Caffeine Consumption and Its Effects on Teenagers

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Introduction

The project was to survey the effects of caffeine on high school students. The inspiration for this project was to see how much caffeine teenagers consume, how it affects teens during school, and if teens use it for sports or anything else. Also wanting to see what different kinds of caffeine were being consumed, to see what time of day it was being consumed, and if there were any side effects. Some of the things that were expected to come from the survey were that the higher grade you are in the more caffeine consumption, people who are more stressed drink more caffeine, and women drink more caffeine. The hope was to see what group of teenagers consume the most caffeine.

What is Caffeine?

Caffeine is a naturally occurring substance found in coffee beans, guarana seeds, kola nuts, tea leaves, cacao pods, and many other plants. Caffeine is one of the world's most valuable crops and is an economically important export product for several countries. The largest producers include countries such as Brazil, Vietnam, Indonesia, and Colombia. However, many other countries in Central and South America as well as in East Africa produce caffeine crops extensively.

In the United States, coffeehouses became popular starting in the early 1800s. Coffee was seen as a luxury item, and people drank it mainly for its caffeine content. However, over time, coffee became more accepted, and people started to drink it for its flavor as well. Its initial popularity in North America may have also been due to the fact that coffee was seen as a healthy drink; it was thought to help improve mental alertness and reduce fatigue.

How Caffeine Chemically Works

The chemical name for the bitter, white powder known as caffeine is 1,3,7 trimethylxanthine (Harvard School of Public Health, 2023). Caffeine is absorbed within about 45 minutes after consuming, and peaks in the blood anywhere from 15 minutes to 2 hours. It is distributed throughout body water and readily crosses cell membranes including the brain. The main mechanisms caffeine has that increase stimulatory activity are the blocking of adenosine receptors and inhibition of phosphodiesterases (Institute of Medicine (US) Committee on Military Nutrition Research, *Pharmacology of Caffeine* 1970). Adenosine receptors are 7 transmembrane receptors that mediate the central and peripheral actions of the most widely used psychoactive agents: caffeine, methylxanthines, and theophylline. Additionally, phosphodiesterase inhibitors are a type of medication that causes blood vessels to relax and widen. This in turn improves circulation and lowers a person's blood pressure, which makes phosphodiesterase inhibitors useful for treating a large variety of different medical conditions, including problems with the skin, joints, heart, and lungs (professional, *Phosphodiesterase inhibitors: Types and purpose*).

Illnesses That Can Be Contracted From Overconsumption of Caffeine

Caffeine is commonly known to be a stimulant drug that excites the central nervous system causing an effect of what a person's body perceives to be an "energy boost". Though it is commonly believed that caffeine gives an "energy boost", this information is false. Caffeine does not give energy nor can it chemically make a person happier. It only takes away the feeling of exhaustion. Due to this, it is easy to over consume caffeinated products for those effects. Some negative side effects due to excessive caffeine consumption can alter or change a person and

their habits for the rest of their life. A quote from VeryWell Health: “Caffeine can have a negative effect on many parts of a teen's growing body. It can stunt their maturing brain and lead to bone loss. It can worsen other health conditions the teen may already have. It can also cause the teen to lose much-needed sleep, in turn affecting their overall health” (Morin A., 2023). Effects can range from Osteoporosis (weakening or decrease of bone strength), Gastric Ulcers (open sores that develop on the lining of the stomach due to stomach acid eating away at the protective stomach lining), lifelong dietary problems, cardiovascular diseases, and sleep impairment.

How Does Caffeine Negatively Affect Teens

Adolescents are much more susceptible to caffeine consumption effects because of their changing developmental brain chemistry, lack of tolerance, and increasing independence and distance from parental figures. There can be multiple reasons for drinking caffeinated beverages such as habit, health reasons, religious and ethnic reasons, or even addiction. The main reason to be found for why teenagers consume caffeine is because it is an extremely easily accessible way to stay awake as there are no federal laws restricting adolescents from purchasing caffeinated products.

Teenagers may wish to stay up due to society's party culture and pressure to keep up, to use it for an all-nighter study period, or just to wake up in the mornings because their physical and emotional battery is drained. Caffeine, much like alcohol, has a dose-response effect which means that it takes less to affect a young adult’s functions. Though there are some positive reasons for drinking caffeine, there are a plethora of negative side effects that are linked to the overconsumption of caffeine as a teenager. Side effects including but not limited to anxiety,

dependency, nervousness, irritability, sleep issues, and flu-like symptoms can come from consuming caffeinated products.

