal. This includes questionnaires, research instruments, letters of consent, approvals from authorized officials, etc. *Caffeine Intake Questionnaire (Bühler et al, 2013)* *Pittsburgh Sleep Quality Index (Buysse et. al, 1989)* *24 Hour Dietary Recall (self-created)*

HUMAN SUBJECTS REVIEW BOARD
PART III: SUMMARY OF PROPOSAL

Summarize the proposed project and procedures to which humans will be subjected. **Consent form(s), questionnaires, etc. must be attached**. The summary should include purpose(s), solicitation and number of subjects, data collection procedures, an explanation of how consent is obtained, procedures for maintaining confidentiality and any potential risks involved for the subjects. Explain the nature of any deception if it is part of the design.

1. Project Description

The objective of this research is to assess the relationship between caffeine consumption and total caloric intake, specifically with that of undergraduate students. Upon informed consent, Ashland University undergraduates will be asked to complete a caffeine intake assessment tool (Bühler, et al., 2013) in addition to a 24 hour diet recall, Pittsburgh Sleep Quality Index (Buysse, et al., 1989), and a short survey (see attached documentation). These questionnaires will quantify the amount of energy (kcals) and caffeine (mg) consumed by an individual on the previous day while also accounted for variables, including: sleep quality and duration, gender, tobacco use, and belief of a relationship between caffeine and caloric intake. The surveying process will be conducted in a pen and paper format. After completion of the various questionnaires and assessment tools described above, data will be analyzed through the use of SPS with both significant and insignificant findings reported. Any and all data will be shared with those who had granted permission for their tools to be used throughout the study.

2. Subject Recruitment

A. Research subjects will be recruited through the setup of survey stations throughout the campus of Ashland University. These tables will be located in the Hawkins-Conard Student Center, Richard E. & Sandra J. Dauch College of Business & Economics, and the Kettering Science Center during regular class hours, spanning Tuesday through Friday. Here, students will be informed of the intent of the research, incentivized with the raffle of a $35 Amazon gift card, and asked to provide active and signed consent along with the completion of the entire set of questionnaires. Students will be asked to provide their email address in the case that they win the gift card raffle.

B. Individuals will qualify for participation in this research if they are 18 years or older, enrolled in undergraduate curriculum, exhibiting functional mental capacity, and willing to participate in the presented study. The sample will be made up of 200 or more such students, exhibiting diversity in both gender and race (Bühler, et al., 2013). It is necessary to use this population as no changes in caffeine metabolism have been exhibited across races or sexes (Welfare, et al., 2000). In addition, undergraduate students are known for being a high caffeine

consuming group, purely based on their environment. Establishing a link between caffeine consumption and caloric intake could allow a window to be formed into the overall health and habits of this specific population.

3. Confidentiality of Data

Collected research data will be separated from identifiable information from first encounter. Names and emails will only be accessed during the assignment of codes and if contacted for winning the Amazon gift card raffle. The list of names to codes will be kept in a locked cabinet or drawer. After the required 36 months, all identifiable data will be destroyed through the fire or shredding.

4. Informed Consent Procedures

A. How will the subject be informed of the nature of the investigation, the reasonably foreseeable risks, and the voluntary nature of his/her participation?

__X__ In writing (attach a written copy of this explanation)

_____ Orally (attach a written copy of this explanation)

B. Once the above information has been presented, will you obtain written consent from the subject (i.e., their signature) prior to their participation?

__X__ Yes (attach a copy of the written consent form)

_____ No (attach a detailed justification for requesting waiver of written consent)

C. Are the subjects: (Check all that apply)

_____ children	_____ mentally disabled
_____ prisoners	_____ economically disadvantaged
_____ pregnant women	_____ educationally disadvantaged
__X__ other (please specify)	_Ashland University Undergraduate Students____

The subjects of this research are not an especially vulnerable group. Thus, consent will be derived from the subjects themselves.

5. Risks to Subjects

A. As this study is only assessing the individual's previous intake, it requires little to no risk for the assessed population.

B. Deception will not be a part of this research in any form.

6. Benefits

This research will allow health professionals and the public alike to catch a glimpse into the workings of metabolic action as a result of caffeine intake. As caffeine is the most used drug in the world, it is highly important that the practical effects of the stimulant are highly understood and assessed. This research will allow for further understanding of this drug as well as assess its role as an appetite suppressant, stimulant, or neither. As the obesity rate continues to rise in the United States, it is important that excess caloric intake is thoroughly assessed. This research will be able to explain if caffeine is tied to this issue in any way, shape, or form.