Methodology

Survey Questions

The survey questions were developed in two sections, information on caffeine intake and demographics. To make the survey accessible and quick to fill out, specific and detailed information was left out in favor of more general information that someone would know off the top of their head. For example, it's doubtful that anyone would know how many milligrams of caffeine they consume in a week, so instead, the survey asks about topics like the frequency of caffeine intake and what types of drinks they consume. The other questions about caffeine consist of self-reported reasons to drink and side effects of caffeine, such as ranking how caffeine affects mood, and productivity.

The second section of the survey was based on demographic information, to see if any patterns emerged. Grade, grade point average, gender, and race of the participants were all asked on the survey. There was one more question that did not fit neatly into either section, asking how often the participants felt overwhelmed in their daily lives. This question was asked to see if there was any correlation between caffeine intake and stress. Questions were asked with the caveat of “in your normal schedule,” as the goal of the survey was to see the effects of caffeine without extraordinary circumstances.

Note on the question about GPA, it was not specified whether participants would give weighted or unweighted GPA, and it was an open-response question. Most respondents gave a number on the 1.0 - 5.0 scale. Any answer with extra information was cut to just the number.

Any answer with both unweighted and weighted provided used the weighted GPA given. Finally, any answer that gave information not on the scale was removed.

Distribution

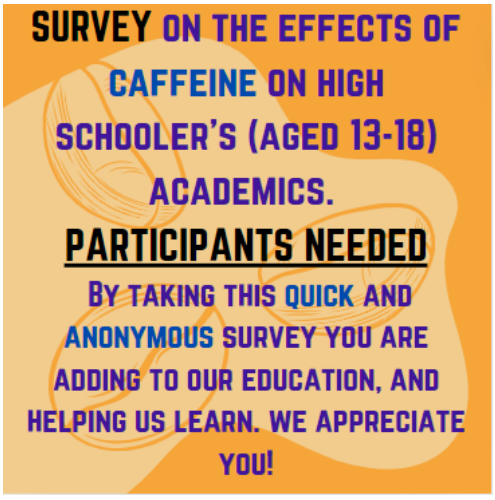
The distribution of the survey was carried out through multiple tactics; primarily interpersonal connections and social media advertising. These methods were chosen because of their accessibility and plausibility, and each had several rounds of launching. The survey was sent to at least thirty-five individuals outside of the Renaissance community with the hopes that they would spread it amongst their own circles as well.

Aside from person-to-person connections, local Charlottesville organizations like C-VILLE Weekly, the YMCA, Community Climate Collaborative, and CANDYD were all reached out to in hopes of publishing an ad for the survey on their website or passing it along to their members. To reach the YMCA, Spencer Snyder, former program director of the Virginia Model General Assembly, was contacted. He brought the current program director into discussion, who agreed to help spread the word about the survey. Susan Kruse, executive director of the Community Climate Collaborative, was contacted and sent it to Sarah Delgado who gave the survey to their teenage interns to participate in. CANDYD, a network of local community-focused organizations, also responded. They agreed to share the survey with their "teen director" and pass it along to the network which includes more than thirty-six organizations. The survey was also published in the Civics Unplugged newsletter and reached an estimated nine hundred alumni and fellows, as well as several posts of Figure 2 in the fellow servers which garnered multiple responses.

Figure 1: Promotional Poster

Figure 1 was then physically distributed throughout the Charlottesville area. Local restaurants (primarily downtown) and other teen hot spots were targeted for this method of advertising. There was a noticeable difference in the number of responses before and after the rounds of media distribution. Factors used in getting people to respond were taken into consideration. Diverse groups were contacted and included from different schools to interest groups like local gym members, athletes, and theater groups.

Figure 2: Online Ad



Hypothesizing the behavior and patterns of teenagers led to a different methodology of how and when the survey was advertised and created. The first answers were filled out on April 29th and closed on May 16, 2024. This left 18 days for participants. In total, 135 people filled out the survey.

Analysis

For the analysis, we decided to look at the various correlations we could have between our answers. Figure 6 shows the data on the graph shows that the more people drink caffeine, the more they think it's improving their mood, with a slight correlation of R=.31. From the second graph, figure 7, we find that the correlation of stress and caffeine is also only slightly correlated with an R=.28. Figure 8 was the final correlation graph that compared how often people drink caffeine with their grade, this came out to an R or 0.24, which again is only slightly correlated. For the first pie chart, figure 3, the data chart shows that the majority of people drank caffeine in the morning, the second most was in the afternoon, and the third most was in the evening. For the second pie chart, figure 4, the data chart shows the different caffeine types consumed. The majority of people drank coffee, the second most was caffeinated tea, and the third most was the answer for not drinking any caffeine. The final pie chart, figure 5, shows the reasons why people drink caffeine. The top three answers, from highest to lowest, were productivity, energy, and taste.

Our data analysis was mostly based on correlation graphs created using Google Sheets. From there, we were able to come to a conclusion. The whole idea of this survey was to figure out how caffeine affects the average high schooler. Our research showed that the more often someone has caffeine products, the more often overwhelmed with school or other

responsibilities. While under the influence of caffeine, your senses are skewed, only masking the sleepiness instead of curing it, likely causing only long-term exhaustion, which would probably stem from homework, home life, work, etc. This supported our hypothesis. Our data seemed to support this and also found that the more often that someone has caffeine, the more it has a positive impact on their general mood. However, both of these findings were not dramatically correlated with caffeine consumption. With only a slight correlation on all of our comparisons, it'd be hard to make any solid claims based on this. We believe that the reason for this uncertainty is that we did not have the resources to reach a large and varied enough audience of our participants. For anyone doing this type of work for a career, the results would not be exceptional, but for amateur surveyors and analysts such as us, we call it a success.

Appendix

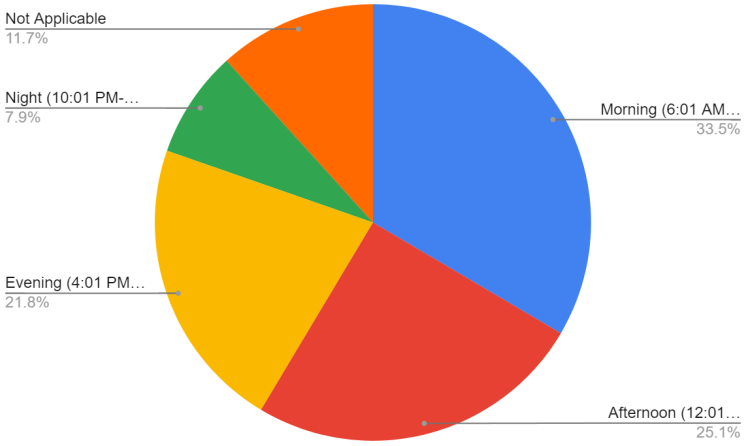


Figure 3: Pie chart showing the answers to the question about what time caffeine is had.

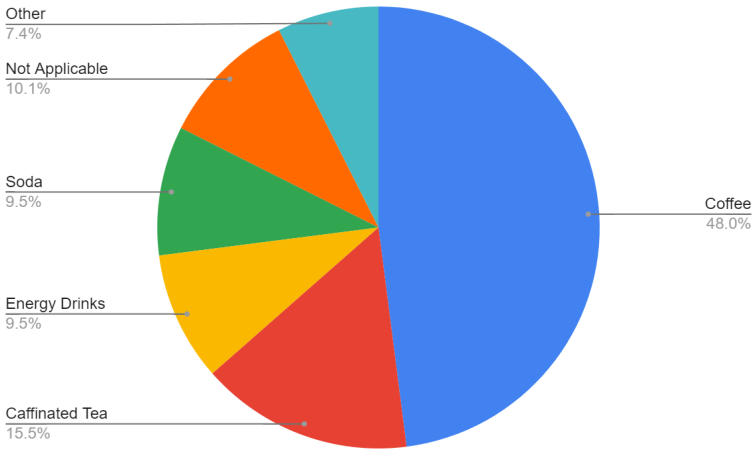


Figure 4: Pie chart showing the answers to the question about what type of caffeine is had.

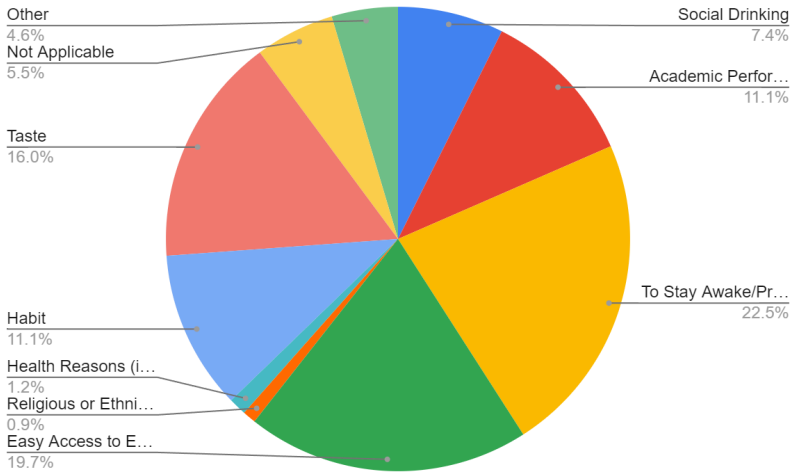


Figure 5: pie chart showing the answer to the question of why caffeine is had.

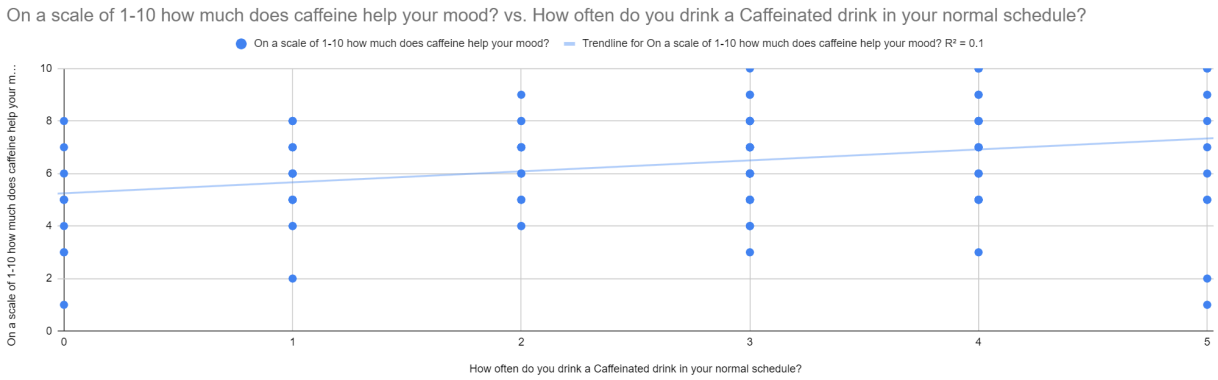


Figure 6: Comparison chart of mood vs caffeine consumption

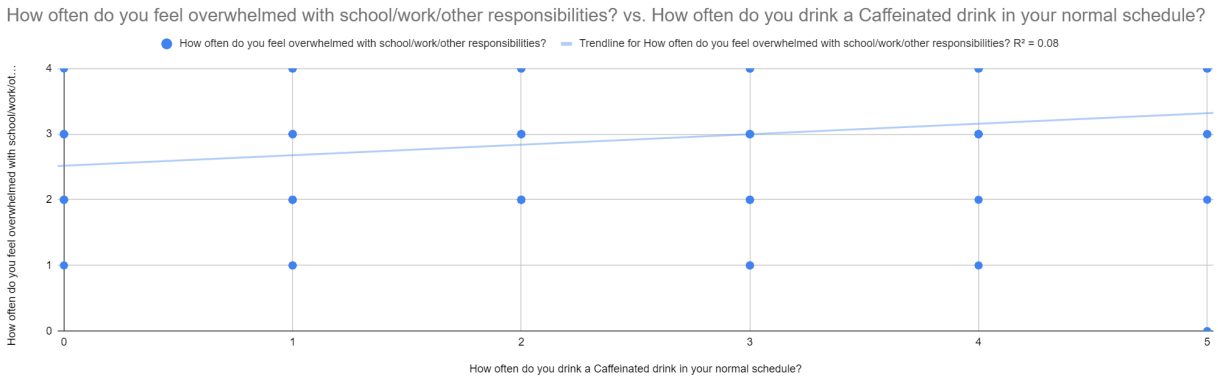


Figure 7: a comparison chart of schoolwork vs caffeine consumption

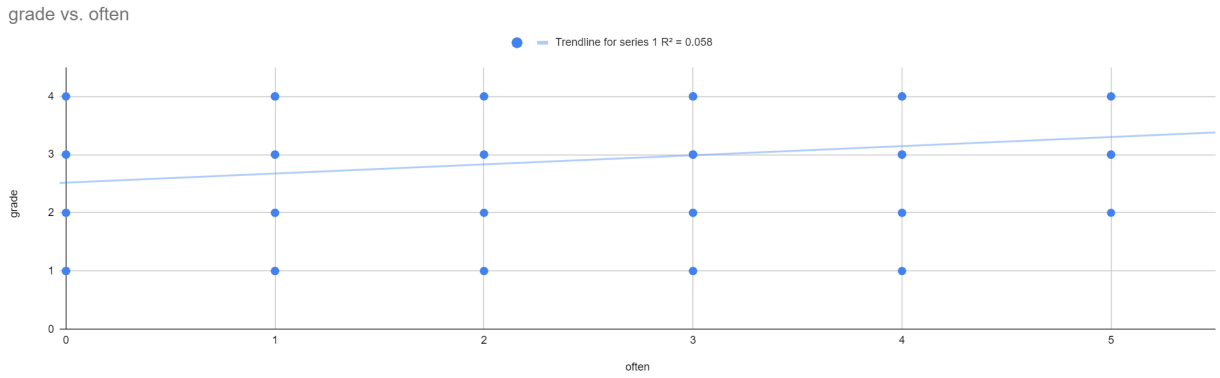


Figure 8: Comparison chart of grade vs caffeine consumption

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